

MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION

Diploma Programme in **Electronics and Telecommunication Engineering**

I – Scheme

Programme Educational Objectives (PEO) *(What s/he will continue to do even after 3-5 years of working in the industry)*

- PEO 1. Provide socially responsible, environment friendly solutions to Electronics and Telecommunication engineering related broad-based problems adapting professional ethics.
- PEO 2. Adapt state-of-the-art Electronics and Telecommunication engineering broad-based technologies to work in multi-disciplinary work environments.
- PEO 3. Solve broad-based problems individually and as a team member communicating effectively in the world of work.

Program Outcomes (PO) given by NBA. *(What s/he will be able to do at the entry point of industry soon after diploma programme)*

- PO 1. **Basic knowledge:** Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad-based Electronics and Telecommunication engineering problems.*
- PO 2. **Discipline knowledge:** Apply Electronics and Telecommunication engineering knowledge to solve broad-based Electronics and Telecommunications engineering related problems.*
- PO 3. **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Electronics and Telecommunication engineering problems.*
- PO 4. **Engineering tools:** Apply relevant Electronics and Telecommunications technologies and tools with an understanding of the limitations.*
- PO 5. **The engineer and society:** Assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to practice in field of Electronics and Telecommunication engineering.*
- PO 6. **Environment and sustainability:** Apply Electronics and Telecommunication engineering solutions also for sustainable development practices in societal and environmental contexts.*
- PO 7. **Ethics:** Apply ethical principles for commitment to professional ethics, responsibilities and norms of the practice also in the field of Electronics and Telecommunication engineering.*
- PO 8. **Individual and team work:** Function effectively as a leader and team member in diverse/ multidisciplinary teams.*
- PO 9. **Communication:** Communicate effectively in oral and written form.*
- PO 10. **Life-long learning:** Engage in independent and life-long learning activities in the context of technological changes also in the Electronics and Telecommunication engineering and allied industry.*

Program Specific Outcomes (PSO) *(What s/he will be able to do in the Electronics and Telecommunication engineering specific industry soon after the diploma programme)*

- PSO 1. Electronics and Telecommunication Systems:** Maintain various types of Electronics and Telecommunication systems.

PSO 2. EDA Tools Usage: Use EDA tools to develop simple Electronics and Telecommunication engineering related circuits.

Notes for All the Semesters

1. *Every student has to **separately pass in End-Semester-Examination (ESE)** for **both theory and practical** by securing minimum of 40% marks, (i.e. 30 out of 75, 28 out of 70, 20 out of 50, and 10 out of 25).*
2. ***Progressive Assessment (PA) for Theory** includes Written Exam/micro projects/ Assignment/Quiz/Presentations/attendance according to the nature of the course. The scheme and schedule for progressive assessment should be informed to the students and discussed with them at the start of the term. This scheme should also be informed in writing to the principal of the institute.*
3. *Teachers need to give **marks judiciously for PA of theory and practical** so that there is always a **reasonable correlation** between the **ESE marks** obtained by the **student** and the **PA marks** given by **respective teachers for the same student**. In case the PA marks in some courses of some students seems to be relatively inflated in comparison to ESE marks, then MSBTE may review the PA records of such students.*
4. *For developing self-directed learning skills, from each course about 15-20% of the topics/sub-topics, which are relatively simpler or descriptive in nature are to be given to the students for self-study and proper learning of these topics should be assured through classroom presentations by students (see implementation guideline for details).*
5. **Passing Criterion for Theory and Practical Courses for all Semesters**
 - a. **Passing Criterion for Theory course:** - Each Theory course consists of 2 components, ESE (End Semester Examination) and PA (Progressive Assessment)
 - (i) *The passing criterion for each theory course is obtaining minimum 40% of marks allotted to ESE & PA component together. [i.e. for total marks of ESE (70 marks) + PA(30 marks) together = (Total 70+30 =100), obtaining minimum 40 marks are mandatory for passing the Theory course.]*
 - (ii) *To qualify for above condition (i), obtaining minimum 40% of marks allotted to ESE component is mandatory. [i.e. for total marks of ESE = 70, obtaining minimum 28 marks are mandatory. For passing ESE component]*
 - b. **Passing Criterion for Practical course:** - Practical course consists of 2 components, ESE (End Semester Examination) and PA (Progressive Assessment)
 - (i) *ESE and PA components of Practical course are independent head of passing.*
 - (ii) *The passing criterion for ESE component is obtaining minimum 40 % of marks allotted to ESE component. [i.e. for total marks of ESE= 25, obtaining minimum 10 marks are mandatory for passing in ESE component]*
 - (iii) *The passing criterion for PA component is obtaining minimum 40 % of marks allotted to PA component. [i.e. for total marks of PA= 25, obtaining minimum 10 marks are mandatory for passing in PA component]*

Note: - If Candidate not securing minimum marks for passing in the PA part of practical of any course of any semester then the candidate shall be declared as detained for that semester.



Maharashtra State Board of Technical Education, Mumbai

Teaching and Examination Scheme for Post S.S.C. Diploma Courses

Course Name : Mechanical / Civil / Chemical / Computer / Electronics / Electrical / Textile Engineering Groups

Course Code : CE/CR/CS/CH/PS/CM/CO/IF/CW/DE/EJ/EN/EQ/ET/EX/IE/MU/EE/EP/EU/IS/IC/AE/FG/ME/PG/PT/DC/TX/TC

Duration of Course: 6 Semesters

With Effect From Academic Year: 2017 - 18

Semester : First

Duration : 16 Weeks

S. N.		Course Title		Abbreviation	Sub. Code	Teaching Scheme		Credit (L+T+P)	Examination Scheme												Grand Total		
						L	T		P	Theory						Practical							
										Paper Hrs.	ESE		PA		Total		ESE		PA			Total	
											Max	Min	Max	Min	Max	Min	Max	Min	Max	Min		Max	Min
1	English		ENG	22101	3	--	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150	
2	Basic Science	Physics	BSC	22102	2	--	2	4	2	70*#	28	15*	00	100	40	25@	10	25	10	50	20	200	
		Chemistry			2	--	2	4				15*	00			25@	10	25	10	50	20		
3	Basic Mathematics		BMS	22103	4	2	--	6	3	70	28	30*	00	100	40	--	--	--	--	--	--	100	
4	Fundamentals of ICT		ICT	22001	2	--	2	4	--	--	--	--	--	--	--	25@^	10	25~	10	50	20	50	
5	Engineering Graphics (For CE, CR, CS, ME, AE, PG, PT, FG, EE, EP, EU, CH, PS, DC, TC, TX)		EGM	22002	2	--	4	6	--	--	--	--	--	--	--	50@	20	50~	20	100	40	100	
	Engineering Graphics (For DE, EJ, ET, EN, EX, EQ, IC, IE, IS, MU, CO, CM, CW, IF)		EGE	22003	2	--	4	6	--	--	--	--	--	--	--	50@	20	50~	20	100	40	100	
6	Workshop Practice. (For CE, CR, CS, ME, AE, PG, PT, FG, EE, EP, EU, CH, PS,)		WPM	22004	--	--	4	4	--	--	--	--	--	--	--	50@	20	50~	20	100	40	100	
	Workshop Practice. (For CO, CM, CW, IF)		WPC	22005	--	--	4	4	--	--	--	--	--	--	--	50@	20	50~	20	100	40	100	
	Workshop Practice. (For DE, EJ, ET, EN, EX, EQ, IC, IE, IS, MU)		WPE	22006	--	--	4	4	--	--	--	--	--	--	--	50@	20	50~	20	100	40	100	
	Workshop Practice. (For TX, TC, DC)		WPT	22007	--	--	4	4	--	--	--	--	--	--	--	50@	20	50~	20	100	40	100	
Total					15	2	16	33	--	210	--	90	--	300	--	200	--	200	--	400	--	700	

Student Contact Hours Per Week: 33 Hrs. Medium of Instruction: English

Theory and practical periods of 60 minutes each. Total Marks : 700

Abbreviations: ESE- End Semester Exam, PA- Progressive Assessment, L - Lectures, T - Tutorial, P - Practical

@ Internal Assessment, # External Assessment, *# On Line Examination, ^ Computer Based Assessment

* Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment (5 marks each for Physics and Chemistry) to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain LOs required for the attainment of the COs.

~ For the courses having ONLY Practical Examination, the PA has two parts, marks for : (i) Practical Part - 60% of total marks (ii) Micro-Project Part - 40% of total marks

➤ Candidate remaining absent in practical examination of any one part of Basic Science course i.e. Physics, Chemistry will be declare as Absent in Mark List and has to appear for examination. The marks of the part for which candidate was present will not be processed or carried forward.

➤ If Candidate not securing minimum marks for passing in the "PA" part of practical of any course of any semester then the candidate shall be declared as "Detained" for that semester.



Program Name : All Branches of Diploma in Engineering and Technology.

Program Code : CE/CR/CS/CH/PS/CM/CO/IF/CW/DE/EJ/EN/EQ/ET/EX/IE/MU/EE/EP/EU/IS/IC/AE
/FG/ME/PG/PT/DC/TX/TC

Semester : First

Course Title : English

Course Code : 22101

1. RATIONALE

English language skills have become inevitable in the era of globalization. The skills of language contribute substantially to the career of engineering profession, where almost all the service manuals, installation and commissioning manuals of the various equipment are in English and technologist has to interpret them correctly. Competency in English is need of the hour, not only for Indian industry, but also worldwide, where diploma engineers have the employable opportunity. Therefore, the basic English skills- listening, speaking, reading and writing have become almost mandatory for employability. This course is therefore designed to help the students to communicate in English effectively.

2. COMPETENCY

The aim of this course is to help the students to attain the following industry identified competency through various teaching learning experiences:

- Communicate in English in spoken and written form effectively.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Formulate grammatically correct sentences.
- Summarise comprehension passages.
- Compose dialogues and paragraphs for different situations.
- Use relevant words as per context.
- Deliver prepared speeches to express ideas, thoughts and emotions.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
3	--	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20

(*): Under the theory PA, out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

Legends: L-Lecture; T-Tutorial/Teacher Guided Theory Practice; P-Practical; C-Credit, ESE-End Semester Examination; PA-Progressive Assessment.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

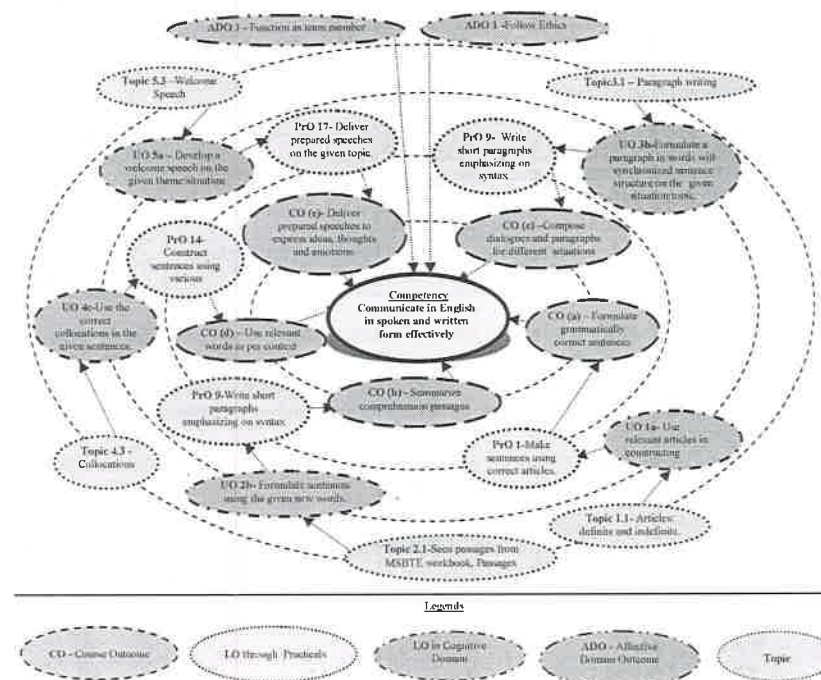


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
Use 'language laboratory' for different practical tasks			
1	Make sentences using correct articles.	I	2
2	Construct sentences using correct prepositions.	I	2*
3	Formulate sentences using correct conjunctions/connectors.	I	2
4	Rewrite sentences using relevant forms of verbs.	I	2*
5	Change the voice from active to passive and vice-versa.	I	2*
6	Change the narration direct to indirect and vice-versa.	I	2*
7	Repeat words on Language Lab software after listening to them.	I	2*
8	Deliver oral presentations using correct grammar.	I	2*



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
9	Write short paragraphs emphasizing on syntax.	II	2*
10	Compose dialogues on various situations.	III	2
11	Enact a role play.	III	2*
12	Construct sentences using idioms.	IV	2*
13	Narrate anecdotes of various situations.	IV	2
14	Construct sentences using various collocations.	IV	2
15	Answer questions based on the given passage.	IV	2
16	Use correct pronunciations and voice modulation while reading articles from different sources.	IV	2*
17	Deliver prepared speeches on the given topic.	V	2*
18	Repeat dialogues on Language Lab software after listening to them.	V	2*
Total			36

Note

i. A suggestive list of **PrOs** is given in the above table. More such **PrOs** can be added to attain the **COs** and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.

ii. The 'Process' and 'Product' related skills associated with each **PrO** is to be assessed according to a suggested sample given below:

S.No.	Performance Indicators	Weightage in %
a.	Setting up of language laboratory	10
b.	Using the language laboratory skillfully	30
c.	Follow Safety measures	10
d.	Work in teams	20
e.	Respond to given questions	10
f.	Self-learning	20
Total		100

The above **PrOs** also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Maintain Cleanliness.
- Demonstrate working as a leader/a team member.
- Follow ethics.

Acquisition of the **ADOs** takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the **ADOs** according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The following topics/subtopics is to be taught and assessed in order to develop **UOs** for achieving the **COs** to attain the identified competency.

S. No.	Equipment Name with Broad Specifications	Exp. S.No.
1	Language Lab with relevant software and Computer system with all necessary components like: Motherboard, Random Access Memory (RAM), Read-Only Memory (ROM), Graphic cards, Sound Cards, Internal Hard Disk Drives, DVD drive, Network Interface Card	All
2	LCD Projector with document reader	All
3	Smart Board with networking	All

8. UNDERPINNING THEORY COMPONENT'S

The following topics/subtopics should be taught and assessed in order to develop **LOs** in cognitive domain for achieving the **COs** to attain the identified competency:

Unit	Unit Outcomes (UOs) (in cognitive domain)		Topics and Sub-topics
	Writing Skills	Speaking Skills	
Unit – I Applied Grammar	1a. Use relevant articles in constructing sentences.	1g. Formulate grammatically correct sentences for the specified situation.	1.1. Articles: Definite and Indefinite
	1b. Apply prepositions to construct meaningful sentences.	1h. Use relevant Prepositions for the situation mentioned.	1.2. Prepositions: Usage
	1c. Identify conjunctions to connect phrases and clauses in the specified sentences.	1i. Apply relevant conjunctions to use idiomatic language for the given situation.	1.3. Conjunctions: Coordinating and Subordinating
	1d. Use correct form of tenses in given situation.	1j. Apply the relevant voice in formal communication for the given passage.	1.4. Types of sentences: Assertive, Imperative, Exclamatory, Interrogative
	1e. Change the active and passive voice from the specified passage/list.	1k. Use relevant narrations for the given situation.	1.5. Tenses - Present Tense (Simple, Continuous, Perfect) - Past Tense (Simple, Continuous, Perfect) - Future Tense (Simple)
	1f. Change the narration for the given situation.		1.6. Active and Passive Voice
Unit– II Comprehension	2a. Answer the given questions of the specified passage.	2e. Pronounce the words correctly in the given passage.	1.7. Direct and Indirect Speech
	2b. Formulate sentences using the given new words	2f. Give oral instructions with correct pronunciation and	2.1 Seen Passages From Msbte Work Book 2.2 Importance Of Comprehension 2.3 Unseen Passages 2.4 Interpretation Of



Unit	Unit Outcomes (UOs) (in cognitive domain)		Topics and Sub-topics
	Writing Skills	Speaking Skills	
	2c. Use correct syntax to construct meaningful sentences for the given situation. 2d. Answer the questions on the given unseen passage.	2g. Answer the questions orally on the given unseen passage with correct pronunciation.	Passages In Written And Spoken Form
Unit- III Paragraph and Dialogue Writing	3a. Differentiate the given types of paragraphs with justification. 3b. Formulate a paragraph in words with synchronized sentence structure on the given situation / topic. 3c. Explain the theme on given paragraph precisely.	3d. Summarise the given paragraph with correct pronunciation and intonation. 3e. Take part in debates with correct pronunciation, intonation and using verbal and non-verbal gestures on the given themes.	3.1 Types of Paragraph i. Technical ii. Descriptive iii. Narrative iv. Compare and Contrast 3.2 Dialogue Writing i. Greetings ii. Development of Dialogue iii. Closing Sentence
Unit- IV Vocabulary Building	4a. Remove the spelling errors in the given sentences/paragraph 4b. Use relevant words to correctly express for the given themes/situation. 4c. Use the collocations correctly. 4d. Construct sentences using given idioms.	4e. Speak in specified formal situations with correct pronunciation. 4f. Speak in specified informal situations with correct pronunciation. 4g. Speak sentences using relevant collocations	4.1 Rules of Spelling 4.2 Words Often Confused 4.3 Collocations 4.4. Idioms
Unit-V Speeches	5a. Develop a welcome speech on the given theme/situation. 5b. Develop a farewell speech for the given theme/situation. 5c. Formulate a speech for introducing a guest in the given situation. 5d. Develop a vote of thanks for the given	5e. Introduce oneself with correct pronunciation, intonation and using verbal and non-verbal gestures. 5f. Give extempore talks with correct pronunciation, intonation and using verbal and non-verbal gestures for the given theme/ situation.	5.1. Importance of Public Speaking 5.2. Characteristics of Good Speech 5.3. Welcome Speech 5.4. Farewell Speech 5.5. Introducing a Guest 5.6. Vote of Thanks

Unit	Unit Outcomes (UOs) (in cognitive domain)		Topics and Sub-topics
	Writing Skills	Speaking Skills	
	situation.		

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Blooms's 'Cognitive Domain Taxonomy'

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Applied Grammar	12	02	04	08	14
II	Comprehension	20	05	06	13	24
III	Paragraph and Dialogue Writing	06	02	04	06	12
IV	Vocabulary Building	06	02	04	06	12
V	Speeches	04	02	02	04	08
Total		48	13	20	37	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

- Collect good articles from newspapers and find and write the meanings of words.
- Listen to TV news.
- Read articles from magazines/newspapers.
- Undertake micro-projects.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About 15-20% of the topics/sub-topics which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
 - Arrange various communication activities using functional grammar.
 - Show video/animation films to develop listening skills and enhance vocabulary.
 - Use real life situations for explanation.



- d. Prepare and give oral presentations
- e. Guide micro-projects in groups as well as individually.

12. SUGGESTED TITLES OF MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of practicals PrOs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

- a. Develop language games, activities, crossword puzzles enhancing word power to be used in English language.
- b. Prepare advertisement for five technical projects using contextual vocabulary.
- c. After studying standard English newspapers, prepare a booklet identifying various grammatical aspects of sentences.
- d. Prepare a booklet of the interviewing any successful person in your locality in context with his life journey, inspiration, social contribution, role model and keys to success.
- e. Prepare a booklet of the contribution of eminent Indian scientists and develop well organized paragraphs.
- f. Summarise the contents of a famous book/books.[fiction/non fiction]
- g. Prepare a collage using different idioms with their origins and their contextual usage.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	English Workbook	MSBTE	MSBTE, Mumbai, 2017
2	Effective English with CD	Kumar, E. Suresh; Sreehari, P.; Savithri, J.	Pearson Education, Noida, New Delhi, 2009 ISBN: 978-81-317-3100-0
3	English Grammar at Glance	Gnanamurali, M.	S. Chand and Co, New Delhi, 2011 ISBN:9788121929042
4	Essential English Grammar	Murphy, Raymond	Cambridge University Press, New Delhi, Third edition, 2011, ISBN: 9780-0-521-67580-9
5	Living English Structure	Allen, W.S.	Pearson Education, New Delhi, Fifth edition, 2009, ISBN:108131728498,99

14. SOFTWARE/LEARNING WEBSITES

- a. <https://www.britishcouncil.in/english/learn-online>
- b. <http://learner.english.britishcouncil.org/en/content>

- c. <http://www.talkenglish.com/>
- d. language.labsystem.com
- e. www.wordsworthelt.com



Course Name : All Branches of Diploma in Engineering and Technology.

Course Code : CE/CR/CS/CH/PS/CM/CO/IF/CW/DE/EJ/EN/EQ/ET/EX/IE/MU/EE/EP/EU/IS/IC/AE/FG/ME/PG/PT/DC/TX/TC

Semester : First

Subject Title : Basic Science (Physics & Chemistry)

Subject Code : 22102

1. RATIONALE

Diploma engineers (also called technologists) have to deal with various materials and machines. This course is designed with some fundamental information to help the technologists apply the basic concepts and principles of physics and chemistry to solve broad-based engineering problems. The study of basic principles of sciences and the concepts related to various materials such as metals, alloys, inorganic salts, polymers, lubricants, paints, varnishes, adhesives, heat, electricity, magnetism, optics, semiconductors and others will help in understanding the technology courses where emphasis is on the applications of these in different technology applications.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Solve broad-based engineering problems applying principles of physics and chemistry.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following **industry oriented** COs associated with the above mentioned competency:

- Estimate errors in the measurement of physical quantities.
- Apply the principles of electricity and magnetism to solve engineering problems.
- Use the basic principles of heat and optics in related engineering applications.
- Apply the catalysis process in industries.
- Use corrosion preventive measures in industry.
- Use relevant engineering materials in industry.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
2	2	2	4	2	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
2	2	2	4	2	70*#	28	15*	00	100	40	25@	10	25	10	50	20
2	2	2	4	2	70*	28	15*	00	100	40	25@	10	25	10	50	20

(*): Under the theory P.A. out of 30 marks, 10 marks are for micro-project assessment (5 marks each for Physics and Chemistry) to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: L-Lecture; T-Tutorial/Teacher Guided Theory Practice; P-Practical; C-Credit; ESE-End Semester Examination; PA-Progressive Assessment

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

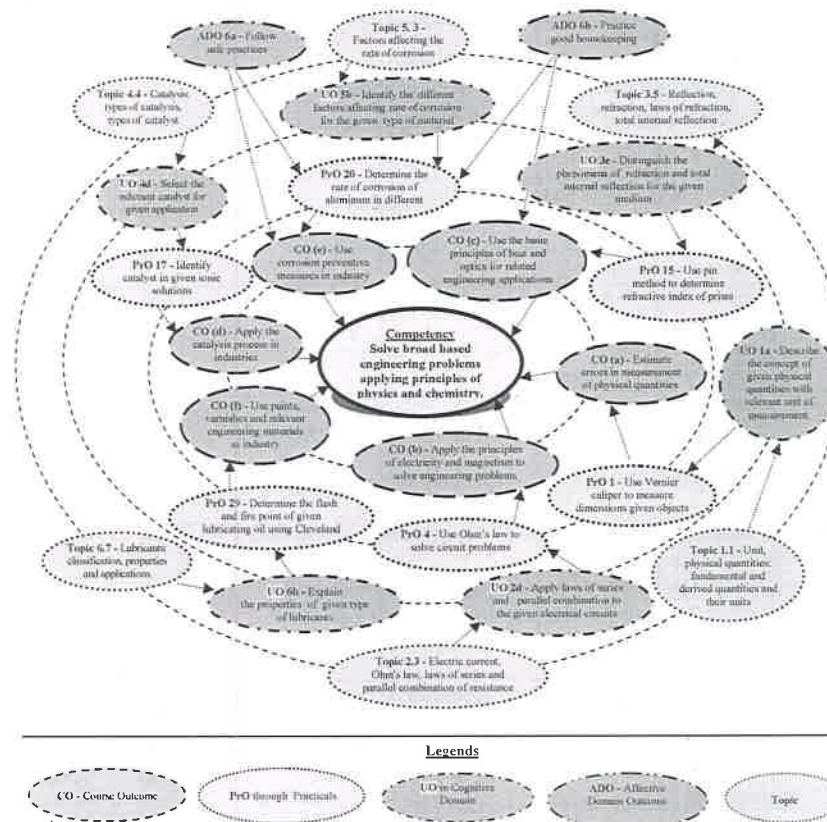


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
Physics			



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Use Vernier caliper to : (i) Measure dimensions of given objects. (ii) Measure the dimensions of objects of known dimensions. (iii) Estimate the errors in measurement.	I	02*
2	Use Screw gauge to: (i) Measure dimensions of given objects. (ii) Measure the dimensions of objects of known dimensions. (iii) Estimate the errors in measurement.	I	02*
3	Use Spherometer to measure radius of curvature of any curved surface.	I	02
4	Use Ohm's law to solve circuit problems.	II	02*
5	Determine the specific resistance of given wire.	II	02*
6	Use the principle of series resistance in solving electrical engineering problems.	II	02
7	Use the principle of parallel resistance in solving electrical engineering problems.	II	02
8	Use magnetic compass to draw the magnetic lines of forces of magnet of different shapes.	II	02*
9	Use magnetic compass to determine the neutral points when (i) North pole of bar magnets points towards the north pole of earth. (ii) South pole of bar magnets points towards the north pole of earth.	II	02
10	Use p-n junction diode to draw forward bias and reverse bias I-V characteristics.	II	02*
11	Determine forbidden energy band gap in semiconductors.	II	02
12	Determine the pressure-volume relation using Boyle's law.	III	02
13	Use Joule's calorimeter to determine Joule's mechanical/electrical equivalent of heat.	III	02*
14	Use Searle's thermal conductivity apparatus to find co-efficient of thermal conductivity of a given material.	III	02*
15	Use pin method to determine refractive index of prism.	III	02*
16	Determine the refractive index of glass slab using TIR phenomenon.	III	02
Chemistry			
17	Identify cation in given ionic solutions.	IV	02*
18	Identify anion in given ionic solutions.	IV	02
19	Determine the percentage of iron in the given sample using redox titration.	IV, V	02*
20	Prepare the corrosive medium for Aluminium at different temperature.	V	02
21	Determine the rate of corrosion on different temperatures for Aluminium.	V	02*
22	Determine the electrode potential of Copper metal.	V	02
23	Determine the electrode potential of Iron metal.	V	02*
24	Determine the voltage generated from chemical reaction using	V	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	Daniel Cell.		
25	Determine the pH value of given solution using pH meter and universal indicator.	V	02*
26	Determine electrochemical equivalent of Cu metal using Faraday's first law.	V	02
27	Determine equivalent weight of metal using Faraday's second law.	V	02
28	Determine the effect of temperature on viscosity for given lubricating oil using Redwood viscometer-I.	VI	02*
29	Determine the steam emulsification number of given lubricating oil.	VI	02
30	Determine the flash and fire point of given lubricating oil using Cleveland open cup apparatus.	VI	02*
31	Determine the flash point of given lubricating oil using Abel's closed cup apparatus.	VI	02*
32	Determine thinner content in oil paint.	VI	02*
Total			64

Note

- i. A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 (each in Physics and Chemistry) or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- ii. The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and Recording	10
5	Interpretation of result and Conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs



according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year and
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of PrOs, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Exp. S.No.
1	Vernier Calipers: Range: 0-150mm, Resolution: 0.1mm	1
2	Micrometer screw gauge: Range: 0-25mm, Resolution: 0.01mm, Accuracy: ± 0.02 mm or better	2
3	Spherometer: range: -10 to +10 mm, LC = 0.01mm	3
4	Digital multimeter: 3½ digit display, 9999 counts, digital multimeter measures: V_{ac} , V_{dc} (1000V max), A_{dc} , A_{ac} (10 amp max), Hz, Resistance (0-100 M Ω), Capacitance and Temperature	4, 5, 6, 7, 21, 22, 23
5	Resistance Box: 4 decade ranges from 1 ohm to 1K Ω , accuracy 0.1 % - 1 %	4, 5, 6, 7
6	Battery eliminator: 0- 12V, 2A	6, 7, 25, 26
7	Boyle's apparatus: U tube manometer, digital barometer	12
8	Joule's calorimeter: well insulated 'mechanical/Electrical equivalent of heat apparatus' in wooden box, digital/analog thermometer	13
9	Searle's thermal conductivity apparatus : Cylindrical copper, aluminum, brass, glass and iron rod, steam chamber, digital / analogue thermometer, arrangement for fitting tubes and thermometer	14
10	Forbidden energy band gap set up: Oven : temperature range up to 100°C, thermometer, micro ammeter, Ge diode	11
11	pH meter reading up to pH14: ambient temp. -40 to 70°C.; pH/mV resolution: 13 bit	24
12	Electronic balance, with the scale range of 0.001g to 500gm pan size 100 mm; response time 3-5 sec.; power requirement 90-250 V, 10 watt	13, 17, 19, 25, 26, 31
13	Electric oven inner size 18"x18"x18"; temperature range 100 to 250°C. with the capacity of 40 lt.	31
14	Ammeter 0-2 amp	25, 26
15	Redwood viscometer-I	27
16	Cleveland open cup apparatus	29
17	Abel's close cup apparatus	30

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics are to be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency:

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Physics		

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Units and Measurements	1a. Describe the given measurement device and its application. 1b. Describe with justification the device required to measure the radius of curvature of the given object. 1c. State with justification the error in the given measurement quantity. 1d. Describe the procedure to determine the dimensions of the given physical quantities.	1.1 Unit, physical quantities: fundamental and derived quantities and their units 1.2 Systems of unit: CGS, MKS, FPS and SI 1.3 Dimensions, dimensional formula 1.4 Errors, types of errors: instrumental, systematic and random error, estimation of errors: absolute, relative and percentage error, significant figures
Unit– II Electricity, Magnetism and Semiconductors	2a. Calculate electric field, potential and potential difference of the given static charge. 2b. Describe the concept of given magnetic intensity and flux with relevant units. 2c. Explain the heating effect of the given electric current. 2d. Apply laws of series and parallel combination in the given electric circuits. 2e. Distinguish the given conductors, semiconductors and insulators on the basis of energy bands. 2f. Explain the I-V characteristics and applications of the given p-n junction diodes.	2.1 Concept of charge, Coulomb's inverse square law, Electric field, Electric field intensity, potential and potential difference 2.2 Magnetic field and magnetic field intensity and its units, magnetic lines of force, magnetic flux 2.3 Electric current, Ohm's law, specific resistance, laws of series and parallel combination of resistance, heating effect of electric current 2.4 Conductors, Insulators and Semiconductors, Energy bands, intrinsic and extrinsic semiconductors 2.5 p-n junction diode, I-V characteristics of p-n junction, applications of p-n junction diode
Unit– III Heat and Optics	3a. Convert the given temperature in different temperature scales. 3b. Describe the properties of the given good and bad conductors of heat. 3c. Relate the characteristics of the three gas laws. 3d. Determine the relation between specific heats for the given materials. 3e. Distinguish the phenomena of total internal reflection for	3.1 Heat, temperature, temperature scales 3.2 Modes of transfer of heat, good and bad conductors of heat, law of thermal conductivity 3.3 Boyle's law, Charles's law, Gay Lussac's law, perfect gas equation 3.4 Specific heat of gas at constant pressure and volume (C_p and C_v), ratio of specific heats 3.5 Reflection, refraction, laws of refraction, total internal reflection



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	the given mediums. 3f. Describe light propagation in the given type of optical fiber.	3.6 Optical fiber: Principle, construction and path of light through optical fiber, applications of optical fibers.
Chemistry		
Unit-IV Chemical bonding and Catalysis	4a. Explain the properties of given material based on the bond formation. 4b. Describe the molecular structure of given solid, liquid and gases. 4c. Describe the crystal structure of the given solids. 4d. Select the relevant catalyst for given application.	4.1 Electronic theory of valency, chemical bonds: types and characteristics, electrovalent bond, covalent bond, coordinate bond, hydrogen bond, metallic bond, metallic properties, intermolecular force of attraction. 4.2 Molecular arrangement in solid, liquid and gases. 4.3 Structure of solids: crystalline and amorphous solid, properties of metallic solids-, unit cell- of simple cubic, body centre cubic, face centre cubic, hexagonal close pack crystals. 4.4 Catalysis: Types of catalysis, Catalyst, Types of Catalyst, Positive Catalyst, Negative Catalyst, Auto-catalyst, Catalytic Promoter and Catalytic inhibitor, Industrial Application of Catalyst
Unit-V Metal Corrosion, its prevention and Electrochemistry	5a. Describe the phenomenon of the given type of corrosion and its prevention. 5b. Identify the different factors affecting rate of corrosion for the given type of material. 5c. Select the protective measures to prevent the corrosion in the given corrosive medium. 5d. Differentiate the salient features of the given electrolytic cell and electrochemical cell. 5e. Distinguish the given	5.1 Corrosion: Types of corrosion- Dry corrosion, Wet corrosion. Oxidation corrosion (Atmospheric corrosion due to oxygen gas), mechanism, Types of oxide film, Wet corrosion mechanism (Hydrogen evolution in acidic medium) 5.2 Concentration cell corrosion -oxygen absorption mechanism in neutral or alkaline medium, Pitting corrosion, Waterline corrosion, Crevice corrosion. 5.3 Factors affecting the rate of corrosion control: Modification of environment, Use of protective coatings- coating of less active metal like Tin (Tinning), coating of more active metal like Zinc (Galvanizing), Anodic and cathodic protection, Choice of material-using pure metal and using metal alloys 5.4 Electrolyte- strong and weak, Non-Electrolyte, Electrolytic cell, Electrochemical cell. Cathode, Anode, Electrode potential- oxidation and reduction, Construction and working of

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	primary and secondary electrolytic cells. 5f. Describe the process of electrolysis for the given electrolyte. 5g. Describe the process of electroplating of the given material.	Daniel cell Ionisation and dissociation 5.5 Faradays first and second law 5.6 Primary cell and secondary cell Electrolysis- Mechanism, Electroplating and electro-refining of copper.
Unit-VI Paints, Varnishes, Insulators, Polymer, Adhesives and Lubricants	6a. Identify the ingredients of the given paints. 6b. Differentiate salient properties of the given paint and varnish. 6c. Describe the properties of insulating materials for the given application. 6d. Differentiate the given types of structural polymers. 6e. Describe the polymerization process of the given polymer. 6f. Explain the properties and uses of the given polymer, elastomer and adhesive. 6g. Describe the application of relevant adhesives required for the given material. 6h. Explain the properties of given type of lubricants.	6.1 Paints: Purpose of applying paint, Characteristics of paints, Ingredients of paints, Function and Examples of each ingredients 6.2 Varnish: Types, Difference between paints and varnishes 6.3 Insulators: Characteristics, Classification, Properties and Application of Glass wool, Thermo Cole 6.4 Polymer and Monomer, Classification: on the basis of Molecular structure, on the basis of monomers (homo polymer and copolymer), on the basis of Thermal behavior (Thermoplastics and Thermosetting) 6.5 Types Polymerization Reaction, Addition Polymerization, Condensation Polymerization, Synthesis, properties and application of Polyethylene, Polyvinyl chloride, Teflon, Polystyrene, Phenol formaldehyde, Epoxy Resin 6.6 Adhesives: Characteristics, Classification and their uses 6.7 Lubricants: Classification, properties and applications

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
	Physics					
I	Units and Measurements	06	02	03	-	05
II	Electricity, Magnetism and Semiconductors	14	03	05	08	16

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
III	Heat and Optics	12	03	05	06	14
	Chemistry					
IV	Chemical bonding and Catalysis	08	02	03	04	09
V	Metal Corrosion, prevention and Electrochemistry	12	03	04	05	12
VI	Paints, Varnishes, Insulators, Polymer Adhesives and Lubricants	12	03	05	06	14
Total		64	16	25	29	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

- Market survey of different resins and compare the following points.
 - Structure
 - Properties
 - Applications
- Library survey regarding engineering material used in different industries.
- Power point presentation or animation for showing different types of bonds or molecules.
- Seminar on any relevant topic.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Guide student(s) in undertaking micro-projects.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. The micro-project could be industry

application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

- Optical Fiber and TIR:** Prepare models by using water and diode laser to demonstrate total internal reflection and the working of optical fiber.
- Conductivity:** Collect different materials such as metal, plastics, glass etc. and prepare models to differentiate between good and bad conductor within collected materials.
- Gas laws:** Prepare models to demonstrate Boyle's laws, Charle's Law and Gay Lussac's law using house hold materials.
- Battery and Cell:** Collect wastage material from lab and household and prepare working model of cell.
- Adhesives:** Prepare model to demonstrate the applications of various adhesives.
- Polymer:** Collect the samples of different polymers and list their uses.
- Series and parallel resistances:** Prepare models for combination of series and parallel resistances using bulbs/ LED.
- Systems and units:** Prepare chart on comparison of systems of units for different physical quantities.
- Magnetic flux:** Prepare models to demonstrate magnetic lines of lines of forces of different types of magnets.
- Dimensional analysis:** Prepare chart on dimensions of fundamental and derived physical quantities and highlights the applications of dimensional analysis.
- Types of bonds:** Prepare chart and models displaying different types of bonds with examples.
- Ionization:** Prepare chart displaying ionization phenomenon.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Physics Textbook Part I - Class XI	Narlikar, J. V.; Joshi, A. W.; Mathur, Anuradha; et al	National Council of Education Research and Training, New Delhi, 2010, ISBN : 8174505083
2	Physics Textbook Part II - Class XI	Narlikar, J. V.; Joshi, A. W.; Mathur, Anuradha; et al	National Council of Education Research and Training, New Delhi, 2015, ISBN : 8174505660
3	Physics Textbook Part I - Class XII	Narlikar, J.V.; Joshi, A. W.; Ghatak A.K. et al	National Council of Education Research and Training, New Delhi, 2013, ISBN : 8174506314
4	Physics Textbook Part II - Class XII	Narlikar, J.V.; Joshi, A. W.; Ghatak A.K. et al	National Council of Education Research and Training, New Delhi, 2013, ISBN : 8174506713
5	Fundamentals of	Haliday, David;	John Wiley and sons, Hoboken,



S. No.	Title of Book	Author	Publication
	Physics	Resnik, Robert and Walker, Jearl	USA, 2014 ISBN : 812650823X
6	Engineering Chemistry	Jain and Jain	Dhanpat Rai and sons; New Delhi, 2015, ISBN : 9352160002
7	Engineering Chemistry	Dara, S. S.	S.Chand. Publication, New Delhi, 2013, ISBN: 8121997658
8	Fundamental of electrochemistry	Bagotsky, V.S.	Wiley International N. J., 2005, ISBN: 9780471700586

14. SOFTWARE/LEARNING WEBSITES

- a. <http://nptel.ac.in/course.php?disciplineId=115>
- b. <http://nptel.ac.in/course.php?disciplineId=104>
- c. <http://hperphysics.phy-astr.gsu.edu/hbase/hph.html>
- d. www.physicsclassroom.com
- e. www.physics.org
- f. www.fearofphysics.com
- g. www.sciencejoywagon.com/physicszone
- h. www.science.howstuffworks.com
- i. <https://phet.colorado.edu>
- j. www.chemistryteaching.com
- k. www.visionlearning.com
- l. www.chem1.com
- m. www.onlinelibrary.wiley.com
- n. www.rsc.org
- o. www.chemcollective.org



Program Name : All Branches of Diploma in Engineering and Technology.

Program Code : CE/CR/CS/CH/PS/CM/CO/IF/CW/DE/EJ/EN/EQ/ET/EX/IE/MU/EE/EP/EU/IS/IC/AE/FG/ME/PG/PT/DC/TX/TC

Semester : First

Course Title : Mathematics

Course Code : 22103

1. RATIONALE

Mathematics is the core course to develop the competencies of most of the technological courses. This basic course of Mathematics is being introduced as a foundation which will help in developing the competency and the requisite course outcomes in most of the engineering diploma programmes to cater to the needs of the industry and thereby enhance the employability. This course is an attempt to initiate the multi-dimensional logical thinking and reasoning capabilities. It will help to apply the principles of basic mathematics to solve related technology problems. Hence, the course provides the insight to analyze engineering problems scientifically using logarithms, determinants, matrices, trigonometry, coordinate geometry, mensuration and statistics.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Solve broad-based technology problems using the principles of basic mathematics.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following **industry oriented** COs associated with the above mentioned competency:

- Apply the concepts of algebra to solve engineering related problems.
- Utilize basic concepts of trigonometry to solve elementary engineering problems.
- Solve basic engineering problems under given conditions of straight lines.
- Solve the problems based on measurement of regular closed figures and regular solids.
- Use basic concepts of statistics to solve engineering related problems.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
4	2	--	6	3	70	28	30*	00	100	40	--	--	--	--	--	--

(*): Under the theory P.A. Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

Legends: L-Lecture; T-Tutorial/Teacher Guided Theory Practice; P-Practical; C-Credit.
ESE - End Semester Examination; PA - Progressive Assessment.

5. COURSE MAP (with sample COs, Unit Outcomes i.e. UOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

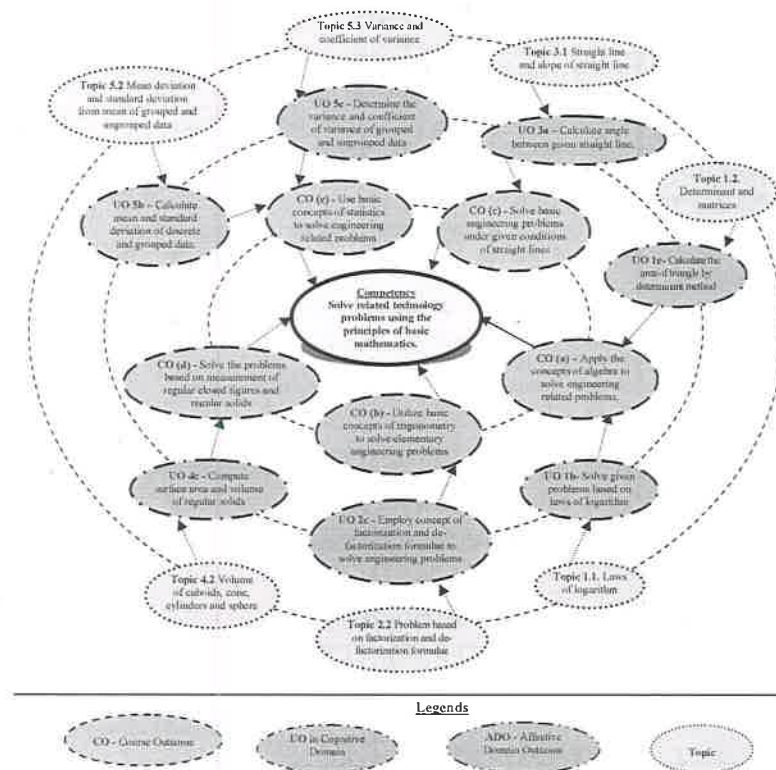


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The tutorials in this section are UOs (i.e. sub-components of the COs) to be developed and assessed in the student to lead to the attainment of the competency.

S. No.	Tutorials	Unit No.	Appr. Hrs. Required
1	Solve simple problems of Logarithms based on definition and laws.	1	2
2	Solve problems on determinant to find area of triangle, and solution of simultaneous equation by Cramer's Rules.	1	2
3	Solve elementary problems on Algebra of matrices.	1	2

S. No.	Tutorials	Unit No.	Appro. Hrs. Required
4	Solve solution of Simultaneous Equation using inversion method.	I	2
5	Resolve into partial fraction using linear non repeated, repeated, and irreducible factors.	I	2
6	Solve problems on Compound, Allied, multiple and sub multiple angles.	II	2
7	Practice problems on factorization and de factorization.	II	2
8	Solve problems on inverse circular trigonometric ratios.	II	2
9	Practice problems on equation of straight lines using different forms.	III	2
10	Solve problems on perpendicular distance, distance between two parallel lines, and angle between two lines.	III	2
11	Solve problems on Area, such as rectangle, triangle, and circle.	IV	2
12	Solve problems on surface and volume, sphere, cylinder and cone.	IV	2
13	Solve practice problems on the surface area, volumes and its applications.	IV	2
14	Solve problems on finding range, coefficient of range and mean deviation.	V	2
15	Solve problems on standard deviation.	V	2
16	Solve problems on coefficient of variation and comparison of two sets.	V	2
Total			32

Note: The above tutorial sessions are for guideline only. The remaining tutorial hours are for revision and practice.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

- Not applicable -

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs in cognitive domain for achieving the COs to attain the identified competency.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Algebra	1a. Solve the given simple problem based on laws of logarithm. 1b. Calculate the area of the given triangle by determinant method. 1c. Solve given system of linear equations using matrix inversion method and by Cramer's rule. 1d. Obtain the proper and improper partial fraction for the given simple rational function.	1.1 Logarithm: Concept and laws of logarithm 1.2 Determinant and matrices a. Value of determinant of order 3x3 b. Solutions of simultaneous equations in three unknowns by Cramer's rule. c. Matrices, algebra of matrices, transpose adjoint and inverse of matrices. Solution of simultaneous equations by matrix inversion method. d. Types of partial fraction based on nature of factors and related

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		problems.
Unit– II Trigonometry	2a. Apply the concept of Compound angle, allied angle, and multiple angles to solve the given simple engineering problem(s). 2b. Apply the concept of Sub- multiple angle to solve the given simple engineering related problem(s). 2c. Employ concept of factorization and de-factorization formulae to solve the given simple engineering problem(s). 2d. Investigate given simple problems utilizing inverse trigonometric ratios.	2.1 Trigonometric ratios of Compound, allied, multiple and sub-multiple angles (without proofs) 2.2 Factorization and de-factorization formulae (without proofs) 2.3 Inverse trigonometric ratios and related problem. 2.4 Principle values and relation between trigonometric and inverse trigonometric ratio.
Unit– III Coordinate Geometry	3a. Calculate angle between given two straight lines. 3b. Formulate equation of straight lines related to given engineering problems. 3c. Identify perpendicular distance from the given point to the line. 3d. Calculate perpendicular distance between the given two parallel lines.	3.1 Straight line and slope of straight line a. Angle between two lines. b. Condition of parallel and perpendicular lines. 3.2 Various forms of straight lines. a. Slope point form, two point form. b. Two points intercept form. c. General form. d. Perpendicular distance from a point on the line. e. Perpendicular distance between two parallel lines.
Unit-IV Mensuration	4a. Calculate the area of given triangle and circle. 4b. Determine the area of the given square, parallelogram, rhombus and trapezium. 4c. Compute surface area of given cuboids, sphere, cone and cylinder. 4d. Determine volume of given cuboids, sphere, cone and cylinder.	4.1 Area of regular closed figures, Area of triangle, square, parallelogram, rhombus, trapezium and circle. 4.2 Volume of cuboids, cone, cylinders and sphere.
Unit –V Statistics	5a. Obtain the range and coefficient of range of the given grouped and ungrouped data. 5b. Calculate mean and standard deviation of discrete and grouped data related to the given simple engineering problem. 5c. Determine the variance and coefficient of variance of given grouped and ungrouped data.	5.1 Range, coefficient of range of discrete and grouped data. 5.2 Mean deviation and standard deviation from mean of grouped and ungrouped data, weighted means 5.3 Variance and coefficient of variance. 5.4 Comparison of two sets of observation.



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	5d. Justify the consistency of given simple sets of data.	

Note: To attain the COs and competency, above listed Unit Outcomes (UOs) need to be undertaken to achieve the ‘Application Level’ and above of Bloom’s ‘Cognitive Domain Taxonomy’.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Algebra	20	02	08	10	20
II	Trigonometry	18	02	08	10	20
III	Coordinate Geometry	08	02	02	04	08
IV	Mensuration	08	02	02	04	08
V	Statistics	10	02	05	07	14
Total		64	10	25	35	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom’s Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course.

- Identify engineering problems based on real world problems and solve with the use of free tutorials available on the internet.
- Use graphical softwares: EXCEL, DPLLOT and GRAPH for related topics.
- Use MathCAD as Mathematical Tools and solve the problems of Calculus.
- Identify problems based on applications of matrix and use MATLAB to solve these problems.
- Prepare models to explain different concepts.
- Prepare a seminar on any relevant topic.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (MOOCs) may be used to teach various topics/sub topics.
- ‘L’ in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About 15-20% of the topics/sub-topics which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the

development of the UOs/COs through classroom presentations (see implementation guideline for details).

- With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
- Guide student(s) in undertaking micro-projects.
- Apply the mathematical concepts learnt in this course to branch specific problems.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty.

- Prepare charts using determinants to find area of regular shapes.
- Prepare models using matrices to solve simple problems based on cryptography.
- Prepare models using matrices to solve simple mixture problems.
- Prepare charts displaying regular solids.
- Prepare charts displaying regular closed figures.
- Prepare charts for grouped and ungrouped data.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Higher Engineering Mathematics	Grewal, B.S.	Khanna publications, New Delhi, 2015 ISBN: 8174091955
2	Advanced Engineering Mathematics	Krezig, Ervin	Wiley Publications, New Delhi, 2014 ISBN :978-0-470-45836-5
3	Engineering Mathematics (third edition).	Croft, Anthony	Pearson Education, New Delhi, 2014 ISBN 978-81-317-2605-1
4	Getting Started with MATLAB-7	Pratap, Rudra	Oxford University Press, New Delhi, 2014, ISBN: 0199731241
5	Advanced Engineering Mathematics	Das, H.K.	S. Chand & Co.; New Delhi; 2008, ISBN-9788121903455

14. SOFTWARE/LEARNING WEBSITES

- www.scilab.org/ - SCI Lab
- www.mathworks.com/products/matlab/ - MATLAB
- www.dplot.com/ - DPlot
- www.allmathcad.com/ - MathCAD
- www.wolfram.com/mathematica/ - Mathematica
- <https://www.khanacademy.org/math?gclid=CNqHuabCys4CFdOJaAoddHoPig>



g. www.easycalculation.com
h. www.math-magic.com



Program Name : All Branches of Diploma in Engineering and Technology.

Program Code : CE/CR/CS/CH/PS/CM/CO/IF/CW/DE/EJ/EN/EQ/ET/EX/IE/MU/EE/EP/EU/IS/IC/AE/FG/ME/PG/PT/DC/TX/TC/BC

Semester : First

Course Title : Fundamentals of ICT

Course Code : 22001

1. RATIONALE

In any typical business setup in order to carry out routine tasks related to create business documents, perform data analysis and its graphical representations and making electronic slide show presentations, the student need to learn various software as office automation tools like word processing applications, spreadsheets and presentation tools. They also need to use these tools for making their project reports and presentations. The objective of this course is to develop the basic competency in students for using these office automation tools to accomplish the job.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Use computers for internet services, electronic documentation, data analysis and slide presentation.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Use computer system and its peripherals.
- Prepare business document using word processing tool.
- Interpret data and represent it graphically using spreadsheet.
- Prepare professional presentations.
- Use different types of web browsers.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme													
L	T	P		Theory								Practical					
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
2	--	2	4	--	--	--	--	--	--	25@S	10	25~	10	50	20		

(~): For the courses having **ONLY** practical examination, the PA has two components under practical marks i.e. the assessment of practicals (seen in section 6) has a weightage of 60% (i.e. 15 marks) and micro-project assessment (seen in section 12) has a weightage of 40% (i.e. 10 marks). This is designed to facilitate attainment of COs holistically, as there is no theory ESE.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P – Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment; # No theory exam.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

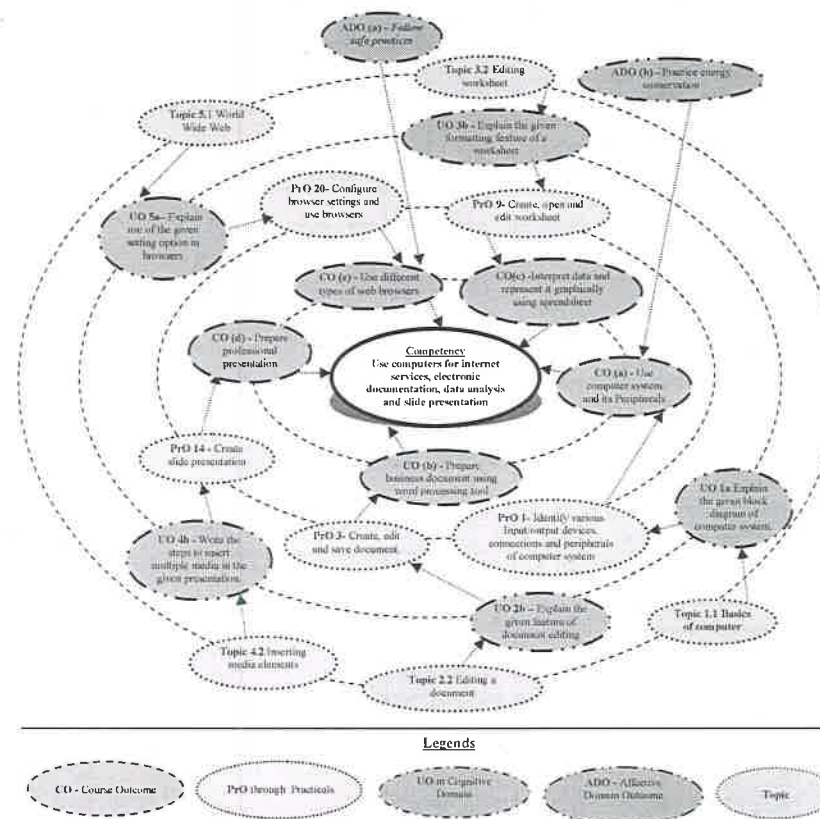


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
Computer system and Operating system:			
1	Identify various Input/output devices, connections and peripherals of computer system	I	1*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
2	Manage files and folders : Create, copy, rename, delete, move files and folder	I	1
Word Processing			
3	Create, edit and save document : apply formatting features on the text - line, paragraph	II	2*
4	Use bullets, numbering, page formatting	II	2
5	Insert and edit images and shapes, sizing, cropping, colour, background, group/ungroup	II	2
6	Insert and apply various table formatting features on it.	II	2
7	Apply page layout features i. Themes, page background, paragraph, page setup ii. Create multicolumn page iii. Use different options to print the documents	II	2*
8	Use mail merge with options.	II	1
Spreadsheets			
9	Create, open and edit worksheet i. Enter data and format it, adjust row height and column width ii. Insert and delete cells, rows and columns iii. Apply wrap text, orientation feature on cell.	III	2*
10	Insert formulas, "IF" conditions, functions and named ranges in worksheet.	III	2
11	Apply data Sort, Filter and Data Validation features.	III	2*
12	Create charts to apply various chart options.	III	2
13	Apply Page setup and print options for worksheet to print the worksheet.	III	1
Presentation Tool			
14	Create slide presentation i. Apply design themes to the given presentation ii. Add new slides and insert pictures/images, shapes	IV	2*
15	i. Add tables and charts in the slides. ii. Run slide presentation in different modes iii. Print slide presentation as handouts	IV	2
16	Apply animation effects to the text and slides.	IV	1
17	Add audio and video files in the given presentation	IV	1
Internet Basics			
18	Configure Internet connection	V	1
19	Use internet for different web services.	V	2*
20	Configure browser settings and use browsers.	V	1*
Total			32

*: compulsory practicals to be performed.

Note

- A suggestive list of practical UOs is given in the above table, more such PrOs can be added to attain the COs and competency.
- Hence, the 'Process' and 'Product' related skills associated with each PrOs of the laboratory/workshop/field work are to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
a.	Use of Appropriate tool to solve the problem (Process)	40
b.	Quality of output achieved (Product)	30
c.	Complete the practical in stipulated time	10
d.	Answer to sample questions	10
e.	Submit report in time	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of PrOs, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Exp. S.No.
1	Computer system with all necessary components like: motherboard, random access memory (RAM), read-only memory (ROM), Graphics cards, sound cards, internal hard disk drives, DVD drive, network interface card.	1
2	Double side printing laser printer.	1,6,12,13
3	Hubs, Switches, Modems.	1, 16,17
4	Any operating system.	2 to 18
5	Any Office Software.	2 to 15
6	Any browser.	16,17,18

Note: There are no specifications fixed for the above listed systems, devices and instruments. Depending on the availability in the institute they can be utilized for the purpose.

UNDERPINNING THEORY COMPONENTS

The following topics/subtopics are to be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency.



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Introduction to Computer System	1a. Explain the given block diagram of computer system. 1b. Classify the given type of software 1c. Explain characteristics of the specified type of network. 1d. Describe procedure to manage a file /folder in the given way. 1e. Describe application of the specified type of network connecting device	1.1 Basics of Computer System: Overview of Hardware and Software: block diagram of Computer System, Input/Output unit CPU, Control Unit, Arithmetic logic Unit (ALU), Memory Unit 1.2 Internal components: processor, motherboards, random access memory (RAM), read-only memory (ROM), video cards, sound cards and internal hard disk drives) 1.3 External Devices: Types of input/output devices, types of monitors, keyboards, mouse, printers: Dot matrix, Inkjet and LaserJet, plotter and scanner, external storage devices CD/DVD, Hard disk and pen drive 1.4 Application Software: word processing, spreadsheet, database management systems, control software, measuring software, photo-editing software, video-editing software, graphics manipulation software System Software compilers, linkers, device drivers, operating systems and utilities 1.5 Network environments: network interface cards, hubs, switches, routers and modems, concept of LAN, MAN, WAN, WLAN, Wi-Fi and Bluetooth 1.6 Working with Operating Systems: Create and manage file and folders, Copy a file, renaming and deleting of files and folders, Searching files and folders, application installation, creating shortcut of application on the desktop.
Unit– II Word Processing	2a. Write steps to create the given text document. 2b. Explain the specified feature for document editing. 2c. Explain the given page setup features of a document. 2d. Write the specified table formatting feature.	2.1 Word Processing: Overview of Word processor Basics of Font type, size, colour, Effects like Bold, italic, underline, Subscript and superscript, Case changing options, Previewing a document, Saving a document, Closing a document and exiting application. 2.2 Editing a Document: Navigate through a document, Scroll through text, Insert and delete text, Select text, Undo and redo commands, Use drag and drop to move text, Copy, cut and paste, Use the clipboard, Clear formatting, Format and align text, Formatting Paragraphs, Line and paragraph spacing using FIND and REPLACE, Setting line



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		spacing, add bullet and numbers in lists, add borders and shading, document views, Page settings and margins, Spelling and Grammatical checks 2.3 Changing the Layout of a Document: Adjust page margins, Change page orientation, Create headers and footers, Set and change indentations, Insert and clear tabs. 2.4 Inserting Elements to Word Documents: Insert and delete a page break, Insert page numbers, Insert the date and time, Insert special characters (symbols), Insert a picture from a file, Resize and reposition a picture 2.5 Working with Tables: Insert a table, Convert a table to text, Navigate and select text in a table, Resize table cells, Align text in a table, Format a table, Insert and delete columns and rows, Borders and shading, Repeat table headings on subsequent pages, Merge and split cells. 2.6 Working with Columned Layouts and Section Breaks: a Columns, Section breaks, Creating columns, Newsletter style columns, Changing part of a document layout or formatting, Remove section break, Add columns to remainder of a document, Column widths, Adjust column spacing, Insert manual column breaks.
Unit– III Spreadsheets	3a. Write steps to create the given spreadsheet. 3b. Explain the specified formatting feature of a worksheet. 3c. Write steps to insert formula and functions in the given worksheet. 3d. Write steps to create charts for the specified data set. 3e. Explain steps to perform advance operation on the given data set.	3.1 Working with Spreadsheets: Overview of workbook and worksheet, Create Worksheet Entering sample data, Save, Copy Worksheet, Delete Worksheet, Close and open Workbook. 3.2 Editing Worksheet: Insert and select data, adjust row height and column width, delete, move data, insert rows and columns, Copy and Paste, Find and Replace, Spell Check, Zoom In-Out, Special Symbols, Insert Comments, Add Text Box, Undo Changes, - Freeze Panes, hiding/unhiding rows and columns. 3.3 Formatting Cells and sheet: Setting Cell Type, Setting Fonts, Text options, Rotate Cells, Setting Colors, Text Alignments, Merge and Wrap, apply Borders and Shades, Sheet Options, Adjust Margins, Page

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		<p>Orientation, Header and Footer, Insert Page Breaks, Set Background.</p> <p>3.4. Working with Formula: Creating Formulas, Copying Formulas, Common spreadsheet Functions such as sum, average, min, max, date, In, And, or, mathematical functions such as sqrt, power, applying conditions using IF.</p> <p>3.5. Working with Charts: Introduction to charts, overview of different types of charts, Bar, Pie, Line charts, creating and editing charts. Using chart options: chart title, axis title, legend, data labels, Axes, grid lines, moving chart in a separate sheet.</p> <p>3.6. Advanced Operations: Conditional Formatting, Data Filtering, Data Sorting, Using Ranges, Data Validation, Adding Graphics, Printing Worksheets, print area, margins, header, footer and other page setup options.</p>
Unit– IV Presentation Tool	<p>4a. Write the steps to create the specified slide presentation.</p> <p>4b. Write the steps to insert multiple media in the given presentation.</p> <p>4c. Write steps to apply table features in the given presentation</p> <p>4d. Write steps to manage charts in the given presentation</p>	<p>4.1 Creating a Presentation: Outline of an effective presentation, Identify the elements of the User Interface, Starting a New Presentation Files, Creating a Basic Presentation, Working with textboxes, Apply Character Formats, Format Paragraphs, View a Presentation, Saving work, creating new Slides, Changing a slide Layout, Applying a theme, Changing Colours, fonts and effects, apply custom Colour and font theme, changing the background, Arrange Slide sequence,</p> <p>4.2 Inserting Media elements: Adding and Modifying Graphical Objects to a Presentation - Insert Images into a Presentation, insert audio clips, video/animation, Add Shapes, Add Visual Styles to Text in a Presentation, Edit Graphical Objects on a Slide, Format Graphical Objects on a Slide, Group Graphical Objects on a Slide, Apply an Animation Effect to a Graphical Object, Add Transitions, Add Speaker Notes, Print a Presentation.</p> <p>4.3 Working with Tables: Insert a Table in a Slide, Format Tables, and Import Tables from Other Office Applications.</p>

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		4.4 Working with Charts: Insert Charts in a Slide, Modify a Chart, Import Charts from Other Office Applications.
Unit– V Basics of Internet	<p>5a. Explain use of the given setting option in browsers.</p> <p>5b. Explain features of the specified web service.</p> <p>5c. Describe the given characteristic of cloud.</p> <p>5d. Explain the specified option used for effective searching in search engine.</p>	<p>5.1 World Wide Web: Introduction, Internet, Intranet, Cloud, Web Sites, web pages, URL, web servers, basic settings of web browsers-history, extension, default page, default search engine, creating and retrieving bookmarks, use search engines effectively for searching the content.</p> <p>5.2 Web Services: e-Mail, Chat, Video Conferencing, e-learning, e-shopping, e-Reservation, e-Groups, Social Networking.</p>

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN - Not Applicable -

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

- Prepare journal of practicals.
- Prepare a sample document with all word processing features. (Course teacher shall allot appropriate document type to each students)
- Undertake micro projects

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About 15-20% of the topics/sub-topics which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
- Guide student(s) in undertaking micro-projects.
- Guide student(s) in undertaking various activities in the lab/workshop.
- Demonstrate students thoroughly before they start doing the practice.
- Show video/animation films for handling/functioning of instruments.
- Observe continuously and monitor the performance of students in Lab.



12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

- Word documents:** Prepare Time Table, Application, Notes, Reports. (Subject teacher shall assign a document to be prepared by the each students)
- Slide Presentations:** Prepare slides with all Presentation features such as: classroom presentation, presentation about department, presentation of report. (Subject teacher shall assign a presentation to be prepared by the each student).
- Spreadsheets:** Prepare Pay bills, tax statement, student's assessment record using spreadsheet. (Teacher shall assign a spreadsheet to be prepared by each student).

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Computer Fundamentals	Goel, Anita	Pearson Education, New Delhi, 2014, ISBN: 978-8131733097
2	Computer Basics Absolute Beginner's Guide, Windows 10	Miller, Michael	QUE Publishing: 8th edition August 2015, ISBN: 978-0789754516
3	Linux: Easy Linux for Beginners	Alvaro, Felix	CreatevSpace Independent Publishing Platform- 2016, ISBN: 978-1533683731
4	Microsoft Office 2010: On Demand	Johnson, Steve	Pearson Education, New Delhi India, 2010; ISBN: 9788131770641
5	Microsoft Office 2010 for Windows: Visual Quick Start	Schwartz, Steve	Pearson Education, New Delhi India, 2012, ISBN: 9788131766613
6	OpenOffice.org for Dummies	Leete, Gurdy, Finkelstein Ellen, Mary Leete	Wiley Publishing, New Delhi, 2003 ISBN: 978-0764542220

14. SOFTWARE/LEARNING WEBSITES

- <https://www.microsoft.com/en-in/learning/office-training.aspx>
- <http://www.tutorialsforopenoffice.org/>
- https://s3-ap-southeast-1.amazonaws.com/r4ltue295xy0d/Special_Edition_Using_StarOffice_6_0.pdf



Course Name : Mechanical, Electrical, Chemical, Civil & Textile Program Group
 Course Code : AE/CE/CR/CS/CH/EE/EP/EU/ME/PG/PT/PS/FG/DC/TC/TX
 Semester : First
 Subject Title : Engineering Graphics
 Subject Code : 22002

1. RATIONALE

Engineering graphics is the language of engineers. The concepts of graphical language are used in expressing the ideas, conveying the instructions, which are used in carrying out the jobs on the sites, shop floor. It covers the knowledge and application of drawing instruments and also familiarizes the learner about Bureau of Indian standards related to engineering drawing. The curriculum aims at developing the ability to draw and read various engineering curves, projections and dimensioning styles. The course mainly focuses on use of drawing instruments, developing imagination and translating ideas into sketches. The course also helps to develop the idea of visualizing the actual object or part on the basis of drawings and blue prints. This preliminary course aims at building a foundation for the further courses related to engineering drawing and other allied courses in coming semesters.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Prepare engineering drawing manually using prevailing drawing instruments.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

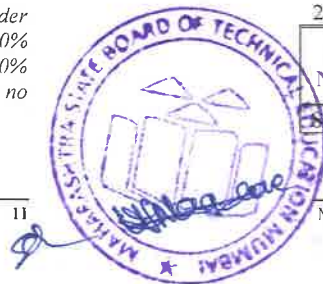
- Draw geometrical figures and engineering curves.
- Draw the views of given object using principles of orthographic projection.
- Draw isometric views of given component or from orthographic projections.
- Use drawing codes, conventions and symbols as per IS SP-46 in engineering drawing.
- Draw free hand sketches of given engineering elements.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme											
L	T	P		Theory						Practical					
				Paper Hrs.	ESE		PA		Total	ESE		PA		Total	
					Max	Min	Max	Min		Max	Min	Max	Min		Max
2	--	4	6	--	--	--	--	--	--	50@	20	50~	20	100	40

(**) marks should be awarded on the basis of internal end semester theory exam of 50 marks based on the *specification* table given in S. No. 9.

(~): For the *courses having ONLY practical examination*, the PA has two components under practical marks i.e. the assessment of practicals (seen in section 6) has a weightage of 60% (i.e. 30 marks) and micro-project assessment (seen in section 12) has a weightage of 40% (i.e. 20 marks). This is designed to facilitate attainment of COs holistically, as there is no theory ESE.



Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment, #: No theory paper.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

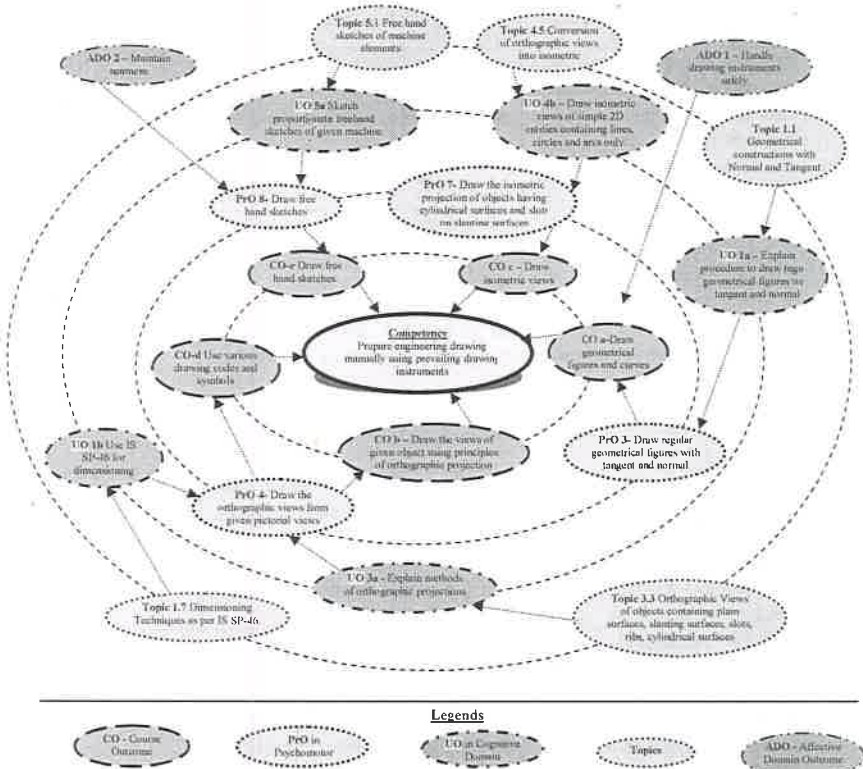


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency. Following practicals (except 1, 2, 3, 4, 31 and 32) are to be attempted on A2 drawing sheets.

S. No.	Practical Outcomes (PrOs) (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. Required
	Sketch Book		

S. No.	Practical Outcomes (PrOs) (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. Required
1	Draw horizontal, vertical, 30 degree, 45 degree, 60 and 75 degrees lines, different types of lines, dimensioning styles using Set squares/ drafter.	I	02
2	Write alphabets and numerical (Vertical only)	I	02
3	Draw regular geometric constructions	I	02
4	Redraw the given figure	I	02
Sheet No. 1 (Three problems)			
5	Draw one figure showing dimensioning techniques. (Problem 1)	I	02
6	Draw one problem on redraw the figure. (Problem 2)	I	02
7	Draw one problem on loci of points - slider crank mechanism. (Problem 3)	I	02
Sheet No. 2 (Two problems)			
8	Draw Engineering Curves. (Problem 1)	II	02
9	Draw Engineering Curves. (Problem 1 continued)	II	02
10	Draw Engineering Curves. (Problem 2)	II	02
11	Draw Engineering Curves. (Problem 2 continued)	II	02
Sheet No. 3 (Two problems)			
12	Draw a problem on orthographic projections using first angle method of projection having plain and slanting surfaces. (Problem 1)	III	02
13	Draw problem on orthographic projections using first angle method of projection having plain and slanting surfaces. (Problem 1 continued)	III	02
14	Draw another problem on orthographic projections using first angle method of projection having plain and slanting surfaces. (Problem 2)	III	02
15	Draw another problem on orthographic projections using first angle method of projection having plain and slanting surfaces. (Problem 2 continued)	III	02
Sheet No. 4 (Two problems)			
16	Draw two problems on orthographic projections using first angle method of projection having cylindrical surfaces, ribs. (Problem 1)	III	02
17	Draw two problems on orthographic projections using first angle method of projection having cylindrical surfaces, ribs. (Problem 1 continued)	III	02
18	Draw two problems on orthographic projections using first angle method of projection having cylindrical surfaces, ribs. (Problem 2)	III	02
19	Draw two problems on orthographic projections using first angle method of projection having cylindrical surfaces, ribs. (Problem 2 continued)	III	02
Sheet No. 5 (Two problems)			
20	Draw two problems on Isometric view of simple objects having plain and slanting surface by using natural scale. (Problem 1)	IV	02
21	Draw two problems on Isometric view of simple objects having plain and slanting surface by using natural scale. (Problem 1 continued)	IV	02

S. No.	Practical Outcomes (PrOs) (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. Required
22	Draw two problems on Isometric view of simple objects having plain and slanting surface by using natural scale. (Problem 2)	IV	02
23	Draw two problems on Isometric view of simple objects having plain and slanting surface by using natural scale. (Problem 2 continued)		
Sheet No. 6 (Two problems)			
24	Draw a problem on Isometric Projection of objects having cylindrical surface by using isometric scale. (Problem 1)	IV	02
25	Draw a problem on Isometric Projection of objects having cylindrical surface by using isometric scale. (Problem 1 continued)	IV	02
26	Draw a problem on Isometric Projection of objects having slot on slanting surface by using isometric scale. (Problem 2)	IV	02
27	Draw a problem on Isometric Projection of objects having slot on slanting surface by using isometric scale. (Problem 2 continued)	IV	02
Sheet No. 7 (Six problems)			
28	Draw free hand sketches/conventional representation of machine elements in sketch book such as thread profiles, nuts, bolts, studs, set screws, washers, Locking arrangements. (Problem 1,2)	V	02
29	Draw free hand sketches/conventional representation of machine elements in sketch book such as thread profiles, nuts, bolts, studs, set screws, washers, Locking arrangements. (Problem 3,4)	V	02
30	Draw free hand sketches/conventional representation of machine elements in sketch book such as thread profiles, nuts, bolts, studs, set screws, washers, Locking arrangements. (Problem 5,6)	V	02
Sketch Book (Two problems)			
31	Problem Based Learning: Given the 3D model of an object, student will try to imagine the three views and draw them in the sketch book. (Problem 1)	III, II, V	02
32	Problem Based Learning: Given the 3D model of an object, student will try to imagine the three views and draw them in the sketch book. (Problem 2)	III, II, V	02
Total			64

All practicals are to be performed.

Note

- A suggestive list of PrOs is given in the above table, more such PrOs can be added to attain the COs and competency.
- The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Neatness, Cleanliness on drawing sheet	10
2	Uniformity in drawing and line work	10

S. No.	Performance Indicators	Weightage in %
3	Creating given drawing	40
4	Dimensioning the given drawing and writing text	20
5	Answer to sample questions	10
6	Submission of drawing in time	10
	Total	100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow cleanliness and neatness.
- Follow ethics and standards.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Exp. S.No.
1	Drawing Table with Drawing Board of Full Imperial/ A1 size.	All
2	Models of objects for orthographic / isometric projections	4,5,6,7
3	Models/ Charts of objects mentioned in unit no. 5	-
4	Set of various industrial drawings being used by industries.	All
5	Set of drawings sheets mentioned in section 6.0 could be developed by experienced teachers and made used available on the MSBTE portal to be used as reference/standards.	All
6	Drawing equipment's and instruments for class room teaching-large size: a. T-square or drafter (Drafting Machine) b. Set squares (45° and 30°- 60°) c. Protractor d. Drawing instrument box (containing set of compasses and dividers)	All
7	Interactive board with LCD overhead projector	All

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics is to be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency:

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Basic elements of Drawing	1a. Prepare drawing using drawing instruments. 1b. Use IS SP-46 for dimensioning. 1c. Use different types of lines. 1d. Draw regular geometrical figures. 1e. Draw figures having tangency constructions.	1.1 Drawing Instruments and supporting material: method to use them with applications. 1.2 Standard sizes of drawing sheets (ISO-A series) 1.3 I.S. codes for planning and layout. 1.4 Letters and numbers (single stroke vertical) 1.5 Convention of lines and their applications. 1.6 Scale - reduced, enlarged and full size 1.7 Dimensioning techniques as per SP-46 (Latest edition) – types and applications of chain, parallel and coordinate dimensioning 1.8 Geometrical constructions.
Unit– II Engineering curves and Loci of Points	2a. Explain different engineering curves with areas of application. 2b. Draw different conic sections based on given situation. 2c. Draw involute and cycloidal curves based on given data. 2d. Draw helix and spiral curves from given data 2e. Plot Loci of points from given data.	2.1 Concept of focus, directrix, vertex and eccentricity. Conic sections. 2.2 Methods to draw an ellipse by Arcs of circle method and Concentric circles method. 2.3 Methods to draw a parabola by Directrix-Focus method and Rectangle method 2.4 Methods to draw a hyperbola by Directrix-Focus method. 2.5 Methods to draw involutes: circle and pentagon, 2.6 Methods to draw Cycloidal curve: cycloid, epicycloid and hypocycloid 2.7 Methods to draw Helix and Archimedean spiral. 2.8 Loci of points on Single slider crank mechanism with given specifications.
Unit– III Orthographic projections	3a. Explain methods of Orthographic Projections. 3b. Draw orthographic views of given simple 2D entities containing lines, circles and arcs only. 3c. Draw the orthographic views from given pictorial views.	3.1 Projections-orthographic, perspective, isometric and oblique: concept and applications.(No question to be asked in examination) 3.2 Orthographic projection, First angle and Third angle method, their symbols. 3.3 Conversion of pictorial view into Orthographic Views – object containing plain surfaces, slanting surfaces, slots, ribs, cylindrical surfaces. (use First Angle Projection Method Only)
Unit– IV Isometric projections	4a. Prepare isometric scale. 4b. Draw isometric views of given simple 2D entities containing lines,	4.1 Isometric projection. 4.2 Isometric scale and Natural Scale. 4.3 Isometric view and isometric projection. 4.4 Illustrative problems related to simple



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	circles and arcs only. 4c. Interpret the given orthographic views. 4d. Draw Isometric views from given orthographic views.	objects having plain, slanting, cylindrical surfaces and slots on slanting surfaces. 4.5 Conversion of orthographic views into isometric View/projection.
Unit- V Free Hand Sketches of engineering elements	5a. Sketch proportionate freehand sketches of given machine elements. 5b. Select proper fasteners and locking arrangement for given situation.	5.1 Free hand sketches of machine elements: Thread profiles, nuts, bolts, studs, set screws, washers, Locking arrangements. (For branches other than mechanical Engineering, the teacher should select branch specific elements for free hand sketching)

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER (INTERNAL) DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Principles of Drawing	04	-	02	04	06
II	Engineering curves and Loci of Points.	06	-	02	04	06
III	Orthographic projections	06	-	02	08	10
IV	Isometric projections	08	02	07	07	16
V	Free Hand Sketches of m/c elements	08	02	02	08	12
Total		32	4	15	31	50

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of LOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

This specification table also provides a general guideline for teachers to frame internal end semester practical theory exam paper which students have to undertake on the drawing sheet.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

- Student should maintain a separate A3 size sketch book which will be the part of term work and submit it along with drawing sheets. Following assignment should be drawn in the sketch book
 - Single stroke vertical Letters and Numbers.

- Type of lines.
 - Redraw the figures (any one).
 - Engineering Curves. One problem for each type of curve.
 - Orthographic projections. Minimum 5 problems.
 - Isometric Projections/Views. Minimum 5 problems.
 - Free hand sketches. All types of machine elements mentioned in Unit no-5.
 - Note- Problems on sheet and in the sketch book should be different.
- Students should collect Maps, Production drawings, Building Drawings. Layouts from nearby workshops/industries/builders/contractors and try to list
 - Types of lines used
 - Lettering styles used
 - Dimension styles used
 - IS code referred.
 - List the shapes and curves you are observing around you in real life with name of place and item. (For Ex. ellipse, parabola, hyperbola, cycloid, epicycloids, hypocycloid, involute, spiral helix).
 - Take one circular shape. Assume one point on circumference and mark it. Roll that shape on flat and circular surface. Observe the path of the point and try to correlate with the theory taught in the class
 - Take circular and pentagonal shape and wrap a thread over the periphery, now unwrap this thread and observe the locus of the end of the thread and try to correlate with the theory taught in the class
 - Each student should explain at least one problem for construction and method of drawing in sheet to all batch colleagues. Teacher will assign the problem of particular sheet to be explained to each student batch.
 - Each student will assess at least one sheet of other students (May be a group of 5-6 students identified by teacher can be taken) and will note down the mistakes committed by them. Student will also guide the students for correcting the mistakes, if any.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- '**L**' in section No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Guide student(s) in undertaking micro-projects.
- Guide student(s) in fixing the sheet and mini drafter on drawing board..
- Show video/animation films to explain orthographic and Isometric projection.
- Demonstrate first and third angle method using model.
- Use charts and industrial drawing/drawing sheets developed by experienced faculty to teach standard symbols and current industrial/teaching practices



12. SUGGESTED MICRO PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs, and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

- Helical springs:** Each batch will collect 5 open coil and closed coil helical springs of various sizes. Each student will measure the significant parameters of one spring and draw corresponding helix curve in his sketch book.
- Flat coil or spiral springs:** Each batch will collect 10 spiral springs of various sizes. Each student will measure the significant parameters of one spring and draw corresponding helix curve in his sketch book.
- Isometric views:** Each student of the batch will try to collect at least one production drawings/ construction drawings/plumbing drawings from local workshops/builders /electrical and mechanical contractors and try to generate isometric views from the orthographic views given in the drawings.
- Isometric views:** Each student of a batch will select a household/industrial real item and will draw its isometric view in the sketch book.
- Isometric and orthographic views:** Each batch will collect a single point cutting tool from workshop and draw its Isometric and orthographic views with a ten times enlarged scale. In carpentry shop each batch will try to make wooden model from these views.
- Isometric views:** The teacher will assign one set of orthographic projections and ask the student to develop 3D thermocol models of the same.
- Involute curves:** Each batch will try to develop cardboard/thermocol working models which can generate involute curve of any regular geometrical shape.
- Cycloidal curves:** Each batch will collect 3 different sizes bicycle tyres and compare the locus of tube air valve by rolling them on flat road.
- Conic curves:** Each batch will go to institute's play ground and one student standing on the boundary throws a ball to the wicket keeper who is 30 meters away from the thrower and the ball has reached a maximum height of 20 meters from the ground, draw the path of the ball and identify the type of conic curve it has traced in air.
- Involute and Cycloidal curves:** Each batch will collect one Involute and one cycloidal tooth profile spur gear and find out the Involute function.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	Engineering Drawing Practice for Schools and Colleges IS: SP-46	Bureau of Indian Standards.	BIS, Government of India, Third Reprint, October 1998; ISBN: 81-7061-091-2



S. No.	Title of Book	Author	Publication
2.	Engineering Drawing	Bhatt, N.D.	Charotar Publishing House, Anand, Gujarat 2010; ISBN: 978-93-80358-17-8
3.	Machine Drawing	Bhatt, N.D.; Panchal, V. M	Charotar Publishing House, Anand, Gujarat 2010; ISBN: 978-93-80358-11-6
4.	Engineering Drawing	Jolhe, D.A.	Tata McGraw Hill Edu. New Delhi, 2010, ISBN: 978-0-07-064837-1
5.	Engineering Drawing	Dhawan, R. K.	S. Chand and Company New Delhi, ISBN:81-219-1431-0
6.	Engineering Drawing	Shaha, P. J.	S. Chand and Company, New Delhi, 2008, ISBN: 81-219-2964-4

14. SOFTWARE/LEARNING WEBSITES

- <https://www.youtube.com/watch?v=TJ4jGyD-WCw>
- https://www.youtube.com/watch?v=dmt6_n7Sgcg
- https://www.youtube.com/watch?v=_MQScnLXL0M
- <https://www.youtube.com/watch?v=3WXPanCq9LI>
- <https://www.youtube.com/watch?v=fvjk7PlxAuo>
- <http://www.me.umn.edu/courses/me2011/handouts/engg%20graphics.pdf>
- <https://www.machinedesignonline.com>

Program Name : Computer & Electronics Program Group

Program Code : CO/CM/IF/CW/DE/EJ/EN/EQ/ET/EX/IE/MU/IS/IC

Semester : First

Course Title : Engineering Graphics

Course Code : 22003

1. RATIONALE

Engineering graphics is the language of engineers. The concepts of graphical language are used in expressing the ideas, conveying the instructions, which helps to do jobs at various places of industry. This course is useful in developing drafting and sketching skills in the student. It covers the knowledge and application of drawing instruments, familiarizes the learner about Bureau of Indian standards related to engineering drawing and to use computer aided drafting software for developing engineering drawings. It attempts to develop the idea of visualizing the actual object or part, on the basis of drawings and blue prints. This course also focuses on developing the imagination and translating ideas into sketches and also the ability to draw and read various engineering curves, projections and dimensioning styles.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Prepare engineering drawings manually using prevailing drawing instruments and computer aided drafting software.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Draw regular geometrical figures.
- Use drawing codes, conventions and symbols as per IS SP-46 in engineering drawing.
- Draw the views of given object using principles of orthographic projection.
- Draw isometric views of given component or from orthographic projections.
- Draw free hand sketches of given engineering elements.
- Use computer aided drafting approach to create engineering drawings.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
2	--	4	6	--	--	--	--	--	--	50@	20	50~	20	100	40	

(**) marks should be awarded on the basis of internal end semester theory exam of 50 marks based on the *specification* table given in S. No. 9.

(~): For the courses having **ONLY practical examination**, the PA has two components under practical marks i.e. the assessment of practicals (seen in section 6) has a weightage of 60% (i.e. 30 marks) and micro-project assessment (seen in section 12) has a weightage of 40% (i.e. 20 marks). This is designed to facilitate attainment of COs holistically, as there is no theory ESE.

Legends: L-Lecture; T- Tutorial/Teacher Guided Theory Practice; P- Practical; C- Credit. ESE - End Semester Examination; PA - Progressive Assessment, #: No theory paper.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

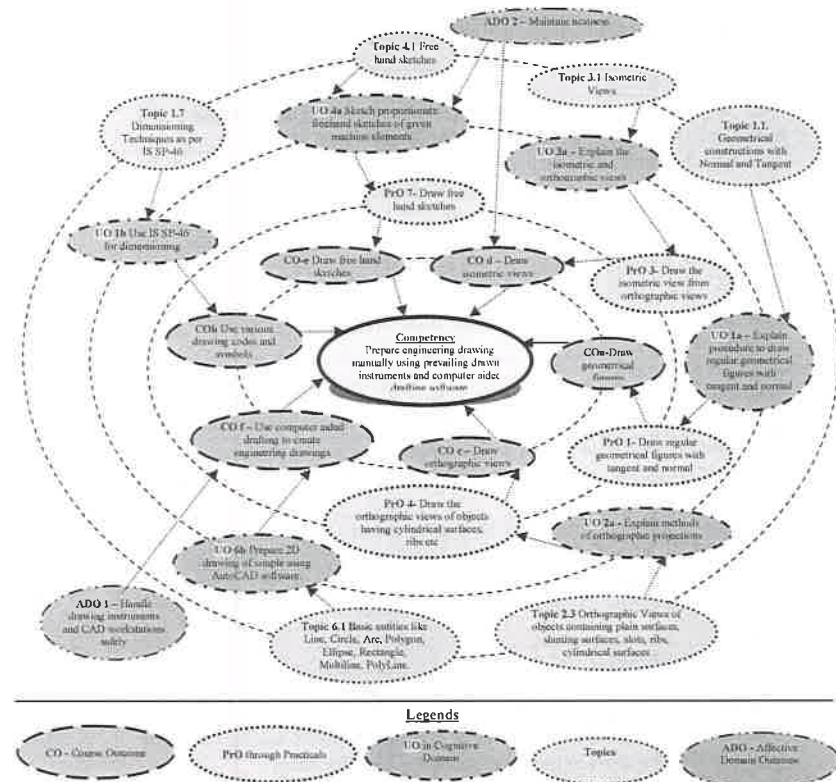


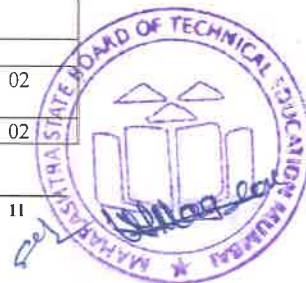
Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency. Following practicals (except 1, 2, 3, 4, 24 and 25) are to be attempted on A2 drawing sheets.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	Sketch Book (Four problems)		

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Draw horizontal, vertical, 30 degree, 45 degree, 60 and 75 degrees lines, different types of lines, dimensioning styles using Tee and Set squares/ drafter. (Problem 1)	I	02
2	Write alphabets and numerical (Vertical only) (Problem 2)	I	02
3	Draw regular geometric constructions and redraw the given figure (Problem 3)	I*	02
4	Draw regular geometric constructions and redraw the given figure (Problem 4)	I	02
Sheet No. 1 (Two problems)			
5	Draw a problem on orthographic projections using first angle method of projection having plain surfaces. (Problem 1)	III	02
6	Draw another problem on orthographic projections using first angle method of projection having plain surfaces. (Problem 1 continued)	III	02
7	Draw a problem on orthographic projections using first angle method of projection having slanting surfaces. (Problem 2)	III	02
8	Draw another problem on orthographic projections using first angle method of projection having slots on slanting surfaces. (Problem 1 continued)	III	02
Sheet No. 2 (Two problems)			
9	Draw two problems on orthographic projections using first angle method of projection having cylindrical surfaces, ribs. (Problem 1)	III	02
10	Draw two problems on orthographic projections using first angle method of projection having cylindrical surfaces, ribs. (Problem 1 continued)	III	02
11	Draw two problems on orthographic projections using first angle method of projection having cylindrical surfaces, ribs. (Problem 2)	III	02
12	Draw two problems on orthographic projections using first angle method of projection having cylindrical surfaces, ribs. (Problem 2 continued)	III	02
Sheet No. 3 (Two problems)			
13	Draw two problems on Isometric view of simple objects having plain and slanting surface by using natural scale. (Problem 1)	IV	02
14	Draw two problems on Isometric view of simple objects having plain and slanting surface by using natural scale. (Problem 1 continued)	IV	02
15	Draw two problems on Isometric view of simple objects having plain and slanting surface by using natural scale. (Problem 2 continued)	IV	02
16	Draw two problems on Isometric view of simple objects having plain and slanting surface by using natural scale. (Problem 2 continued)		
Sheet No. 4 (Two problems)			
17	Draw a problem on Isometric Projection of objects having cylindrical surface by using isometric scale. (Problem 1)	IV	02
18	Draw another problem on Isometric Projection of objects having	IV	02



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	cylindrical surface by using isometric scale. (Problem 1 continued)		
19	Draw a problem on Isometric Projection of objects having slanting surface by using isometric scale. (Problem 2)	IV	02
20	Draw another problem on Isometric Projection of objects having slot on slanting surface by using isometric scale. (Problem 2 continued)	IV	02
Sheet No. 5 (Two problems)			
21	Draw free hand sketches/conventional representation of machine elements in sketch book such as thread profiles, nuts, bolts, studs, set screws, washers, Locking arrangements. (Problem 1)	V	02
22	Draw free hand sketches/conventional representation of machine elements in sketch book such as thread profiles, nuts, bolts, studs, set screws, washers, Locking arrangements. (Problem 2)	V	02
Sketch Book (One problem)			
23	Problem Based Learning: Given the orthographic views of at least three objects with few missing lines, the student will try to imagine the corresponding objects, complete the views and draw these views in sketch book. (Problem 1)	III, II, V	02
Total			46

S. No.	Practical Outcomes (PrOs) (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. Required
Computer and Software Based (Nine problems)			
24	Draw basic 2D entities like: Rectangle, Rhombus, Polygon using AutoCAD (Print out should be a part of progressive assessment). (Problem 1)	V*	02
25	Draw basic 2D entities like: Circles, Arcs, circular using AutoCAD (Print out should be a part of progressive assessment). (Problem 2)	V*	02
26	Draw basic 2D entities like: Circular and rectangular array using AutoCAD (Print out should be a part of progressive assessment). (Problem 3)	V*	02
27	Draw blocks of 2D entities comprises of Rectangle, Rhombus, Polygon, Circles, Arcs, circular and rectangular array, blocks using AutoCAD (Print out should be a part of progressive assessment). (Problem 4)	V*	02
28	Draw basic branch specific components in 2D using AutoCAD (Print out should be a part of term work) (Problem 5)	VI*	02
29	Draw basic branch specific components in 2D using AutoCAD (Print out should be a part of term work) (Problem 6)	VI	02
30	Draw complex branch specific components in 2D using AutoCAD (Print out should be a part of progressive assessment) (Problem 7)	VI*	02
31	Draw complex branch specific components in 2D using AutoCAD (Print out should be a part of progressive assessment) (Problem 8)	VI	02
32	Draw complex branch specific components in 2D using AutoCAD	VI	02

S. No.	Practical Outcomes (PrOs) (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. Required
	(Print out should be a part of progressive assessment) (Problem 9)		
	Total		18

All practicals are to be performed.

Note

- A suggestive list of PrOs is given in the above table, more such PrOs can be added to attain the COs and competency.
- The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Neatness, Cleanliness on drawing sheet	10
2	Uniformity in drawing and line work	10
3	Creating given drawing	40
4	Dimensioning the given drawing and writing text	20
5	Answer to sample questions	10
6	Submission of drawing in time	10
	Total	100

Note: Use above sample assessment scheme for practical exercises 1 to 23.

S. No.	Performance Indicators	Weightage in %
1	Developing/ using Institute Template	20
2	Selecting relevant set up parameters	05
3	Creating given drawing using relevant Commands.	40
4	Dimensioning the given drawing and writing text using blocks and layers effectively.	15
5	Answer to sample questions	10
6	Submission of digital drawing file/plot in time	10
	Total	100

Note: Use above sample assessment scheme for practical exercises 24 to 32.

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow cleanliness and neatness.
- Follow ethics and standards.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Experiment S.No.
1	Drawing Table with Drawing Board of Full Imperial/ A1 size.	All
2	Models of objects for orthographic / isometric projections	1 to 20
3	Models/ Charts of objects mentioned in unit no. 4	-
4	Set of various industrial drawings being used by industries.	All
5	Set of drawings sheets mentioned in section 6.0 could be developed by experienced teachers and made used available on the MSBTE portal to be used as reference/standards.	All
6	Set of various industrial drawings being used by industries. Drawing equipments and instruments for class room teaching-large size: a. T-square or drafter (Drafting Machine). b. Set squares (450 and 300-600) c. Protector. d. Drawing instrument box (containing set of compasses and dividers). e. Drawing sheets, Drawing pencils, Eraser. f. Drawing pins / clips	All
7	Drawing equipment's and instruments for class room teaching-large size: a. T-square or drafter (Drafting Machine) b. Set squares (45° and 30° - 60°) c. Protractor d. Drawing instrument box (containing set of compasses and dividers)	1 to 23
8	Interactive board with LCD overhead projector	All
9	CAD Workstation: 2 GB RAM, 320 GB HDD, 17" Screen, 1 GHz. (Minimum requirement)	24 to 32
10	Plotter: Print resolution Up to 1200 x 600 dpi, 16 MB Memory	24 to 32
11	Licensed latest network version of AutoCAD software	24 to 32

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics is to be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency:

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Basic elements of Drawing	1a. Prepare drawing using drawing instruments. 1b. Use of IS SP-46 for dimensioning technique. 1c. Use different types of lines. 1d. Draw regular geometrical figures. 1e. Draw figures having tangency constructions.	1.1 Drawing Instruments and supporting material: method to use them with applications. 1.2 Convention of lines and their applications. 1.3 Scale - reduced, enlarged and full size 1.4 Dimensioning techniques as per SP-46 (Latest edition) – types and applications of chain, parallel and coordinate dimensioning. 1.5 Geometrical and Tangency constructions.



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		(Redraw the figure)
Unit– II Orthographic projections	2a. Explain methods of Orthographic Projections. 2b. Draw orthographic views of given simple 2D entities containing lines, circles and arcs only. 2c. Draw the orthographic views from given pictorial views. 2d. Use of IS code IS SP-46 for dimensioning technique for given situation.	2.1 Introduction of projections-orthographic, perspective, isometric and oblique: concept and applications.(No question to be asked in examination) 2.2 Introduction to orthographic projection. First angle and Third angle method, their symbols. 2.3 Conversion of pictorial view into Orthographic Views – object containing plain surfaces, slanting surfaces, slots, ribs, cylindrical surfaces. (use First Angle Projection Method Only)
Unit– III Isometric projections	3a. Prepare isometric scale. 3b. Draw isometric views of given simple 2D entities containing lines, circles and arcs only. 3c. Interpret the given orthographic views. 3d. Draw Isometric views from given orthographic views.	3.1 Introduction to isometric projections 3.2 Isometric scale and Natural Scale. 3.3 Isometric view and isometric projection. 3.4 Illustrative problems limited to objects containing lines, circles and arcs shape only. 3.5 Conversion of orthographic views into isometric View/projection.
Unit– IV Free Hand Sketches of engineering elements	4a. Sketch proportionate freehand sketches of given machine elements. 4b. Select proper fasteners and locking arrangement for given situation.	4.1 Free hand sketches of machine elements: Thread profiles, nuts, bolts, studs, set screws, washers, Locking arrangements. (For branches other than mechanical Engineering, the teacher should select branch specific elements for free hand sketching)
Unit– V Computer aided drafting interface	5a. Explain different components of AutoCAD main window. 5b. Open a new/existing file in AutoCAD 5c. Set/edit various parameters in a new/given file.	5.1 Computer Aided Drafting: concept. 5.2 Hardware and various CAD software available. 5.3 System requirement and Understanding the interface. 5.4 Components of AutoCAD software window: Title bar, standard tool bar, menu bar, object properties tool bar, draw tool bar, modify toolbar, cursor cross hair. Command window, status bar, drawing area, UCS icon. 5.5 File features: New file, Saving the file, Opening an existing drawing file, Creating

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		Templates, Quit. 5.6 Setting up new drawing: Units, Limits, Grid, Snap. 5.7 Undoing and Redoing action
Unit– VI Computer aided drafting	6a. Draw basic 2D entities in AutoCAD software. 6b. Prepare 2D drawing of given simple engineering components using AutoCAD software. 6c. Print given drawing using Printer/plotter.	6.1 Draw basic entities like Line, Circle, Arc, Polygon, Ellipse, Rectangle, Multiline, Poly Line. 6.2 Methods of Specifying points: Absolute coordinates, Relative Cartesian and Polar coordinates. 6.3 Modify and edit commands like trim, delete, copy, offset, array, block, layers. 6.4 Dimensioning: Linear, Horizontal, Vertical, Aligned, Rotated, Baseline, Continuous, Diameter, Radius, Angular Dimensions. 6.5 Dim scale variable. 6.6 Editing dimensions. 6.7 Text: Single line Text, Multiline text. 6.8 Standard sizes of sheet. Selecting Various plotting parameters such as Paper size, paper units, Drawing orientation, plot scale, plot offset, plot area, print preview

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER (INTERNAL) DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Basic elements of Drawing	04	-	02	04	06
II	Orthographic projections	06	-	02	08	10
III	Isometric projections	08	02	02	06	10
IV	Free hand sketches of engineering elements	04	02	-	04	06
V	Computer aided drafting interface	04	02	04	-	06
VI	Computer aided drafting	06	02	04	06	12
Total		32	08	14	28	50

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.



This specification table also provides a general guideline for teachers to frame internal end semester practical theory exam paper which students have to undertake on the drawing sheet.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

- a. Student should maintain a separate A3 size sketch book which will be the part of term work and submit it along with drawing sheets. Following assignment should be drawn in the sketch book-
 - i. Single stroke vertical Letters and Numbers.
 - ii. Type of Lines.
 - iii. Redraw the figures. Any three.
 - iv. Engineering Curves. One problem for each type of curve.
 - v. Orthographic projections. Minimum 5 problems.
 - vi. Isometric Projections/Views. Minimum 5 problems.
 - vii. Free hand sketches. All types of engineering elements mentioned in Unit no.-4.
 - viii. Note- Problems on sheet and in the sketch book should be different.
- b. Students should collect Maps, Production drawings, Building Drawings, Layouts from nearby workshops/industries/builders/contractors and try to list
 - i. types of lines used
 - ii. lettering styles used
 - iii. dimension styles used
 - iv. IS code referred
- c. Name the shapes and curves you are observing around you in real life with name of place and item. (For example ellipse, parabola, hyperbola, cycloid, epicycloids, hypocycloid, involute, spiral helix).
- d. Each student should explain at least one problem for construction and method of drawing in sheet to all batch colleagues. Teacher will assign the problem of particular sheet to be explained to each student batch.
- e. Each student will assess at least one sheet of other students (May be a group of 5-6 students identified by teacher can be taken) and will note down the mistakes committed by them. Student will also guide the students for correcting the mistakes, if any.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course

- a. Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
- b. '*L*' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c. About *15-20% of the topics/sub-topics* which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
 - a. Guide student(s) in undertaking micro-projects.
 - b. Guide student(s) in fixing the sheet and mini drafter on drawing board.

- c. Show video/animation films to explain orthographic and Isometric projection.
- d. Demonstrate first and third angle method using model.
- e. Use charts and industrial drawing/drawing sheets developed by experienced faculty to teach standard symbols and current industrial/teaching practices.

12. SUGGESTED LIST OF MICRO PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs, and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than *16 (sixteen) student engagement hours* during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

- a. **Isometric views:** Each student of the batch will try to collect at least one production drawings/construction drawings/plumbing drawings from local workshops/builders /electrical and mechanical contractors and try to generate isometric views from the orthographic views given in the drawings.
- b. **Isometric views:** Each student of a batch will select a household/industrial real item and will draw its isometric view in the sketch book.
- c. **Isometric views:** The teacher will assign one set orthographic projections and ask the student to develop 3D thermocol models of the same.
- d. **Computer aided drafting:** Each batch will collect 5 components/circuits/items specific to their branch and draw their orthographic views using AutoCAD software.
- e. **Computer aided drafting:** Prepare Logo of your institute/board using AutoCAD and then create a template of your institute for drawing and printing all the drawings prepared in AutoCAD.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	Engineering Drawing Practice for Schools and Colleges IS: SP-46	Bureau of Indian Standards	BIS, Government of India, Third Reprint, October 1998; ISBN: 81-7061-091-2
2.	Engineering Drawing	Bhatt, N.D.	Charotar Publishing House, Anand, Gujarat 2010; ISBN: 978-93-80358-17-8
4.	Engineering Drawing	Jolhe, D.A.	Tata McGraw Hill Edu, New Delhi, 2010, ISBN No. 978-0-07-064837-1
5.	Engineering Drawing	Dhawan, R. K.	S. Chand and Company New Delhi, ISBN No. 81-219-1431-0
	Engineering Drawing	Shaha, P. J.	S. Chand and Company New Delhi, 2008, ISBN: 81-219-2964-4
7.	Engineering Graphics	Kulkarni, D. M.;	PHI Learning Private Limited-New



S. No.	Title of Book	Author	Publication
	with AutoCAD	Rastogi, A. P.; Sarkar, A. K.	Delhi (2010), ISBN: 978-8120337831
8.	Essentials of Engineering Drawing and Graphics using AutoCAD	Jeyapoovan, T.	Vikas Publishing House Pvt. Ltd, Noida, 2011, ISBN: 978-8125953005
9.	AutoCAD User Guide	Autodesk	Autodesk Press, USA, 2015
10.	AutoCAD 2016 for Engineers and Designers	Sham, Tickoo	Dreamtech Press; Galgotia Publication New Delhi, 2015, ISBN: 978-9351199113

14. SOFTWARE/LEARNING WEBSITES

- a. <https://www.youtube.com/watch?v=TJ4jGyD-WCw>
- b. https://www.youtube.com/watch?v=dmr6_n7Sgcg
- c. https://www.youtube.com/watch?v=_MQScnLXL0M
- d. <https://www.youtube.com/watch?v=3WXPanCq9LI>
- e. <https://www.youtube.com/watch?v=fvjk7PlxAuo>
- f. <http://www.me.umn.edu/courses/me2011/handouts/engg%20graphics.pdf>
- g. <https://www.machinedesignonline.com>



Program Name : Mechanical, Civil Chemical & Plastic Program Group.

Program Code : CE/CR/CS/CH/PS/CM/EE/EP/AE/FG/ME/PG/PT

Semester : First

Courset Title : Workshop Practice

Course Code : 22004

1. RATIONALE

Workshop Practice is a basic practical engineering course. The knowledge of basic workshops such as wood working, fitting, welding, plumbing and sheet metal shop is essential for technician to perform his/her duties in industries. Students are able to perform various operations using hand tool equipment and machineries in various shops. Working in workshop develops the attitude of group working and safety awareness. This course provides miniature industrial environment in the educational institute.

2. COMPETENCY

The course should be taught and implemented with the aim to develop the course outcomes (COs) so that student demonstrates the following competency needed by the industry:

- Prepare simple jobs on the shop floor of the engineering workshop.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Select tools and machinery according to job.
- Use hand tools in different shops for performing different operation.
- Operate equipment and machinery in different shops.
- Prepare job according to drawing.
- Maintain workshop related tools, equipment and machinery.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme				Examination Scheme											
L	T	P	Credit (L+T+P)	Theory						Practical					
				Paper Hrs.	ESE		PA		Total	ESE	PA		Total	Max	Min
					Max	Min	Max	Min		Max	Min	Max			
--	--	4	4	--	--	--	--	--	--	50@	20	50~	20	100	40

(~): For the courses having **ONLY** practical examination, the PA has two components under practical marks i.e. the assessment of practicals (seen in section 6) has a weightage of 60% (i.e. 30 marks) and micro-project assessment (seen in section 12) has a weightage of 40% (i.e. 20 marks). This is designed to facilitate attainment of COs holistically, as there is no theory ESE.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE – End Semester Examination; PA - Progressive Assessment

5. COURSE MAP with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

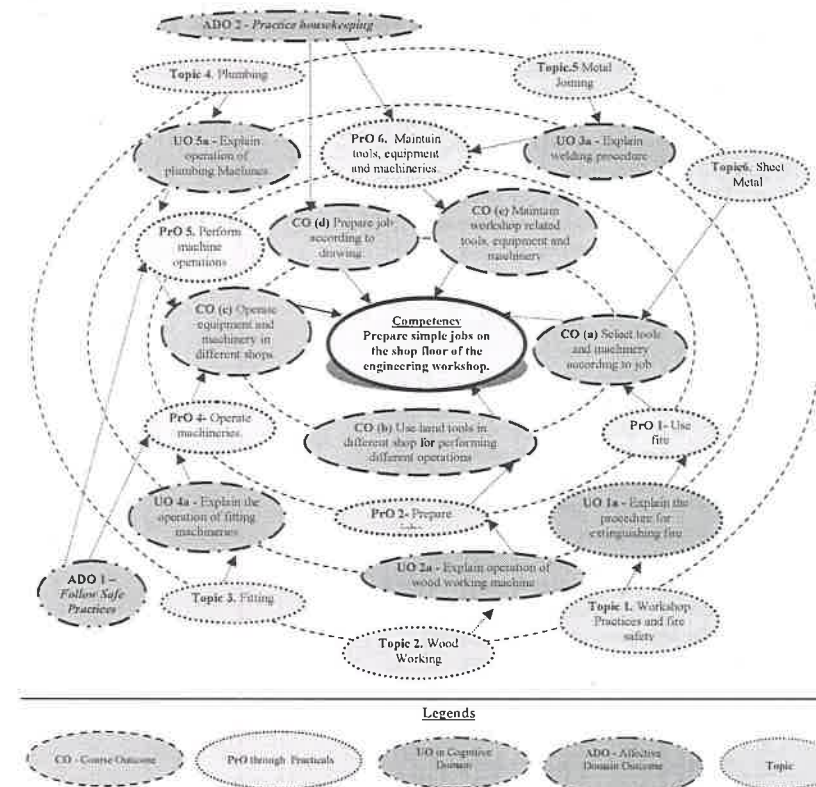


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. required
1	Perform mock drill session in group of minimum 10 students for extinguishing fire – Part I	I	2*
2	Perform mock drill session in group of minimum 10 students for extinguishing fire – Part II	I	2

S. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. required
3	Prepare job with following operations: – Part I a. Marking operation as per drawing b. punching operation as per drawing c. filing operation as per drawing d. chamfering operation as per drawing e. sawing operation as per drawing f. drilling operation as per drawing g. tapping operation as per drawing	II	2*
4	Prepare job with following operations: – Part II a. Marking operation as per drawing b. punching operation as per drawing c. filing operation as per drawing d. chamfering operation as per drawing e. sawing operation as per drawing f. drilling operation as per drawing g. tapping operation as per drawing	II	2
5	Prepare job with following operations: – Part III a. Marking operation as per drawing b. punching operation as per drawing c. filing operation as per drawing d. chamfering operation as per drawing e. sawing operation as per drawing f. drilling operation as per drawing g. tapping operation as per drawing	II	2
6	Prepare job with following operations: – Part IV a. Marking operation as per drawing b. punching operation as per drawing c. filing operation as per drawing d. chamfering operation as per drawing e. sawing operation as per drawing f. drilling operation as per drawing g. tapping operation as per drawing	II	2
7	Prepare job with following operations: – Part V a. Marking operation as per drawing b. punching operation as per drawing c. filing operation as per drawing d. chamfering operation as per drawing e. sawing operation as per drawing f. drilling operation as per drawing g. tapping operation as per drawing	II	2
8	Prepare job with following operations: – Part VI a. Marking operation as per drawing b. punching operation as per drawing c. filing operation as per drawing d. chamfering operation as per drawing e. sawing operation as per drawing f. drilling operation as per drawing	II	2



S. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. required
9	g. tapping operation as per drawing Prepare job with following operations: – Part VI a. Marking operation as per drawing b. punching operation as per drawing c. filing operation as per drawing d. chamfering operation as per drawing e. sawing operation as per drawing f. drilling operation as per drawing g. tapping operation as per drawing	II	2
10	Prepare T joint pipe fitting job as per given drawing (individually)	III	2*
11	Prepare elbow joint pipe fitting job as per given drawing	III	2*
12	Prepare bill of material for given pipeline layout – Part I	III	2*
13	Prepare bill of material for given pipeline layout – Part II	III	2
14	Prepare lap joint using gas welding as per given drawing – Part I	IV	2*
15	Prepare lap joint using gas welding as per given drawing – Part II	IV	2
16	Prepare butt joint using gas welding as per given drawing – Part I	IV	2
17	Prepare butt joint using gas welding as per given drawing – Part II	IV	2*
18	Prepare utility job(like stool, benches, tables or similar jobs) involving arc welding and artificial wood as per given drawing (in group of 4 to 5 students) – Part I a. Fabrication operation involve measuring, marking, cutting, edge preparation, welding b. Carpentry operation involve measuring, marking cutting and assembly with fabrication part.	IV, V	2 *
19	Prepare utility job(like stool, benches, tables or similar jobs) involving arc welding and artificial wood as per given drawing (in group of 4 to 5 students) – Part II a. Fabrication operation involve measuring, marking, cutting, edge preparation, welding b. Carpentry operation involve measuring, marking cutting and assembly with fabrication part.	IV, V	2
20	Prepare utility job(like stool, benches, tables or similar jobs) involving arc welding and artificial wood as per given drawing (in group of 4 to 5 students) – Part III a. Fabrication operation involve measuring, marking, cutting, edge preparation, welding b. Carpentry operation involve measuring, marking cutting and assembly with fabrication part.	IV, V	2*
21	Prepare utility job(like stool, benches, tables or similar jobs) involving arc welding and artificial wood as per given drawing (in group of 4 to 5 students) – Part IV a. Fabrication operation involve measuring, marking, cutting, edge preparation, welding b. Carpentry operation involve measuring, marking cutting and assembly with fabrication part.	IV, V	2
	Prepare utility job(like stool, benches, tables or similar jobs)	IV,	2

S. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. required
	involving arc welding and artificial wood as per given drawing (in group of 4 to 5 students) – Part V a. Fabrication operation involve measuring, marking, cutting, edge preparation, welding b. Carpentry operation involve measuring, marking cutting and assembly with fabrication part.	V	
23	Prepare utility job(like stool, benches, tables or similar jobs) involving arc welding and artificial wood as per given drawing (in group of 4 to 5 students) – Part VI a. Fabrication operation involve measuring, marking, cutting, edge preparation, welding b. Carpentry operation involve measuring, marking cutting and assembly with fabrication part.	IV, V	2*
24	Prepare utility job(like stool, benches, tables or similar jobs) involving arc welding and artificial wood as per given drawing (in group of 4 to 5 students) – Part VII a. Fabrication operation involve measuring, marking, cutting, edge preparation, welding b. Carpentry operation involve measuring, marking cutting and assembly with fabrication part.	IV, V	2
25	Prepare utility job(like stool, benches, tables or similar jobs) involving arc welding and artificial wood as per given drawing (in group of 4 to 5 students) – Part VIII a. Fabrication operation involve measuring, marking, cutting, edge preparation, welding b. Carpentry operation involve measuring, marking cutting and assembly with fabrication part.	IV, V	2
26	Prepare sheet metal utility job using following operations – Part I: a. Cutting and Bending b. Edging c. End Curling d. Lancing e. Soldering f. Riveting	VI	2*
27	Prepare sheet metal utility job using following operations – Part II: a. Cutting and Bending b. Edging c. End Curling d. Lancing e. Soldering f. Riveting	VI	2
28	Prepare sheet metal utility job using following operations – Part III: a. Cutting and Bending b. Edging c. End Curling d. Lancing e. Soldering	VI	2

S. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. required
	f. Riveting		
29	Prepare sheet metal utility job using following operations – Part IV: a. Cutting and Bending b. Edging c. End Curling d. Lancing e. Soldering f. Riveting	VI	2
30	Prepare sheet metal utility job using following operations – Part V: a. Cutting and Bending b. Edging c. End Curling d. Lancing e. Soldering f. Riveting	VI	2
31	Prepare sheet metal utility job using following operations – Part VI: a. Cutting and Bending b. Edging c. End Curling d. Lancing e. Soldering f. Riveting	VI	2
32	Prepare sheet metal utility job using following operations – Part VI: a. Cutting and Bending b. Edging c. End Curling d. Lancing e. Soldering f. Riveting	VI	2
Total			64

Note

- A suggestive list of **PrOs** is given in the above table. More such **PrOs** can be added to attain the **COs** and competency. A judicious mix of minimum 24 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each **PrO** is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Setting of experimental set up	20
2	Operate equipment skillfully	30
3	Follow Safety measures	10
4	Work in team	10
5	Record Observations	10
6	Interpret Results to conclude	10



S. No.	Performance Indicators	Weightage in %
7	Answer to sample questions	5
8	Submit report in time	5
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Exp. S.No.
1	Fire buckets of standard size.	I, II, III, IV, V, VI
2	Fire extinguisher A,B and C types	I, II, III, IV, V, VI
3	Wood Turning Lathe Machine, Height of Centre: 200mm, Distance between Centers: 1200mm, Spindle Bore: 20mm with Taper, Range of Speeds: 425 to 2800 with suitable Motor Drive. with all accessories	II
4	Circular Saw Machine, Diameter of saw blade 200 mm, Maximum Depth of Cut 50 mm, Table Size -350 x 450 mm, Table Tilting - 45°	II
5	Wood working tools- marking and measuring tools, saws, claw hammer, mallet, chisels, plans, squares,	II
6	Carpentry Vice 200 mm	II
7	Work Benches- size: 1800 x 900 x 750 mm	III
8	Bench Drilling machine (upto 13 mm drill cap.) with ½ H.P. Motor 1000 mm. Height.	III
9	Power Saw machine 350 mm mechanical with 1 HP Motor & all Accessories.	III
10	Bench Grinder 200 mm Grinding Disc diameter 200 mm. with 25 mm. bore 32 mm. with ½ HP/1HP Motor.	III
11	Vernier height Guage 450 mm	III

S. No.	Equipment Name with Broad Specifications	Exp. S.No.
12	Surface Plate 600 x 900 mm Grade I	III
13	Angle Plate 450 x 450 mm	III
14	Welding machine 20 KVA 400A welding current 300A at 50, 100, 200, 250, 300 with std. Accessories and Welding Cable 400 amp. ISI with holder	IV
15	Oxygen and acetylene gas welding and cutting kit with cylinders and regulators.	IV
16	Pipe Bending Machine	IV
17	Pipe Vice – 100 mm	IV
18	Pipe Cutter- 50 mm	IV
19	Bench Vice 100 mm	II, III, IV, V, VI
20	Portable Hammer Drill Machine 0-13 mm A.C. 230 V, 2.5Amp. Pistol type, having different types of bits	II, III, IV, V, VI
21	Sheet Bending Machine	VI
22	Sheet Cutting Machine	VI
23	Brazing Equipment	VI
24	Fitting tools - hammers, chisels, files, hacksaw, surface plate, punch, v block, angle plate, try square, marking block, steel rule, twist drills, reamers, tap set, die set.	III
25	Plumbing tools- pipe vice, pipe bending equipment, pipe wrenches, dies.	IV
26	Gas welding hand tools- welding torch, welding tip, pressure regulator, oxygen and acetylene cylinders, spark lighter	V
27	Arc welding hand tools- electrode holder, cable connector, cable lugs, chipping hammer, earthing clamp, wire brush.	V
28	Sheet metal hand tools- snip, shears sheet gauge, straight edge, L square, scriber, divider, trammel, punches, pliers, stakes, groovers, limit set	VI

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics are to be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I General Workshop Practice	1a. Describe the procedure for extinguishing the given type of fire	1.1 Safety Practices, Causes of accidents, General safety rules, Safety signs and symbols.
	1b. Describe the procedure to use the given firefighting equipment	1.2 First Aid
	1c. Locate the specified equipment in workshop	1.3 Fire, Causes of Fire, Basic ways of extinguishing the fire Classification of fire, Class A, B, C, D, Firefighting equipment, fire extinguishers, and their types.
	1d. Describe the ways to maintain good housekeeping in the given situation.	1.4 Workshop Layout 1.5 Issue and return system of tools, equipment and consumables
Unit – II	2a. Explain operation of the given	2.1 Fitting hand tools bench vice,

Fitting	fitting shop machines 2b. Describe the procedure to use the given fitting tools 2c. Describe the operation the given machinery. 2d. Describe the procedure to perform fitting operations 2e. Describe the procedure to maintain tools, equipment and machinery.	hammers, chisels, files, hacksaw, surface plate, punch, v block, angle plate, try square, marking block, steel rule, twist drills, reamers, tap set, die set and their Specifications 2.2 Operation of fitting shops machineries - Drilling machine, Power saw, grinder their specifications and maintenance, 2.3 Basic process chipping, filling, scraping, grinding, marking, sawing, drilling, tapping, dieing, reaming.
Unit- III Plumbing	3a. Explain operation of fitting shop machines 3b. Describe the procedure to use the given plumbing tools 3c. Describe the procedure to operate the given type of plumbing machinery. 3d. Describe the procedure to maintain the given type of plumbing tools, equipment and machinery.	3.1 Plumbing hand tools pipe vice, pipe bending equipment, pipe wrenches, dies and their Specifications 3.2 Pipe fittings- bends, elbows, tees, cross, coupler, socket, reducer, cap, plug, nipple and their Specifications 3.3 Operation of Machineries in plumbing shops- pipe bending machine their specifications and maintenance. 3.4 Basic process cutting, threading.
Unit- IV Metal Joining	4a. Describe the procedure to identify the given metal joining tools. 4b. Explain the given type of welding procedure 4c. Describe the procedure to use the given metal joining tools. 4d. Describe the procedure to perform the given type of joining metals	4.1 Gas welding hand tools- welding torch, welding tip, pressure regulator, oxygen and acetylene cylinders, spark lighter and their Specifications 4.2 Arc welding hand tools- electrode holder, cable connector, cable lugs, chipping hammer, earthing clamp, wire brush and their Specifications 4.3 Operation of machineries in welding shops- arc welding transformer their specifications and maintenance. 4.4 Welding Electrode, filler rod, fluxes, and solders. 4.5 Basic process welding, brazing and soldering.
Unit- V Furniture Making	5a. Select wood working tools as per job/ requirement with justification 5b. Explain operation of wood working machines 5c. Describe the procedure to use the given furniture making tools 5d. Describe the procedure to	5.1 Types of artificial woods such as plywood, block board, hardboard, laminated boards, Veneer, fiber Boards and their applications. 5.2 Wood working hand tools carpentry vice, marking and measuring tools, saws, claw hammer, mallet, chisels, plans, squares, and their specifications 5.3 Operation of wood working

	operate the given wood working machinery. 5e. Describe the procedure to maintain given wood working tools, equipment and machinery.	machineries - Wood turning lathe, circular saw, their specifications and maintenance. 5.4 Basic process- marking, sawing, planing, chiseling, turning, grooving, boring.
Unit-VI Sheet Metal	6a. Identify sheet metal tools. 6b. Explain operation of sheet metal machineries. 6c. Use sheet metal tools 6d. Describe the procedure to operate the sheet metal machinery. 6e. Describe the procedure to perform the given bending operations 5f. Describe the procedure to maintain the given sheet metal tools, equipment and machinery.	6.1 Sheet metal hand tools snip, shears sheet gauge, straight edge, L square, scribe, divider, trammel, punches, pliers, stakes, groovers, limit set and their Specifications 6.2 Operation of machineries in sheet metal shops- sheet cutting and bending machine their specifications and maintenance. 6.3 Basic process- marking, bending, folding, edging, seaming, staking, riveting.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

- Not applicable.-

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

- Prepare work diary based on practical performed in workshop. Work diary consist of job drawing, operations to be perform, required raw materials, tools, equipments, date of performance with teacher signature.
- Prepare journals consist of free hand sketches of tools and equipments in each shop, detail specification and precautions to be observed while using tools and equipment.
- Prepare/Download a specifications of followings:
 - Various tools and equipment in various shops.
 - Precision equipment in workshop
 - Various machineries in workshop
- Undertake a market survey of local dealers for procurement of workshop tools, equipment machineries and raw material.
- Visit any fabrication/wood working/sheet metal workshop and prepare a report.

11. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics. 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.



- c. About 15-20% of the topics/sub-topics which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the LOs/COs through classroom presentations (see implementation guideline for details).
- d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
- e. Guide student(s) in undertaking micro-projects.
- f. Arrange visit to nearby industries and workshops for understanding various manufacturing process.
- g. Show video/animation films to explain functioning of various processes like shaping, lapping, honing, turning, milling, knurling etc.
- h. Prepare maintenance charts various workshop machineries.

12. SUGGESTED TITLES OF MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of POs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than 16 (sixteen) student engagement hours during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

- a. Prepare a utility job using various wood working shop operations as per given drawing.
- b. Prepare a utility job using various plumbing operations as per given drawing.
- c. Prepare a utility job using various sheet metal operations as per given drawing.

Note:

- i. Utility job will be assigned by the teacher.
- ii. Utility Job will be completed in a group of 4 to 5 students and students have to maintain work diary consist of job drawing, operations details, required raw materials, tools, equipments, date wise performance record.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	Workshop Practice	Bawa, H.S.	McGraw Hill Education, Noida; ISBN: 978-0070671195
2.	A Textbook of Manufacturing Process (Workshop Tech.)	Gupta, J.K.; Khurmi, R.S.	S.Chand and Co. New Delhi ISBN:81-219-3092-8
4.	Introduction to Basic Manufacturing Process & Workshop Technology	Singh, Rajender	New Age International, New Delhi; 2014, ISBN: 978-81-224-3070-7

14. SOFTWARE/LEARNING WEBSITES

- a. <http://www.asnu.com.au>
- b. <http://www.abmttools.com/downloads/Woodworking%20Carpentry%20Tools.pdf>
- c. <http://www.weldingtechnology.org>
- d. <http://www.newagepublishers.com/samplechapter/001469.pdf>
- e. <http://www.youtube.com/watch?v=TeBX6cKKHWY>
- f. <http://www.youtube.com/watch?v=QHF0sNHnttw&feature=related>
- g. <http://www.youtube.com/watch?v=Kv1zo9CAxt4&feature=relmfu>
- h. <http://www.piehtoolco.com>
- i. <http://sourcing.indiamart.com/engineering/articles/materials-used-hand-tools/>
- j. https://www.youtube.com/watch?v=9_cnkaAbtCM



Program Name : Computer Program Group

Program Code : CM/CO/IF/CW

Semester : First

Course Title : Workshop Practice

Course Code : 22005

1. RATIONALE

A diploma engineer (also called technologist) in his/her professional life works in a typical business environment where s/he interacts with computers, peripherals and related devices and instruments. They must be able to use and maintain these equipments authentically. They must also possess basic knowledge/skills of wiring system, selecting components, soldering, de-soldering for elementary level testing and maintenance of such hardware. Hence, this course is designed to develop these vital skills in them through various workshop based activities.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Perform simple maintenance operations on computer system, peripherals and network.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following **industry oriented** COs associated with the above mentioned competency:

- Use electrical tools, instruments, devices and equipment for basic level maintenance of computers and peripherals.
- Identify active and passive electronic components.
- Undertake basic level maintenance of a PC.
- Use different kinds of printers and scanners.
- Identify the layout of wired and wireless LAN environment.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme											
L	T	P		Theory						Practical					
				Paper Hrs.	ESE		PA		Total	ESE		PA		Total	
					Max	Min	Max	Min		Max	Min	Max	Min		
--	--	4	4	--	--	--	--	--	--	50 @	20	50~	20	100	40

(*) For the courses having **ONLY** practical examination, the PA has two components under practical marks i.e. the assessment of practicals (seen in section 6) has a weightage of 60% (i.e. 30 marks) and micro-project assessment (seen in section 12) has a weightage of 40% (i.e. 20 marks). This is designed to facilitate attainment of COs holistically, as there is no theory ESE.

Legends: L - Lecture; T - Tutorial/Teacher Guided Theory Practice; P - Practical; C - Credit. ESE - End Semester Examination; PA - Progressive Assessment.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

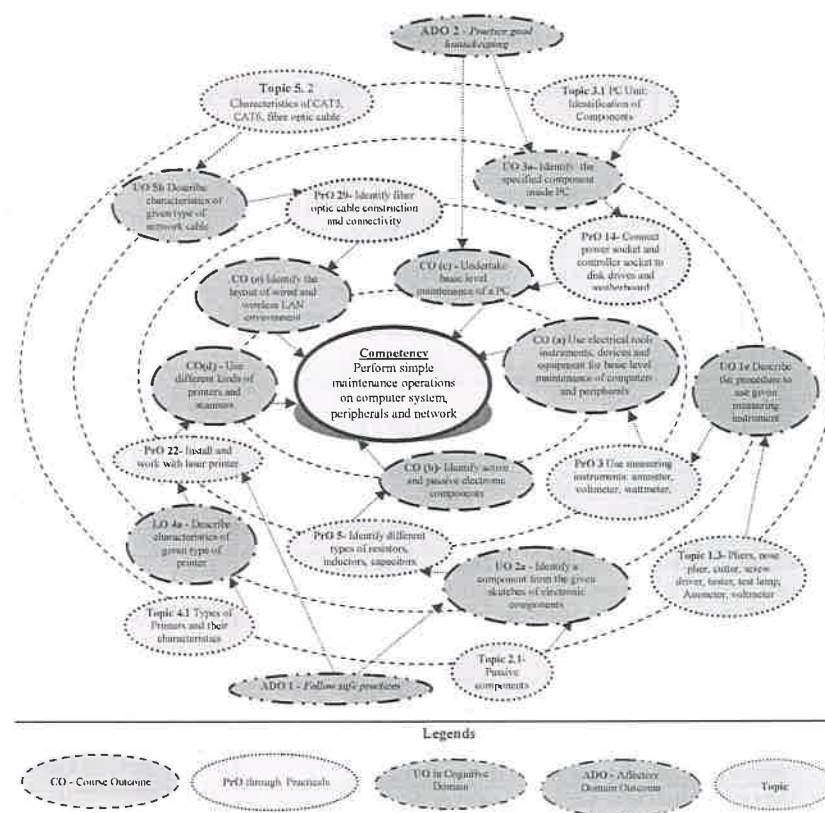


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
	Use devices: Pliers, nose pliers, cutter, screw driver	I	2
	Use devices: tester, test lamp of different sizes	I	2

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
3	Use measuring instruments: ammeter, voltmeter, wattmeter	I	2
4	Use measuring instruments: clip on meter, multimeter, Megger	I	2
5	Identify different types of: resistors, inductors, capacitors, potentiometers, Thermistor, Transformer, auto transformer from the given components	II	2
6	Identify the terminals of the following components: Diode, Zener diode, Varactor diode, LED, Photo diode, BJT, Photo transistor, FET, LDR, Solar cell, Photocell, Opto-coupler, 7 Segment Display, Relays	II	2
7	Perform soldering and de-soldering operations	I	2
8	Connect UPS with mains and batteries	I	2
9	Connect batteries of battery bank	I	2
10	Open PC Panel and Identify Components (Part-I)	III	2
11	Open PC Panel and Identify Components (Part-II)	III	2
12	Clean inside PC - Boards and Slots (Part-I)	III	2
13	Clean inside PC - Boards and Slots (Part-II)	III	2
14	Connect power socket and controller socket to disk drives and motherboard. (Part-I)	III	2
15	Connect power socket and controller socket to disk drives and motherboard. (Part-II)	III	2
16	Connect/disconnect LAN Cable, External Hard disk, Modem	III	2
17	Connect desktop computer and laptop with LCD/DLP Projector	III	2
18	Clean Keyboard and fitting it to computer	IV	2
19	Connect different types of mouse to ports	IV	2
20	Install and work with Dot matrix printer	IV	2
21	Work with Dot matrix printer settings (various types of buttons and their functions, changing ribbon cartridge, paper fitting, eject)	IV	2
22	Install and work with laser printer (various types of configuration settings on printer, removing and mounting cartridge, troubleshooting paper jam)	IV	2
23	Install and work with scanner with default settings	IV	2
24	Change scans settings, scanning documents/images and saving in different formats.	IV	2
25	Connect Modem, Hub/Switches/routers physically.	V	2
26	Prepare and test crossover and straight cable, CAT5, CAT6 Cable, using Crimping tools, Splicer	V	2
27	Connect two Switches/Hubs using normal and uplink port	V	2
28	Write on CD/DVD, single session/multisession	V	2
29	Identify fiber optic cable construction and connectivity	V	2
30	Identify Wi-Fi environment and its setup	V	2
31	Identify wired network environment and its setup	V	2
32	Identify blue tooth based wireless mouse, keyboard and other devices	V	2
Total			64

Note

- i. A suggestive list of **PrOs** is given in the above table. More such **PrOs** can be added to attain the **COs** and competency. A judicious mix of minimum 24 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- ii. The 'Process' and 'Product' related skills associated with each **PrO** is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
a.	Use of Appropriate tool to solve the problem	10
b.	Operate equipment skillfully	30
c.	Follow Safety measures	10
d.	Quality of output achieved	30
e.	Answer to sample questions	10
f.	Submit report in time	10
Total		100

The above **PrOs** also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safe practices
- Practice good housekeeping
- Practice energy conservation.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical practices.

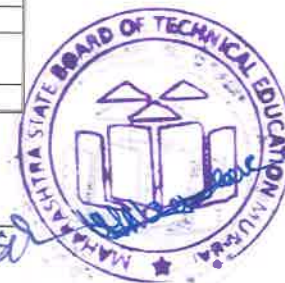
The ADOs are not specific to any one **PrO**, but are embedded in many **PrOs**. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned

S. No.	Equipment Name with Broad Specifications	Exp. S.No.
1	Computer system with all necessary components like; motherboard, random access memory (RAM), read-only memory (ROM), Graphics cards, sound cards, internal hard disk drives, DVD drive, network interface card	10, 11, 12, 13, 14, 15, 16, 17, 18, 19
2	LCD/DLP Projector	17



S. No.	Equipment Name with Broad Specifications	Exp. S.No.
3	Modems, hubs, switches, Router	25,27
4	Wi-Fi set-up with access point and repeater	30
5	Bluetooth based wireless mouse and keyboard or any other device	32
6	Uninterrupted Power supply unit with battery	8,9
7	Cat5/Cat6 cable with RJ 45 Connectors	26, 27
8	Fibre optic cable with SC,ST, LC Connectors	29
9	Dot Matrix Printer, Laser Printer, Inkjet Printer	20, 21, 22
10	Scanner	23, 24
11	Hub/Switches/Routers	25, 27
12	Blank CDs/DVDs	28
13	Pliers, nose pliers, cutter, screw driver, tester, test lamp, Crimping tool	1, 26
14	Resistors, inductors, capacitors, potentiometers, Thermistor, Transformer, auto transformer	5
15	Diode, Zener diode, Varactor diode, LED, Photo diode, BJT, Photo transistor, FET, LDR, Solar cell, Photocell, Opto-coupler, 7 Segment Display, Relays	6

Note: There are no fixed specifications for the above listed equipment, devices and instruments. Depending on the availability in the institute they can be utilized for the purpose.

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics is to be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit – I Electrical Tools, Cables and Switches	1a. Explain the characteristics of given type of wires, cables, light sources and switches. 1b. Explain use of the given type of switch. 1c. Describe the procedure to use given electrical Tool. 1d. Describe application of the given type of uninterrupted power supply. 1e. Describe the procedure to use the given measuring instrument.	1.1 Electrical: Basic wiring- Single core cable, multicore cable, single strand wire, multi strand wire, shielded wire 1.2 Use of different types of switches ; Toggle switch, Rotary switch, Push button switch, micro switch, circuit breakers; MCB, ELCB, Regulators. 1.3 Using Pliers, nose plier, cutter, screw driver, tester, test lamp, Ammeter, voltmeter, wattmeter, clip on meter, Multimeter, Megger, Solder iron, solder-stand, solder-wire, flux, desolder pump, De-solder wick 1.4 Using Uninterrupted power supply units-online, offline, batteries and their types
Unit– II Electronic Components	2a. Identify a component from the given sketch of electronic components. 2b. Describe the applications of the given active electronic	2.1 Passive components: Different types of: resistors, inductors, capacitors, potentiometers, Thermistor, Transformer, auto transformer 2.2 Active components: Diodes, LED,



Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
	component.	Photo diode, BJT, Photo transistor, LDR, Opto-coupler, seven segment display
Unit– III Inside the Computer system	3a. Identify the specified component inside PC. 3b. Describe applications of the specified device drives. 3c. Explain procedure of Connecting the given cable/ device in a PC. 3d. Describe procedure to handle laptop safely.	3.1 PC Unit: Identification of Components- Motherboard, RAM, ROM, Add-on Cards, CMOS battery, SMPS, Hard disk, DVD, flash Memory And PEN DRIVE, Power Connection, Controller Connection, NIC Cards. 3.2 Connecting and disconnecting LAN Cable, External Hard disk, Modem, Motherboard Supply, Basic handling of laptop, Connecting computer with LCD Projector
Unit– IV Computer Peripheral and Devices	4a. Describe characteristics of the given type of printer. 4b. Classify given type of scanner. 4c. Explain procedure to connect given printer/scanner to computer. 4d. Explain procedure of scanning the given document/ image using a scanner. 4e. Describe working principle of the given type of mouse.	4.1 Types of Printers and their characteristics- DOT Matrix, Laser, Inkjet, Connecting and sharing printer, Scanner – flatbed scanner, hand held scanner, setting scanning parameters, scanning documents and saving in different formats 4.2 Keyboards, different types of mouse- Optical, mechanical, Wireless, trackball, Connecting mouse to ports
Unit– V Network Devices and Components	5a. Explain Application of NIC and the given connecting devices. 5b. Describe characteristics of the given type of network cable. 5c. Describe features of the given type of network 5d. Identify components of the given wired/wireless network set-up.	5.1 Applications of Network interface cards (NIC), HUB, Switches, Routers, Modem 5.2 Characteristics of CAT5, CAT6, fibre optic cable, use of crossover and straight cable, RJ-45 connectors, SC, ST, FC, LC type fibre connectors 5.3 Concept of LAN, MAN, WAN Wireless network and devices; Wi-Fi, Access point, repeaters, Bluetooth

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

- Not Applicable -

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

- Prepare journal of practicals.
- Prepare chart displaying network set-up layout of their institute.
- Download videos/ animations to illustrate the following:
 - Identify components inside the PC.
 - Making of Cross/Straight Cat5/Cat6 cables by connecting RJ-45 connector.
 - Any other video related to Practical exercises as given above.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
- '*L*' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About *15-20% of the topics/sub-topics* which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
- Guide student(s) in undertaking micro-projects.
- Guide student(s) in undertaking various activities in the lab/workshop.
- Demonstrate students thoroughly before they start doing the practice
- Show video/animation films to explain handling/functioning of different instruments.
- Continuously observe and monitor the performance of students in Lab/Workshop

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of POs, UOs, and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than *16 (sixteen) student engagement hours* during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

- Prepare a small report on different types of wires, cables, light sources and switches.
- Prepare a small report on different measuring instrument with their broad specifications.
- Prepare brief report on different components with their functions inside PC.
- Prepare a small report of printers and scanners based on their technological differences.

- Prepare brief report of various networking devices/components installed with their application by doing survey of computer labs.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Peter Norton's New Inside the PC	Norton, Peter; Clark, Scott H.	Sams Publishing, Carmel, Indiana, USA 2010, ISBN: 9780672322891
2	Computer Basics Absolute Beginner's Guide, Windows 10	Miller, Michael	QUE Publishing, Indianapolis, USA, August 2015, ISBN: 978-0789754516
3	Principles of Electronics	Mehta, V. K.; Mehta, Rohit	S. Chand, New Delhi, ISBN 9788121924504

14. SOFTWARE/LEARNING WEBSITES

- IT Essentials: Computer Lab Procedures and Tool Use
- <http://www.ciscopress.com/articles/article.asp?p=2086239&seqNum=4> Essential Introduction to Computers
- http://uwf.edu/clemley/cgs1570w/notes/01%20-%20intro_to_computer.htm How to operate laptop:
- <http://www.liutilities.com/how-to/operate-a-laptop-computer/>



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
9	Prepare the given fitting job as per given drawings Part-III	II	2
10	Prepare the given fitting job as per given drawings Part-IV	II	2
11	Prepare the given fitting job as per given drawings Part-V	II	2
12	Identify the given hand tools, machine tools and equipment used in sheet metal shop to sketch and write the applications and specifications of each – Part I.	II*	2
13	Identify the given hand tools, machine tools and equipment used in sheet metal shop to sketch and write the applications and specifications of each – Part II.	II*	2
14	Prepare two simple sheet metal jobs as per given drawings Part-I	II*	2
15	Prepare two simple sheet metal jobs as per given drawings Part-II	II	2
16	Prepare two simple sheet metal jobs as per given drawings Part-III	II	2
17	Prepare two simple sheet metal jobs as per given drawings Part-IV	II	2
18	Perform sheet metal and fitting operation for the given utility job. Part-I	II	2
19	Perform sheet metal and fitting operation for the given utility job. Part-II	II	2
20	Perform sheet metal and fitting operation for the given utility job. Part-III	II	2
21	Perform sheet metal and fitting operation for the given utility job. Part-IV	II	2
22	Identify various: (a) Passive electronic components in the given circuit. (b) Active electronics components in the given circuit.	III*	2
23	Identify various controls available on the front panel of analog and digital multimeter.	III	2
24	Determine the value of given resistor using digital multimeter to confirm with colour code.	III*	2
25	Test the semiconductor diodes using digital multimeter.	III*	2
26	Test the LEDs display using multimeter.	III	2
27	Test 7-segment display using multimeter.	III	2
28	Identify three terminals of a transistor using digital multimeter.	III*	2
29	Connect resistors in series and parallel combination on bread board and measure its value using digital multimeter.	III	2
30	Connect capacitors in series and parallel combination on bread board and measure its value using multimeter.	III	2
31	Identify primary and secondary winding of step down transformer using multimeter.	III	2
32	Identify relay terminals (coil, common, normally open and close)	III	2
33	De-solder the components using de-soldering tools.	IV*	2
34	Build simple circuits using resistors, diode, switch and LED.	III, V	2
35	Build simple circuits using relay and other electronics components.	III, V*	2
36	Test the circuit developed in the experiment No.35 using various testing equipment.	III, V*	2
37	Solder more than two components on PCB for continuity.	V*	2

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
Total			74

Note

i. A suggestive list of **PrOs** is given in the above table. More such **PrOs** can be added to attain the **COs** and competency. A judicious mix of minimum 24 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.

ii. The 'Process' and 'Product' related skills associated with each **PrO** is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Setting of experimental set up	20
2	Operate equipment skillfully	30
3	Follow Safety measures	10
4	Work in team	10
5	Record Observations	10
6	Interpret Results to conclude	10
7	Answer to sample questions	5
8	Submit report in time	5
Total		100

The above **PrOs** also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical practices.

The ADOs are not specific to any one **PrO**, but are embedded in many **PrOs**. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of **PrOs**, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Exp. No.
1	Mechanical foam type fire extinguisher with ISI mark (9 liter. B and C type	1

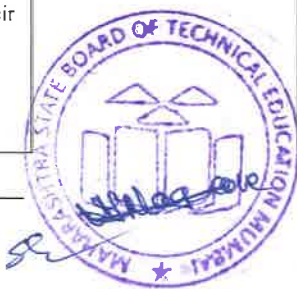
S. No.	Equipment Name with Broad Specifications	Exp. No.
	fire)	
2	A, B.C portable type fire extinguisher with ISI mark	I
3	Bench Drilling machine (up to 13 mm drill cap.) with ½ H.P. Motor 1000 mm. height	II
4	Work Benches: 1800mm*1900mm*750mm	II
5	Power Saw machine 350 mm mechanical with 1 HP Motor & all Accessories.	II
6	Bench Grinder 200 mm Grinding Disc diameter 200 mm. with 25 mm. bore 32 mm. with ½ HP/1HP Motor.	II
7	Vernier height Gauge 450 mm	II
8	Surface Plate 600 x 900 mm Grade I	II
9	Angle Plate 450 x 450 mm	II
10	Bench Vice 100 mm	II
11	Power Saw machine 350 mm mechanical with 1 HP Motor and all Accessories.	II
12	Circular Saw Machine, Diameter of saw blade 200 mm, Maximum Depth of Cut 50 mm, Table Size -350 x 450 mm, Table Tilting - 450	II
13	CRO: 50MHz, Dual trace, Dual beam, Inbuilt +-5 V supply, Component tester, Function Generator	III
14	Soldering Gun: 40Watts, Holding stand, Temperature Control, Power cord	III,I,V
15	De-soldering Gun: 80 Watts, output voltage 24 V	III,IV,V
16	Multimeter 3 and ½ digit with component tester	III,IV,V
17	Wire Cutter	III,IV,V
18	Wire Stripper	III,IV,V
19	Consumable components: Resistors, capacitors, Diodes, Transistors, ICs, IC Sockets, General Purpose PCBs, LEDs, Relays, Switches, Connectors, Connecting Wires, Soldering metal, Soldering Flux, De-soldering mesh.	III,IV,V

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics are to be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I General Workshop Practice and Fire Fighting	1a. Describe the procedure for extinguishing the given type of fire 1b. Describe the procedure to use the given fire fighting equipment 1c. Locate the specified equipment in workshop 1d. Describe the ways to maintain good housekeeping in the given situation.	1.1 Safety Practices, Causes of accidents, General safety rules, Safety signs and symbols. 1.2 First Aid 1.3 Fire, Causes of Fire, Basic ways of extinguishing the fire Classification of fire, Class A, B.C, D. Firefighting equipment, fire extinguishers, and their types 1.4 Workshop Layout 1.5 Issue and return system of tools, equipment and consumables

Unit– II Fitting and Sheet Metal Shop	2a. Explain operation of the given fitting shop machines 2b. Describe the procedure to use the given fitting tools 2c. Describe the operation the given machinery. 2d. Describe the procedure to perform the given fitting operations 2e. Describe the procedure to maintain the given tools, equipment and machinery. 2f. Explain the given type of welding procedure. 2g. Describe the procedure to use the given metal joining tools.	2.1 Fitting hand tools and their specifications: bench vice, hammers, chisels, files, hacksaw, surface plate, punch, V block, angle plate, try square, marking block, steel rule, twist drills, reamers, tap set, die set 2.2 Basic process chipping, filling, scraping, grinding, marking, sawing, drilling, tapping, dyeing, reaming etc. 2.3 Sheet metal hand tools and their Specifications: snip, shears sheet gauge, straight edge, L square, scribe, divider, trammel, punches, pliers, stakes, groovers, limit set 2.4 Machinery and their Specifications in sheet metal shops- sheet cutting and bending machine 2.5 Basic process- marking, bending, folding, edging, seaming, staking, riveting.
Unit– III Identification of Electronic Components	3a. Explain working of given type of electronics circuits 3b. Identify given type of active and passive electronics components. 3c. Describe steps to use the given type of multimeter. 3d. Describe the steps to test the given electronics components using the multimeter.	3.1 Sources: AC and DC, Batteries. 3.2 Electronic components: Passive components like resistor, capacitor and inductor, Active components like diode, transistor, IC. 3.3 Switches, relays, LEDs, 7-segment display, step-down transformer, connectors and cables used in electronics circuits. 3.4 Data sheet and the catalog of electronics components, multimeter. 3.5 Tools required for electronic workshop :specifications, cost and other important characteristics (Catalogs of multimeter, power supply, and soldering machine to collect the latest information of tools).
Unit– IV Electronic Soldering Shop	4a. Select the soldering and de-soldering tools for the given job. 4b. Describe procedure for using the given soldering related component. 4c. Explain function of the given type of desoldering device. 4d. Describe problems of given	4.1 Soldering and de-soldering tools like normal soldering gun, temperature controlled soldering gun, soldering metals, soldering flux, soldering pot, De-soldering gun, De-soldering pump, De-soldering mesh. 4.2 Soldering techniques like hand soldering, wave soldering and dip soldering.



	type of soldering.	4.3 Dry soldering, problems of dry and loose soldering.
Unit- V Hands On Skills	5a. Describe the procedure to build given type simple electronic circuit on bread board. 5b. Explain the procedure of assembling given simple electronic circuit on general purpose PCB. 5c. Explain the procedure to use the given type of meter for continuity testing. 5d. Explain the procedure to test the continuity of the given circuit using the given type of digital multimeter.	5.1 Soldering of simple electronics components like resistors, capacitors, diode, switches, LEDs on general purpose PCB. 5.2 De-soldering of the components from the PCB. 5.3 Continuity testing using multimeter. 5.4 Measurement of Series and parallel combination of resistors and capacitors.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

- Not applicable -

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course.

- Prepare chart displaying various electronics components and Instrument.
- Prepare broad specifications of tools and equipment used in the electronics workshop with the help of handbooks and product catalogues available on internet.
- List specifications of various electronics components.
- Download the catalogue of multimeter, CRO, soldering gun, relays and connectors of various reputed manufacturers from websites to update the latest developments.
- Undertake a market survey of local dealers for procurement of workshop tools, equipment machineries and raw material.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.



- Guide student(s) in undertaking micro-projects
- Show video/animation films to explain functions of fire extinguisher and fire fighting procedure.
- Arrange visit to nearby electronics manufacturer/testing Industry.
- Show video/animation films to explain functioning of electronics components and their application.
- Assign micro projects to students on simple electronics circuits.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the **beginning** of the semester. S/he ought to submit it by the end of the semester to develop the **industry** oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

- Prepare chart showing comparison of various types of resistors used in the electronics Industry.
- Build heat sink for the given specification.
- Build a cabinet for the given circuit/ equipment/ instrument.
- Solder components on PCB and check the continuity.
- Test the active and passive components connected in the given electronic equipment.
- Prepare small report on market survey on diodes used in the small electronics industry.
- Prepare the specifications of active and passive components and their manufacturers and their addresses.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	A Course in Workshop Technology	Raghuwanshi, B.S.	Dhanpat Rai sons, New Delhi ; 2011, or latest edition, ISBN:000017108
2	A Textbook of Manufacturing Process (Workshop Technology)	Gupta, J.K.; Khurmi, R.S.	S.Chand and Co. New Delhi, or latest edition, ISBN:81-219-3092-8
3	Electronic Components Handbook	Jones, Thomas H.	Reston Publishing, Reston, Virginia, United states latest edition, ISBN: 9780879092221
4	Principles of Electronics	Mehta, V.K.; Mehta, Rohit	S. Chand and Co. Ram Nagar, New Delhi-110 055, 2014, ISBN: 9788121924504

14. SOFTWARE/LEARNING WEBSITES

- www.nptel.iitm.ac.in

- b. <http://www.eleccircuit.com>
- c. <http://www.electroschematics.com>
- d. <http://www.asnu.com.au>
- e. <http://fireextinguishertraining.com/>
- f. www.youtube.com/watch?v=WE-SislzSMY
- g. www.youtube.com/watch?v=IUojOIHvC8c
- h. https://mightyohm.com/files/soldercomic/FullSolderComic_EN.pdf
- i. http://www.aura-o.aura-astronomy.org/aura/sites/default/files/files/Referencia_Bibliografica



Program Name : Textile Program Group

Program Code : DC/TC/TX

Semester : First

Course Title : Workshop Practice

Course Code : 22007

1. RATIONALE

Skills in operation of various machines and tools in industries are expected to be possessed by the diploma engineers of programmes in textile technology and fashion/clothing. It is also necessary to have preliminary skills in operating related mechanical and electrical equipment in different types of workshops. This course is aimed to develop core hands-on skills related to work as well as use of firefighting equipment from safety point of view, which are required in the later courses.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain machines, tools and fire safety equipment used in textile/FCT Industry.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Use relevant tools and gauges employed in Textile/ FCT industry.
- Print job by block printing and screen printing.
- Perform relevant basic mechanical operations and functions related to sewing and embroidery.
- Perform relevant basic wiring activities of electrical installations in FCT/ Textile industry.
- Perform mock drill related to fire fighting in simulated environment.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme											
L	T	P		Theory						Practical					
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total
					Max	Min	Max	Min			Max	Min	Max	Min	
--	--	4	4	--	--	--	--	--	--	50@	20	50~	20	100	40

(~2): For the courses having **ONLY practical** examination, the PA has two components under practical marks i.e. the assessment of practicals (seen in section 6) has a weightage of 60% (i.e. 30 marks) and micro-project assessment (seen in section 12) has a weightage of 40% (i.e. 20 marks). This is designed to facilitate attainment of COs holistically, as there is no theory ESE.

Legends: L-Lecture; T- Tutorial/Teacher Guided Theory Practice; P- Practical; C- Credit, ESE - End Semester Examination; PA - Progressive Assessment.

5. COURSE MAP (with sample COs, Learning Outcomes i.e. LOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

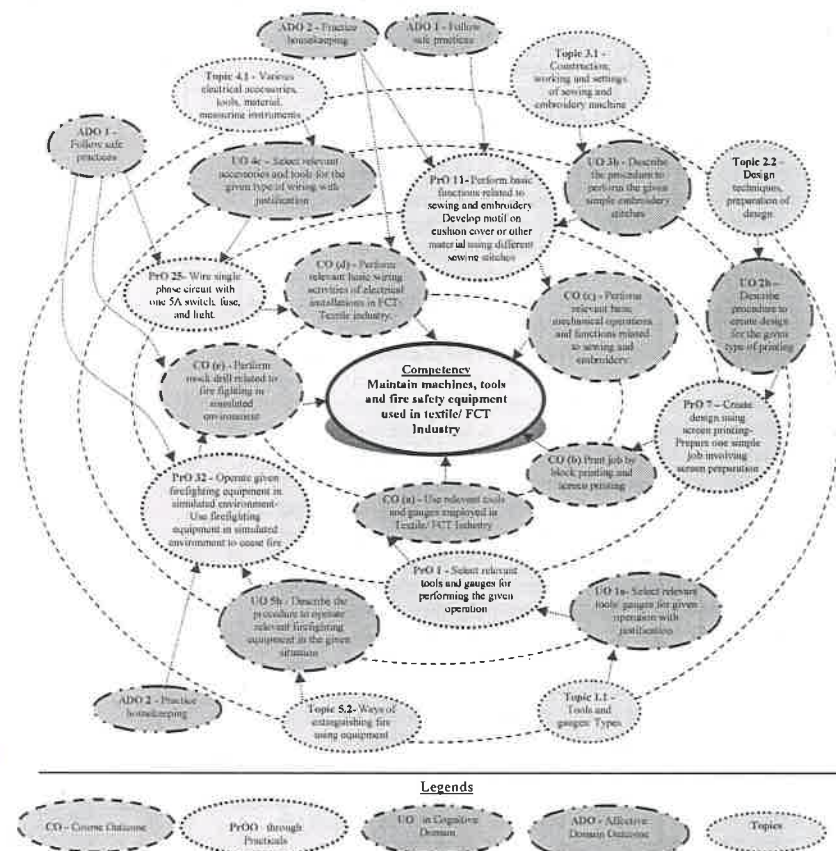


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PROs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PROs)	Unit No.	Approx. Hrs. required
1	Select relevant tools and gauges for performing one simple activities involving applications of working of different	I	02*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
	maintenance tools, like cot buffing, eccentricity meter, tachometer, stripping machine, carding gauges, pressure gauge, torque spanners, Allen keys, tailors tape, ¼ scale, thermometer - Part I		
2	Select relevant tools and gauges for performing one simple activities involving applications of working of different maintenance tools, like cot buffing, eccentricity meter, tachometer, stripping machine, carding gauges, pressure gauge, torque spanners, Allen keys, tailors tape, ¼ scale, thermometer - Part II	I	02
3	Select relevant tools and gauges for performing one simple activities involving applications of working of different maintenance tools, like cot buffing, eccentricity meter, tachometer, stripping machine, carding gauges, pressure gauge, torque spanners, Allen keys, tailors tape, ¼ scale, thermometer - Part III	I	02
4	Select relevant tools and gauges for performing one simple activities involving applications of working of different maintenance tools, like cot buffing, eccentricity meter, tachometer, stripping machine, carding gauges, pressure gauge, torque spanners, Allen keys, tailors tape, ¼ scale, thermometer - Part IV	I	02
5	Select relevant tools and gauges for performing one simple activities involving applications of working of different maintenance tools, like cot buffing, eccentricity meter, tachometer, stripping machine, carding gauges, pressure gauge, torque spanners, Allen keys, tailors tape, ¼ scale, thermometer - Part V	I	02
6	Select relevant tools and gauges for performing one simple activities involving applications of working of different maintenance tools, like cot buffing, eccentricity meter, tachometer, stripping machine, carding gauges, pressure gauge, torque spanners, Allen keys, tailors tape, ¼ scale, thermometer - Part VI	I	02
7	Create design using screen printing: Prepare one simple job involving screen preparation (Group activity)	II	02*
8	Create design using screen printing: Prepare one simple job involving screen printing (Group activity)	II	02
9	Create design using block printing: Prepare one simple job involving block preparation (Group activity)	II	02
10	Create design using block printing: Prepare one simple job involving block printing (Group activity)	II	02
11	Perform basic functions related to sewing and embroidery: Develop motif on cushion cover or other material using different sewing stitches.	III	02*
12	Perform basic functions related to sewing and embroidery: Develop shopping bag/ folder using different sewing stitches and accessories like buttons, sewing threads, and laces.	III	02
13	Perform basic functions related to sewing and embroidery: Segregate different fabric qualities woven, knitted, non-woven, 100 % cotton, 100 % polyester, blends	III	02
14	Perform basic functions related to sewing and embroidery: Prepare different fabric swatches	III	02



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
15	Perform basic functions related to sewing and embroidery: Prepare embroidered table cloth.	III	02
16	Perform basic functions related to sewing and embroidery: Prepare embroidered cushion cover.	III	02
17	Perform basic functions related to sewing and embroidery: Prepare embroidered bed sheet.	III	02
18	Perform basic functions related to sewing and embroidery: Collect accessories and its application.	III	02
19	Perform basic mechanical operations related to machines and accessories. Prepare catalogue of mould, castings, patterns, and tools used in casting shop.	III	02 *
20	Perform basic mechanical operations related to machines and accessories. Prepare a job on lathe machine	III	02
21	Perform basic mechanical operations related to machines and accessories. Assemble/fit simple parts/ spare parts /accessories/ mechanisms of simple FCT related machine in workshop.	III	02
22	Perform basic mechanical operations related to machines and accessories. Assemble/fit simple parts/ spare parts /accessories/ mechanisms of simple TEXTILE related machine in workshop.	III	02
23	Perform basic mechanical operations related to machines and accessories. Segregation of different types of Material handling equipment in FCT industry.	III	02
24	Perform basic mechanical operations related to machines and accessories. Segregation of different types of Material handling equipment in TEXTILE industry.	III	02
25	Perform basic activities related to wiring of electrical installation in Textile industry: Wire single phase circuit with one 5A switch, fuse, and light.	IV	02 *
26	Perform basic activities related to wiring of electrical installation in Textile industry: Connect single phase motor to power supply.	IV	02
27	Perform basic activities related to wiring of electrical installation in Textile industry: Connect one MCB to load circuit	IV	02
28	Perform basic activities related to wiring of electrical installation in Textile industry: Prepare a catalogue of lighting accessories used in FCT/ Textile industry.	IV	02
29	Perform basic activities related to wiring of electrical installation in Textile industry: Connect a three phase load to circuit	IV	02
30	Operate given firefighting equipment in simulated environment. Identify different firefighting equipment	V	02*
31	Operate given firefighting equipment in simulated environment. Prepare chart of firefighting equipment as per applications	V	02
32	Operate given firefighting equipment in simulated environment. Use firefighting equipment in simulated environment to cease fire. (Group activity)	V	02
Total			64

Note

i. A suggestive list of **PrOs** is given in the above table. More such **PrOs** can be added to attain the **COs** and competency. A judicious mix of minimum 24 or more practical need to be performed, out of which, the practicals marked as ‘*’ are compulsory, so that the student reaches the ‘Precision Level’ of Dave’s ‘Psychomotor Domain Taxonomy’ as generally required by the industry.

ii. The ‘Process’ and ‘Product’ related skills associated with each **PrO** is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and Recording	10
5	Interpretation of result and Conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
Total		100

The above **PrOs** also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical practices.

The ADOs are not specific to any one **PrO**, but are embedded in many **PrOs**. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl’s ‘Affective Domain Taxonomy’ should gradually increase as planned below:

- ‘Valuing Level’ in 1st year
- ‘Organising Level’ in 2nd year
- ‘Characterising Level’ in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of **PrOs**, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Exp. No.
1	Different maintenance tools such as cot buffing, eccentricity meter, tachometer, stripping machine, carding gauges, pressure gauge, torque spanners, Allen keys, tailors tape, ¼ scale, thermometer etc.	1 to 6
2	Hardware and consumables related to Screen and Block Printing	7 to 10
3	Basic straight stitch sewing machine, button machine, embroidery machine, lock stitch machine with respective accessories and consumables.	11 to 18

S. No.	Equipment Name with Broad Specifications	Exp. No.
4	Automatic multi stitch sewing machine	11 to 18
5	Lathe machine, Spare parts/ accessories/ mechanisms of simple FCT/ textile related machines in FCT/ Textile Industry and other basic machine	19 to 24
6	Electrical switches, MCBs/ fuses used in lighting and main switches/ panels used in production line	25 to 29
7	Electric Motors used in FCT/ Textile Industry	30 to 32
8	Starters relevant to electric motors used in FCT/ Textile industry	30 to 32
9	Different types of fire extinguishers with accessories, consumables, and safety gears.	30 to 32

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics are to be taught and assessed in order to develop **UOs** for achieving the **COs** to attain the identified competency

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit -I Tools and gauges	1a. Select relevant tools and gauges for performing the given operation with justification. 1b. Describe the criteria to identify relevant tools/ gauges for the given operation. 1c. Describe the procedure to use relevant tool for the given textile operation. 1d. Describe the procedure to set tools/ gauges for performing the given textile operation.	1.1 Tools and gauges: Types 1.2 Setting tools and gauges for different textile operations. 1.3 Procedure of using tools and gauges.
Unit -II Block and screen printing	2a. Describe the procedure to prepare the given type of screen. 2b. Describe the procedure to create design for the given type of printing 2c. Describe the procedure to print using screen on paper/ cloth. 2d. Describe the procedure to prepare block of the given type of design. 2e. Describe the procedure to print on cloth/ paper using the given block.	2.1 Block and Screen Printing: Printing equipment, accessories, Chemicals and medium, material used, 2.2 Design techniques, Preparation of design. 2.3 Printing process
Unit -III Sewing, embroidery and Mechanical operations	3a. Describe the procedure to perform basic sewing to create the given items. 3b. Describe the procedure to perform the given simple embroidery stitches. 3c. Describe the procedure to perform basic mechanical operations related to the given type of machines and accessories in textile industry.	3.1 Construction, working and settings of sewing and embroidery machine 3.2 Machine operation for simple stitching and embroidery 3.3 Safety precautions 3.4 Parts and accessories of

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	3d. Describe the safety precautions to be taken when working with the given type of machine.	basic mechanical machines.
Unit - IV Wiring of electrical installation	4a. Describe the procedure to perform basic electrical connections of the given installations in the textile industry. 4b. Describe the procedure to perform wiring of the given type of AC circuit. 4c. Select relevant accessories and tools for the given type of wiring with justification. 4d. Describe the safety precautions to be taken when undertaking the given type of wiring of the installation.	4.1 Various electrical accessories, tools, material, measuring instruments. 4.2 Wiring diagrams 4.3 Wiring of single phase and three phase AC circuit 4.4 Safety precautions.
Unit - V Firefighting operation	5a. Differentiate between the given types of firefighting equipment based on their applications. 5b. Describe the procedure to operate relevant firefighting equipment in the given situation. 5c. Describe the strategies for firefighting in the given situation 5d. Describe the procedure to follow good housekeeping practices for the given situation. 5e. Describe the procedure to follow specified safety operations in the given situation.	5.1 Fire, Causes of Fire, Classification of fire, Class A, B, C, D. Firefighting equipment, fire extinguishers, and their types. 5.2 Ways of extinguishing fire using equipment. 5.3 General Workshop Layout 5.4 Issue and return system of tools, equipment and consumables, 5-S practice of good housekeeping in workplace. 5.5 Safety Practices, Causes of accidents, General safety rules, Safety signs and symbols. 5.6 First Aid.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

- Not applicable -

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

- Prepare presentation displaying various tools and accessories and their specifications

- Prepare charts on types of fires and related fire extinguishing tools for display at institute.
- Prepare presentation on different types of blocks used in printing.
- Arranging Competitions/ exhibitions for creative jobs in identified tasks

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
- '*L*' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About *15-20% of the topics/sub-topics* which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
- Guide student(s) in undertaking micro-projects.
- Arrange visit to nearby industry/ workshop/ Boutique and preparing reports of observations
- Demonstration of various tools, gauges, machines, firefighting equipment, etc.
- Assign micro projects to group of 4 to 5 students and let them prepare and present the project through PPT. Group shall submit a report which is limited to 5 pages.

12. SUGGESTED TITLES OF MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than *16 (sixteen) student engagement hours* during the course.

In the first *four* semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

- Tools and gauges:** Collect information from internet about different types of tools/ gauges such as, eccentricity meter, tachometer, stripping machine, carding gauges and pressure gauges and like as allotted by the teacher.
- Block and screen printing:** Prepare a catalogue of different consumables and printable material for screen printing and block printing.
- Machines in Textile Industry:** Prepare a catalogue of different types of machines used in textile/ FCT industry.
- Types of cloths:** Prepare a catalogue of different types of cloths/ weaves/ Indian men's / women's wear/ children wear/ special clothing (Any one)
- Cloth cuttings:** Prepare a collage of cuttings of different cloths used in textile/ FCT industry.



- f. **Wiring of electrical installation:** Prepare a catalogue of different types of electrical accessories and machines used in textile/ FCT Industry, such as switches, lights, fuses, MCBs, motors, motor starters, multimeter and energy meters
- g. **Firefighting operation:** Prepare a catalogue of different firefighting equipment used in industry and its application.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	A Course in Workshop Technology	Raghuwanshi, B.S.	Dhanpat Rai Sons, New Delhi; 2011, ISBN: 0000017108
2	Electrical Wiring - Estimating and Costing	Uppal, S. L.	Khanna Publishers, New Delhi, ISBN: 9788174092403
3	Elements of Workshop Technology	Choudhary, Hajra S.K.; Choudhary, Hajra, A.K.; Roy Nirajhar	Media Promoters and Publishers Mumbai, 2009, ISBN: 8185099146
4	A Textbook of Manufacturing Process (Workshop Tech.)	Gupta, J.K.; Khurmi, R.S.	S. Chand and Co. New Delhi, 2016-17, ISBN: 9788121930925
5	Electrical Workshop: Safety, Commissioning, Maintenance and Testing of Electrical Equipment	Singh, R.P.	I K International Publishing House Pvt. Ltd. New Delhi, 2012 ISBN: 9789381141205
6	The Complete Technology Book on Textile Processing With Effluents Treatment	NIIR Board	NIIR Board, ISBN: 8178330504

14. SOFTWARE/ LEARNING WEBSITES

- law.resource.org/pub/in/bis/S05/is.732.1989.pdf
- www.sewingpartsonline.com
- Machine manufacturers websites



Shreey's

Maharashtra State Board of Technical Education, Mumbai																						
Teaching and Examination Scheme for Post S.S.C. Diploma Courses																						
Program Name : Civil Engineering Groups											With Effect From Academic Year: 2017 - 18											
Program Code : CE/CR/ CS											Duration : 16 Weeks											
Duration of Program : 6 Semesters											Scheme - I											
Semester : Second																						
S. N.	Course Title		Course Abbreviation	Course Code	Teaching Scheme			Credit (L+T+P)	Examination Scheme												Grand Total	
					L	T	P		Theory						Practical							
									Exam Duration in Hrs.	ESE		PA		Total		ESE		PA		Total		
									Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks		
1	Applied Mathematics		AMS	22201	3	1	-	4	3	70	28	30*	00	100	40	--	--	--	--	--	--	100
2	Applied Science	Physics	ASM	22202	2	-	4	8	90 Min	70*#	28	15*	00	100	40	25@	10	25	10	50	20	200
		Chemistry			2	-						15*	00			25@	10	25	10	50	20	
3	Applied Mechanics		AME	22203	3	1	2	6	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150
4	Construction Materials		CMA	22204	3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150
5	Basic Surveying		BSU	22205	3	-	4	7	3	70	28	30*	00	100	40	50#	20	50	20	100	40	200
6	Civil Engineering Workshop and Practice		CEW	22008	-	-	4	4	--	--	--	--	--	--	--	50#	20	50~	20	100	40	100
7	Business Communication Using Computers		BCC	22009	-	-	2	2	--	--	--	--	--	--	--	35@^	14	15~	06	50	20	50
Total					16	2	18	36	--	350	--	150	--	500	--	235	--	215	--	450	--	950
Student Contact Hours Per Week: 36 Hrs. Medium of Instruction: English																						
Theory and practical periods of 60 minutes each. Total Marks : 950																						
Abbreviations: ESE- End Semester Exam, PA- Progressive Assessment, L - Lectures, T - Tutorial, P - Practical																						
@ Internal Assessment, # External Assessment, *# On Line Examination , ^ Computer Based Assessment																						
* Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment (5 marks each for Physics and Chemistry) to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain LOs required for the attainment of the COs.																						
~ For the courses having ONLY Practical Examination, the PA marks Practical Part - with 60% weightage and Micro-Project Part with 40% weightage																						
➤ It is mandatory for the candidate to appear for practical (ESE) of both the part of Applied Science (Physics & Chemistry). Candidate remaining absent in exam of any one part, will be considered as absent for the head ESE (PR) of Applied Science.																						
➤ If Candidate not securing minimum marks for passing in the "PA" part of practical of any course of any semester then the candidate shall be declared as "Detained" for that semester.																						



S. No.	Tutorials	Unit No.	Approx. Hrs. Required
1	Solve problems based on finding value of the function at different points.	I	1
2	Solve problems to find derivatives of implicit function and parametric function.	I	1
3	Solve problems to find derivative of logarithmic and exponential functions.	I	1
4	Solve problems based on finding equation of tangent and normal.	I	1
5	Solve problems based on finding maxima, minima of function and radius of curvature at a given point.	I	1
6	Solve the problems based on standard formulae of integration.	II	1
7	Solve problems based on methods of integration, substitution, partial fractions.	II	1
8	Solve problems based on integration by parts.	II	1
9	Solve practice problems based on properties of definite integration.	III	1
10	Solve practice problems based on finding area under curve, area between two curves and volume of revolutions.	III	1
11	Solve the problems based on formation, order and degree of differential equations.	IV	1
12	Develop a model using variable separable method to related engineering problem.	IV	1
13	Develop a model using the concept of linear differential equation to related engineering problem.	IV	1
14	Solve problems based on Trapezoidal rule	V	1
15	Solve problems based on Simpson's $1/3^{rd}$ rule and Simpson's $3/8^{th}$ rule.	V	1
16	Make use of concept of numerical integration to solve related civil engineering problems.	V	1
Total			16

Note: The above tutorial sessions are for guideline only. The remaining tutorial hours are for revision and practice.

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED:

- Not applicable -

7. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop LOs in cognitive domain for achieving the COs to attain the identified competency.

Unit	Major Cognitive Domain Learning Outcomes	Topics and Sub-topics
Unit – I Differential Calculus	1a. Solve the given simple problems based on functions. 1b. Solve the given simple problems based on rules of differentiation.	1.1 Functions and Limits: a) Concept of function and simple examples b) Concept of limits without

Unit	Major Cognitive Domain Learning Outcomes	Topics and Sub-topics
	1c. Obtain the derivatives of logarithmic, exponential functions. 1d. Apply the concept of differentiation to find given equation of tangent and normal 1e. Apply the concept of differentiation to calculate maxima and minima and radius of curvature for given function.	examples. 1.2 Derivatives : a) Rules of derivatives such as sum, product, quotient of functions. b) Derivative of composite functions (chain Rule), implicit and parametric functions. c) Derivatives of inverse, logarithmic and exponential functions. 1.3 Applications of derivative : a) Second order derivative without examples. b) Equation of tangent and normal c) Maxima and minima d) Radius of curvature
Unit– II Integral Calculus	2a. Solve the given simple problem(s) based on rules of integration. 2b. Obtain the given simple integral(s) using substitution method. 2c. Integrate given simple functions using the integration by parts. 2d. Evaluate the given simple integral by partial fractions.	2.1 Simple Integration: Rules of integration and integration of standard functions. 2.2 Methods of Integration: a) Integration by substitution. b) Integration by parts c) Integration by partial fractions.
Unit– III Applications of Definite Integration	3a. Solve given simple problems based on properties of definite integration. 3b. Apply the concept of definite integration to find the area under the given curve(s). 3c. Utilize the concept of definite integration to find area between given two curves. 3d. Invoke the concept of definite integration to find the volume of revolution of given surface.	3.1 Definite Integration: a) Simple examples b) Properties of definite integral (without proof) and simple examples. 3.2 Applications of integration : a) Area under the curve. b) Area between two curves. c) Volume of revolution.
Unit-IV First Order First Degree Differential Equations	4a. Find the order and degree of given differential equations. 4b. Form simple differential equations for given simple engineering problem(s). 4c. Solve given differential equations using the method of variable separable. 4d. Solve the given simple problems	4.1 Concept of differential equation 4.2 Order, degree and formation of differential equation. 4.3 Solution of differential equation a. Variable separable form. b. Linear differential equation. 4.4 Application of differential equations and related engineering problems.



Unit	Major Cognitive Domain Learning Outcomes	Topics and Sub-topics
	based on linear differential equations.	
Unit –V Numerical Integration	5a. Apply the concept of numerical integration to find area from given data by Trapezoidal rule. 5b. Apply the concept of numerical integration to find area from given data by Simpson's $1/3^{rd}$ rule. 5c. Apply the concept of numerical integration to find area from given data by Simpson's $3/8^{th}$ rule. 5d. Utilize the concept of numerical integration to solve related engineering problems.	5.1 An introduction to numerical integration. a. Trapezoidal rule. b. Simpson's $1/3^{rd}$ rule. c. Simpson's $3/8^{th}$ rule.

Note: To attain the COs and competency, above listed Learning Outcomes (LOs) need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

8. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Differential calculus	14	04	08	12	24
II	Integral calculus	12	02	06	08	16
III	Applications of Definite Integration.	08	02	02	04	08
IV	First Order First Degree Differential Equations	06	02	02	04	08
V	Numerical integration	08	02	05	07	14
Total		48	12	23	35	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of LOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student -related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

- Identify engineering problems based on real world problems and solve with the use of free tutorials available on the internet.
- Use graphical software's: EXCEL, DPLLOT, and GRAPH for related topics.
- Use Mathcad as Mathematical Tools and solve the problems of Calculus.
- Identify problems based on applications of differential equations and solve these problems.

- Prepare models to explain different concepts of applied mathematics.
- Prepare a seminar on any relevant topic based on applications of integration.
- Prepare a seminar on any relevant topic based on applications of numerical integration to related engineering problems.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
- '*L*' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About *15-20% of the topics/sub-topics* which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the LOs/COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
- Guide student(s) in undertaking micro-projects.

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of practicals, cognitive domain and affective domain LOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than *16 (sixteen) student engagement hours* during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

- Prepare models using the concept of tangent and normal to bending of roads in case of sliding of a vehicle.
- Prepare models using the concept of radius of curvature to bending of railway track.
- Prepare charts displaying the area of irregular shapes using the concept of integration.
- Prepare charts displaying volume of irregular shapes using concept of integration.
- Prepare models using the concept of differential equations for mixing problem.
- Prepare models using the concept of differential equations for radio carbon decay.
- Prepare models using the concept of differential equations for population growth.
- Prepare models using the concept of differential equations for thermal cooling.
- Prepare charts displaying the area of irregular shapes using the concept of Simpson's $1/3^{rd}$ rule.
- Prepare charts displaying the area of irregular shapes using the concept of Simpson's $3/8^{th}$ rule.



12. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Higher Engineering Mathematics	Grewal, B.S.	Khanna publications, New Delhi , 2013 ISBN- 8174091955
2	A Text Book of Engineering Mathematics	Dutta, D.	New Age International Publications, New Delhi, 2006, ISBN: 978-81-224-1689-3
3	Advanced Engineering Mathematics	Krezig, Ervin	Wiley Publications, New Delhi, 2016 ISBN:978-81-265-5423-2,
4	Advanced Engineering Mathematics	Das, H.K.	S. Chand Publications, New Delhi, 2008, ISBN: 9788121903455
5	Engineering Mathematics, Volume 1 (4 th edition)	Sastry, S.S.	PHI learning, New Delhi, 2014 ISBN-978-81-203-3616-2,
6	Comprehensive Basic Mathematics, Volume 2	Veena, G.R.	New Age International Publications, New Delhi, 2005 ISBN:978-81-224-1684-8
7	Getting Started with MATLAB-7	Pratap, Rudra	Oxford University Press, New Delhi, 2009 ISBN: 0199731241
8	Engineering Mathematics (3 rd edition).	Croft, Anthony.	Pearson Education, New Delhi, 2010 ISBN: 978-81-317-2605-1

13. SOFTWARE/LEARNING WEBSITES

- www.scilab.org/ - SCI Lab
- www.mathworks.com/products/matlab/ - MATLAB
- Spreadsheet applications
- www.dplot.com/ - DPlot
- www.allmathcad.com/ - MathCAD
- www.wolfram.com/mathematica/ - Mathematica
- <http://fossee.in/>
- <https://www.khanacademy.org/math?gclid=CNqHuabCys4CFdOJaAoddHoPig>
- www.easycalculation.com
- www.math-magic.com



Program Name : Mechanical and Civil Engineering Program Group

Program Code : AE/CE/FG/ME/PT/PG

Semester : Second

Course Title : Applied Science (Physics & Chemistry)

Course Code : 22202

1. RATIONALE

Diploma engineers have to deal with various materials and machines. The study of concepts and principles of science like elasticity, viscosity, surface tension, motion, thermo couples, photo-sensors, LASERS, X-Rays, metals, alloys, cement, lime, refractory materials water treatment and analysis, fuel and combustion will help the student to select and use relevant materials and methods which will be economical and eco-friendly.

2. COMPETENCY

This aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Solve broad-based engineering problems using principles of advanced physics and chemistry.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Select relevant material in industry by analyzing its physical properties.
- Apply laws of motion in various applications.
- Use LASERS, X-Rays and photo electric sensors.
- Select the relevant metallurgical process related to industrial applications.
- Use relevant water treatment process to solve industrial problems.
- Use relevant fuel in relevant applications.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
2	-	4	8	90	70*	28	15*	00	100	40	25@	10	25	10	50	20
2	-			Min			15*	00			25@	10	25	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment (5 marks each for Physics and Chemistry) to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment

Note: Practical of Chemistry and Physics will be conducted in alternate weeks for each batch.

5. COURSE MAP with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

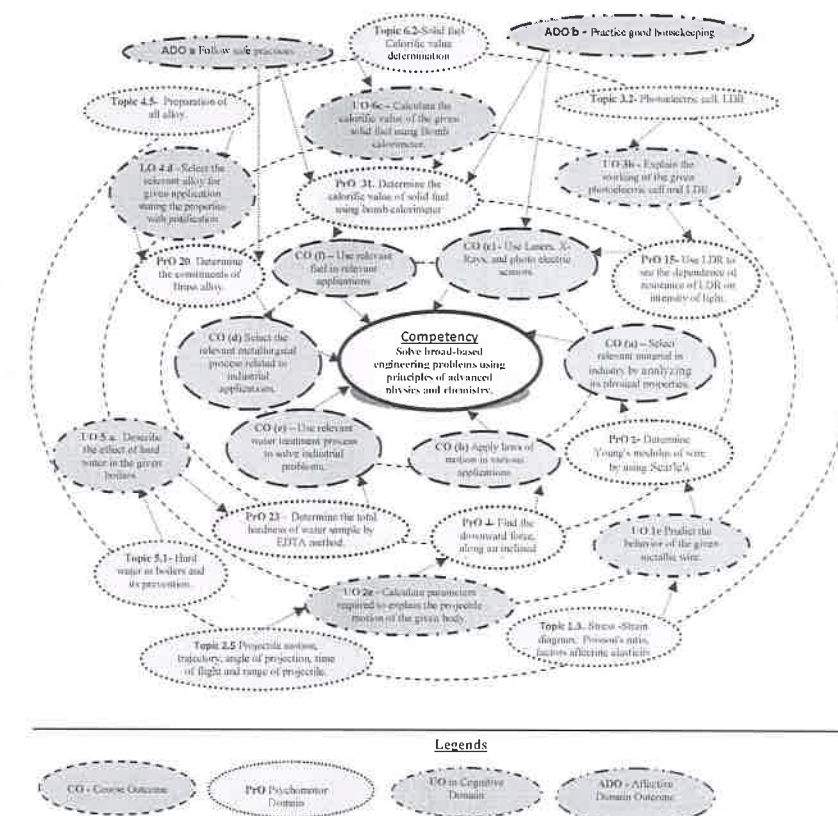


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
Physics			
1	Use Searle's method to determine the Young's modulus of given	1	02*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	wire		
2	Apply Archimedes' principle to determine the buoyancy force on a solid immersed in liquid.	I	02
3	Determine the coefficient of viscosity of given liquid by Stoke's method.	I	02
4	Find the downward force, along an inclined plane, acting on a roller due to gravity and its relationship with the angle of inclination.	I	02
5	Predict the range of the projectile from the initial launch speed and angle.	II	02*
6	i) Find the dependence of the stopping potential on the frequency of light source in photo electric effect experiment. ii) Find the dependence of the stopping potential on the intensity of light source in photo electric effect experiment.	III	02
7	Determine the I-V characteristics of photoelectric cell and LDR.	III	02*
8	Determine the divergence of laser beam.	III	02
	Chemistry		
9	Standardization of KMnO_4 solution using standard oxalic acid and Determine the percentage of iron present in given Hematite ore by KMnO_4 solution.	IV	02*
10	Determine the percentage of copper in given copper ore.	IV	02
11	Determine total hardness, temporary hardness and permanent hardness of water sample by EDTA method.	V	02*
12	Determine the alkalinity of given water sample.	V	02
13	Determine the turbidity of given water sample by Nephelometric method.	V	02
14	Determine the moisture and ash content in given coal sample using proximate analysis.	VI	02*
15	Determine the calorific value of given solid fuel using Bomb calorimeter.	VI	02*
16	Determine the percentage of Sulphur in given coal sample by ultimate analysis.(Gravimetric analysis)	VI	02
	Total		32

Note

- i. A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- ii. The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20



S. No.	Performance Indicators	Weightage in %
3	Safety measures	10
4	Observations and Recording	10
5	Interpretation of result and Conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
	Total	100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safe practices.
- Practice good housekeeping.
- Practice energy conservation.
- Demonstrate working as a leader/a team member.
- Follow ethical Practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by administrators.

S. No.	Equipment Name with Broad Specifications	Exp. No.
1	Searle's apparatus(with slotted mass of 0.5 kg each)	1
2	Liquid container	2
3	Solid body (different size and materials)	3,4
4	Stoke's apparatus (glass tube, viscous liquid, spherical balls of varying sizes)	3
5	Stop watch	4,5
6	Photo transducer	4
7	Timer	4
8	Projectile motion detector	5
9	Photo electric effect apparatus	6
10	Experimental setup for characteristics of photoelectric cell	7
11	Experimental setup for characteristics of LDR	7
12	Laser Source (He Ne, diode laser)	8
13	Electronic balance, with the scale range of 0.001g to 500g pan size 100 mm; response time 3-5 sec; power requirement 90-250 V, 10 watt	All
18	Electric oven inner size 18''x18''x18''; temperature range 100 to 250 ^o C with the capacity of 40 lt.	14,16
19	Bomb calorimeter	15

S. No.	Equipment Name with Broad Specifications	Exp. No.
20	Muffle furnace, Temperature up to 900°C, digital temperature controller with an accuracy of +/- 3°C	14, 16
21	Nephelometer ; Auto-ranging from 20-200 NTU, +/- 2% of reading plus 0.1 NTU, power 220 Volts +/- 10% AC 50 Hz	13

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop LOs in cognitive domain for achieving the COs to attain the identified competency.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Physics		
Unit – I Properties of matter and Non-Destructive Testing	1a. Explain concept of elasticity and plasticity for the given material.	1.1 Deforming Force and Restoring Force, Elasticity, Plasticity, Rigidity
	1b. Establish relation between given types of moduli of elasticity.	1.2 Stress and Strain and their types, Elastic limit and Hooke's law, types of moduli of elasticity
	1c. Predict the behavior of the given metallic wire.	1.3 Stress -Strain diagram, Poisson's ratio, factors affecting elasticity
	1d. Explain pressure-depth relation for the given law.	1.4 Fluid friction, pressure, pressure- depth relation, Pascal's law, Archimedes' principle
	1e. Explain Newton's law of viscosity for the given liquid.	1.5 Viscosity, velocity gradient, Newton's law of viscosity.
	1f. Explain Stokes' law for the free fall of the body through the given viscous medium.	1.6 Free fall of spherical body through viscous medium and Stokes' law, derivation of coefficient of viscosity 'η' by Stokes' method, effect of temperature and adulteration on viscosity of liquids.
	1g. Describe the salient features of the given NDT method.	1.7 Non-destructive testing (NDT), Various NDT methods used, Criteria for the selection of NDT method, merits and demerits of NDT
Unit– II Types of Motion	2a. Explain the equations of motion for the given body moving in the given type of path.	2.1 Displacement, velocity, acceleration and retardation, equations of motion, equations of motion under gravity.
	2b. Calculate the angular velocity of the given body.	2.2 Angular displacement, angular velocity, angular acceleration, three equations of angular motion
	2c. Explain the relevant Newton's laws of motion for the given moving object.	2.3 Momentum, impulse, impulsive force, Newton's laws of motion and their Applications
	2d. Calculate the work/power/energy for the given situation.	2.4 Work, power and energy: potential energy, kinetic energy, work -energy principle.
	2e. Calculate the given	

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	parameters for the given projectile in motion.	2.5 Projectile motion, trajectory, angle of projection, time of flight and range of projectile with formulae.
Unit– III Photoelectricity, X-Rays and LASERS	3a. Explain the concept of the given parameters of the given material.	3.1 Planck's hypothesis, properties of photons, Photo electric effect: threshold frequency, threshold wavelength, stopping potential, Work function, characteristics of photoelectric effect, Einstein's photoelectric equation.
	3b. Explain the working of the given photoelectric device.	3.2 Photoelectric cell and LDR: principle, working and applications.
	3c. Explain the production of X-Rays of the given material with properties and applications.	3.3 Production of X-rays by modern Coolidge tube, properties and applications.
	3d. Differentiate between LASER and given colour of light	3.4 Laser: properties, absorption, spontaneous and stimulated emission, applications of Laser
	3e. Explain the given terms with examples.	3.5 Population inversion, active medium, optical pumping, three energy level system, He-Ne Laser.
Chemistry		
Unit-IV Metals, alloys, Cement, and Refractory materials	4a. Describe construction and working of the given type of furnace.	4.1 Metallurgy: Mineral, ore, gangue, flux, slag.
	4b. Describe the extraction process of the given ore with chemical reaction.	4.2 Types of furnace: Muffle furnace, Blast furnace.
	4c. Explain purposes and preparation methods of making the given alloy.	4.3 Extraction processes of Haematite, copper pyrite ores: Crushing, concentration, reduction, refining.
	4d. Select the relevant alloy for the given application stating the properties with justification.	4.4 Properties of iron and copper: Hardness, tensile strength, toughness, malleability, ductility, refractoriness, fatigue resistance, specific gravity, specific heat, brazing, castability, stiffness.
	4e. Describe the constituents, hardening and setting process of the given type of cement.	4.5 Preparation of alloys (Fusion and compression method).
	4f. Select the relevant refractory for given application stating the properties with justification.	4.6 Ferrous alloys: Low carbon, medium carbon, high carbon steels.
		4.7 Non-ferrous alloy: Brass, Bronze, Duralumin, Tinman Solder, Woods metal.
		4.8 Cement: Types; Biocement and Portland cement; constituents, setting and hardening, applications
		4.9 Lime: classification, constituents, setting and hardening, applications.



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		4.10 Refractory material: Types, properties.
Unit –V Water treatment	5a. Describe the given terminologies related to hard water and their effects	5.1 Hardness; Classification
	5b. Describe the given process for softening of the given water sample.	5.2 Hard water in boilers and prevention: Boiler corrosion, caustic embrittlement, priming and foaming, scales and sludges.
	5c. Describe with sketches the purification of the given type of water.	5.3 Water softening: lime soda process (hot lime soda and cold lime soda process), zeolite process, ion exchange process (cation exchange and anion exchange).
	5d. Describe the given type of waste water treatment.	5.4 Potable water treatment: Sedimentation, coagulation, filtration and sterilization. 5.5 Waste water treatment: sewage treatment, BOD and COD of sewage water; Reverse Osmosis, recycling of waste water.
Unit-VI Fuels and Combustion	6a. Describe salient properties of the given type of fuel.	6.1 Fuel: Calorific value and ignition temperature, classification.
	6b. Explain the given type of analysis of the given type of coal.	6.2 Solid fuels: Coal, Classification and composition, proximate analysis, Ultimate analysis, Bomb calorimeter. Carbonization of coke by Otto Hofmann's oven.
	6c. Calculate the calorific value of the given solid fuel using Bomb calorimeter.	6.3 Liquid fuels: Fractional distillation of crude petroleum, boiling range, composition, properties. Knocking, cracking, octane number and cetane number.
	6d. Describe composition, properties of given gaseous fuel with their applications.	6.4 Gaseous fuels: Biogas, LPG, and CNG. Combustion equation of gaseous fuels, mass and volume of air required for complete combustion.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
	Physics					
I	Properties of matter and NDT	14	03	05	06	14
II	Types of motion	09	02	02	06	10
III	Photoelectricity, X-Ray and LASER.	09	03	04	04	11
	Chemistry					



Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
IV	Metals, alloys, cement, refractory materials	12	02	04	06	12
V	Water treatment	10	02	03	06	11
VI	Fuels and combustion.	10	03	04	05	12
Total		64	15	22	33	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

- Seminar on any relevant topic.
- Library survey regarding engineering material used in different industries.
- Prepare power point presentation or animation for showing applications of lasers.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- Massive open online courses (MOOCs) may be used to teach various topics/sub topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About 15-20% of the topics/sub-topics which is relatively simpler or descriptive in nature is to be given to the students for self-directed learning and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for co-curricular activities.
- Guide student(s) in undertaking micro-projects.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of COs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than 16 (sixteen) student engagement hours during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every

student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

- a. **Elasticity:** Prepare working model to demonstrate the stress – strain behavior of different wires of different thickness and material.
- b. **Viscosity:** Collect 3 to 5 liquids and prepare a working model to differentiate liquids on the basis of viscosity and demonstrate their applications.
- c. **Motion:** Prepare model of ball rolling down on inclined plane to demonstrate the conservation of energy and motion of an object in inclined plane.
- d. **Photo Sensors:** Prepare simple photo sensor using LDR.
- e. **Properties of Laser:** Use Key chain laser to differentiate laser with ordinary light.
- f. **Water analysis:** Collect water samples from different water sources and find the characteristics like acidity, conductivity, dissolved solids, suspended particles.
- g. **Water treatment:** Collect 3 to 5 water samples to find the dosage of bleaching powder required for its sterilization.
- h. **Water analysis:** Prepare model to find the soap foaming capacity of bore water on addition of soda ash.
- i. **Fuels:** Prepare chart showing different types of liquid fuels showing their calorific values and uses.
- j. **Cement:** Collect different samples of cement and find their initial and final setting time.
- k. **Refractory materials:** Prepare chart showing properties of refractory materials.
- l. **Metal properties:** Prepare chart showing different industrial application of metal and relate it with required property or properties using internet.
- m. **Alloy steel:** Find the effect of alloying elements like Mn, Cr, Ni, W, V, Co on properties of steel. Prepare chart of showing percentage composition, properties and industrial applications of different types of steel based on above alloying elements using internet.

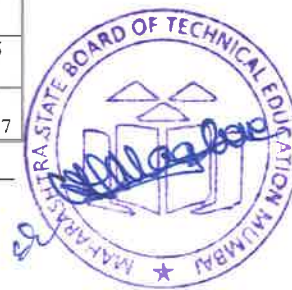
13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Physics Textbook Part I and Part - Class XI	Narlikar, J. V.; Joshi, A. W.; Mathur, Anuradha; <i>et al</i>	National Council of Education Research and Training, New Delhi, 2010. ISBN : 8174505083
2	Physics Textbook Part I and part II - Class XII	Narlikar, J.V.; Joshi, A. W.; Ghatak A.K. <i>et al</i>	National Council of Education Research and Training, New Delhi, 2013. ISBN : 8174506314
3	Engineering Physics	Bhattacharya, D. K.; Tandon Poonam	Oxford Publishing, New Delhi, ISBN:0199452814
4	Principles of Engineering Physics -I	Md. Nazoor Khan and Simanchala Panigrahi	Cambridge university press; New Delhi, 2016 ISBN : 9781316635643
5	Engineering Physics	Palanisamy, P. K.	SCITECH Publications, Chennai, ISBN: 9788183711012
6	Principles of Physics	Walker, J.; Halliday, D; Resnick, R	Wiley Publications, New Delhi, 10 th edition ISBN: 9788126552566
7	Textbook of Engineering Physics	Avadhanulu, M. N.; Kshirsagar, P. G.	S. Chand and Co., New Delhi, 2015 ISBN: 9788121908177
8	Engineering Chemistry	Agarwal, Shikha	Cambridge university press ; New Delhi, 2015 ISBN : 9781107476417

S. No.	Title of Book	Author	Publication
9	Engineering Chemistry	Dara, S. S.; Umare S.S.	S.Chand and Co. Publication, New Delhi, 201, ISBN: 8121997658
10	Engineering Chemistry	Jain & Jain	Dhanpat Rai and sons; New Delhi, 2015. ISBN : 9352160002
11	Engineering Chemistry	Vairam, S.	Wiley India Pvt. Ltd, New Delhi, 2013, ISBN: 9788126543342
10	Chemistry for engineers	Agnihotri, Rajesh	Wiley India Pvt.Ltd, New Delhi, 2014, ISBN: 9788126550784

14. SOFTWARE/LEARNING WEBSITES

- a. <http://nptel.ac.in/course.php?disciplineId=115>
- b. <http://nptel.ac.in/course.php?disciplineId=104>
- c. <http://hyperphysics.phy-astr.gsu.edu/hbase/hph.html>
- d. www.physicsclassroom.com
- e. www.fearofphysics.com
- f. www.sciencejoywagon.com/physicszone
- g. www.science.howstuffworks.com
- h. <https://phet.colorado.edu>
- i. www.chemistryteaching.com
- j. www.visionlearning.com
- k. www.chem1.com
- l. www.onlinelibrary.wiley.com
- m. www.rsc.org
- n. www.chemcollective.org
- o. www.wqa.org
- p. www.em-ea.org



Program Name : Mechanical, Civil Chemical and Fabrication Technology and
Erection Engineering Program Group

Program Code : AE/CE/CH/FG/ME/PT/PG

Semester : Second

Course Title : Applied Mechanics

Course Code : 22203

1. RATIONALE

In day-to-day working we come across different types of structures created for different purposes and functions. While designing the structures, analysis of forces and stresses is an important and prerequisite step. Correct analysis is possible only when one knows the types and effects of forces acting on the structures. This course provides the scope to understand fundamental concepts of laws of mechanics and their applications to different engineering problems. This course is designed to provide basic understanding about the different types of forces, moments and their effects on structural elements, which will analysing different structural systems.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Use principles of applied mechanics to solve broad-based engineering related problems.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Identify the force systems for given conditions by applying the basics of mechanics.
- Select the relevant simple lifting machine(s) for given purposes.
- Determine unknown force(s) of different engineering systems.
- Check the stability of various force systems.
- Apply the principles of friction in various conditions for useful purposes.
- Find the centroid and centre of gravity of various components in engineering systems.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme													
L	T	P		Theory								Practical					
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
3	1	2	6	3	70	28	30*	00	100	40	25@	10	25	10	50	20	

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

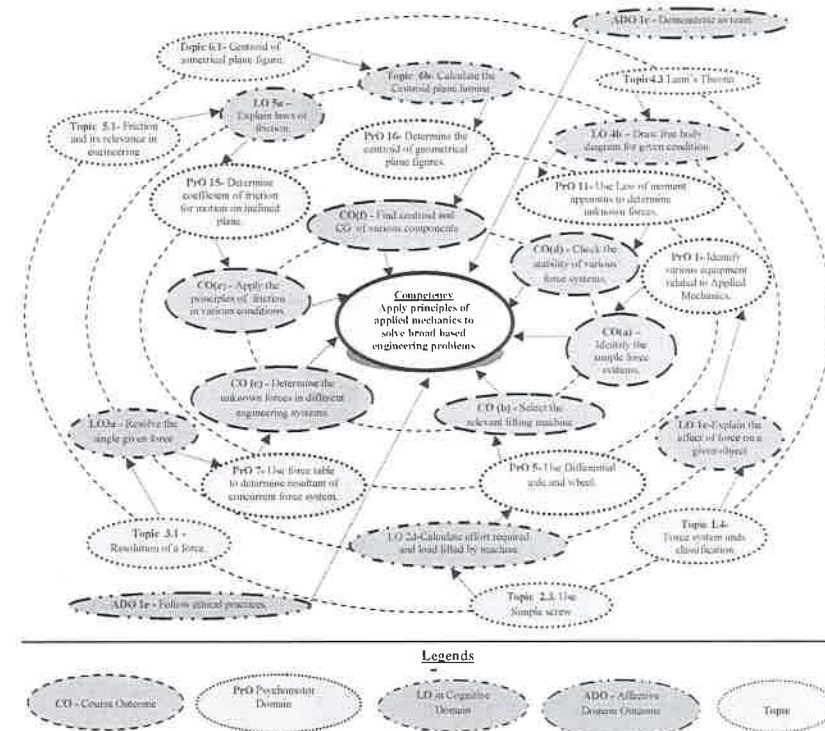


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Identify various equipment related to Applied Mechanics.	I to VI	02
2	Use Differential axle and wheel.	II	02*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
3	Use Simple screw jack.	II	02
4	Use worm and worm wheel.	II	02
5	Use single or double purchase crab.	II	02
6	Use Weston's differential or wormed geared pulley block.	II	02
7	Use force table to determine resultant of concurrent force system applying Law of Polygon of forces. (Part-I)	III	02*
8	Use force table to determine resultant of concurrent force system applying Law of Polygon of forces. (Part-II)	III	02*
9	Graphically determine resultant of concurrent force system.	III	02
10	Graphically determine resultant of parallel force system.	III	02
11	Use Law of moment apparatus to determine unknown forces.	IV	02*
12	Apply Lami's theorem to determine unknown force.	IV	02
13	Determine support reactions for simply supported beam.	IV	02
14	Determine coefficient of friction for motion on horizontal plane.	V	02*
15	Determine coefficient of friction for motion on inclined plane.	V	02
16	Determine centroid of geometrical plane figures.	VI	02
Total			32

Note

- i. A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- ii. The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S.No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and Recording	10
5	Interpretation of result and Conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical practices.



The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year.
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by administrators.

S. No.	Equipment Name with Broad Specifications	Exp. No.
1	Differential axle and wheel (wall mounted unit with the wheel of 40 cm diameter and axles are in steps of 20 cm and 10 cm reducing diameter)	2
2	Simple screw Jack (Table mounted metallic body, screw with a pitch of 5 mm carrying a double flanged turn table of 20 cm diameter.	3
3	Worm and worm wheel (wall mounted unit with threaded spindle, load drum, effort wheel; with necessary slotted weights, hanger and thread)	4
4	Single Purchase Crab winch (Table mounted heavy cast iron body. The effort wheel is of C.I. material of 25 cm diameter mounted on a shaft of about 40mm dia. On the same shaft a geared wheel of 15 cm dia.	5
5	Double Purchase Crab winch (Having assembly same as above but with double set of gearing arrangement.)	5
6	Weston's Differential pulley block (consisting of two pulleys; one bigger and other smaller.	6
7	Weston's Differential worm geared pulley block (Consists of a metallic (preferably steel) cogged wheel of about 20 cm along with a protruded load drum of 10 cm dia to suspend the weights of 10 kg, 20 kg-2 weights and a 50 kg weights)	6
8	Universal Force Table (Consists of a circular 40 cm dia. Aluminum disc, graduated into 360 degrees.) with all accessories.	7, 10
9	Law of moments apparatus consisting of a stainless steel graduated beam 12.5 mm square in section, 1m long, pivoted at centre.	9
10	Beam Reaction apparatus (The apparatus is with two circular dial type 10 kg.	11
11	Friction apparatus for motion along horizontal and inclined plane (base to which a sector with graduated arc and vertical scale is provided. The plane may be clamped at any angle up to 45 degrees. pan. Two weight boxes (each of 5 gm, 10 gm, 2-20 gm, 2-50 gm, 2-100 gm weight).	12
12	Models of geometrical figures.	13

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs in cognitive domain for achieving the COs to attain the identified competency.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Mechanics and force system	1a. Explain concepts of the given terms. 1b. Use the relevant units of various quantities in the given situations. 1c. Explain effects of a force on the given object. 1d. Identify the force system for the given situation.	1.1. Significance and relevance: Mechanics, applied mechanics, statics, dynamics. 1.2. Space, time, mass, particle, body, rigid body. 1.3. Scalar and vector quantity, Units of measurement (SI units)- Fundamental units and derived units. 1.4. Force – unit, representation as a vector and by Bow's notation, characteristics and effects of a force, Principle of transmissibility of force, Force system and its classification.
Unit – II Simple lifting machine	2a. Describe the components of the given lifting machine. 2b. Differentiate the working principle of the given two types of simple lifting machines. 2c. Determine velocity ratio, efficiency and law of the given simple lifting machine. 2d. Calculate effort required and load lifted by the given simple lifting machine. 2e. Interpret the graphs after drawing them with the given data. 2f. Select the relevant simple lifting machine required for the given purpose with justification.	2.1 Simple lifting machine, load, effort, mechanical advantage, applications and advantages. Velocity ratio, efficiency of machines, law of machine. 2.2 Ideal machine, friction in machine, maximum Mechanical advantage and efficiency, reversible and non-reversible machines, condition for reversibility 2.3 Velocity ratios of Simple axle and wheel, Differential axle and wheel, Worm and worm wheel, Single purchase and double purchase crab winch, Simple screw jack, Weston's differential pulley block, geared pulley block. 2.4 Graphs of Load verses Effort, Load verses ideal Effort, Load verses Effort lost in friction, Load verses MA, Load verses Efficiency.
Unit- III Resolution and compositio n	3a. Resolve the given single force. 3b. Calculate the resultant of the given force system analytically. 3c. Determine graphically the resultant of the given force system. 3d. Find the resultant of the given force system using	3.1 Resolution of a force - Orthogonal and Non Orthogonal components of a force, moment of a force, Varignon's Theorem, 3.2 Composition of forces – Resultant, analytical method of determination of resultant for concurrent, non concurrent and parallel co-planar force systems – Law of triangle, parallelogram and polygon of forces. 3.3 Graphic statics, graphical representation

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	law of triangle and law of parallelogram.	of force, Space diagram, force diagram, polar diagram and funicular polygon, Graphical method of determination of resultant for concurrent and parallel co-planar force systems.
Unit– IV Equilibr ium	4a. Draw the free body diagram for the given condition. 4b. Determine unknown force in the given situation using Lami's theorem. 4c. Identify the types of beams required for the given situation. 4d. Determine reactions in the given type of beam analytically and graphically.	4.1 Equilibrium and Equilibrant, Free body and Free body diagram, Analytical and graphical conditions of equilibrium, 4.2 Equilibrium of force systems analytically 4.3 Lami's Theorem. 4.4 Types of beam, supports (simple, hinged, roller and fixed) and loads acting on beam (vertical and inclined point load, UD load, couple), span of beam. 4.5 Beam reaction for cantilever, simply supported beam with or without overhang – subjected to combination of Point load and UD load or Vertical Point load and couple. 4.6 Beam reaction graphically for simply supported beam subjected to vertical loads only.
Unit– V Friction	5a. Determine force of friction and coefficient of friction for the given condition. 5b. Describe the conditions for friction for the give situation. 5c. Determine friction force in the given situation. 5d. Identify the various forces acting on a ladder for the given conditions using free body diagram.	5.1 Friction and its relevance in engineering, types and laws of friction, limiting equilibrium, limiting friction, co-efficient of friction, angle of friction, angle of repose, relation between co-efficient of friction and angle of friction. 5.2 Equilibrium of bodies on level surface subjected to force parallel and inclined to plane. 5.3 Equilibrium of bodies on inclined plane subjected to force parallel to the plane only. 5.4 FBD of ladder in friction
Unit– VI Centroid and centre of gravity	6a. Determine the centroid of geometrical plane figures and centre of gravity of the given simple solid. 6b. Calculate centroid of the given composite plane lamina 6c. Determine centre of gravity of the given solids. 6d. Determine centre of gravity of the given composite solid.	6.1 Centroid of geometrical plane figures (square, rectangle, triangle, circle, semi-circle, quarter circle) 6.2 Centroid of composite figures composed of not more than three geometrical figures 6.3 Centre of Gravity of simple solids (Cube, cuboid, cone, cylinder, sphere, hemisphere) 6.4 Centre of Gravity of composite solids composed of not more than two simple solids.



Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Mechanics and Force System	04	02	02	02	06
II	Simple Lifting Machines	08	02	04	06	12
III	Resolution and Composition	10	02	04	08	14
IV	Equilibrium	10	02	02	10	14
V	Friction	08	02	04	06	12
VI	Centroid and Centre of Gravity	08	02	02	08	12
Total		48	12	18	40	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

- Collect five different photographs indicating concurrent, parallel, general force system in equilibrium.
- Prepare a table of type of machine and relevant industrial application.
- Collect five different situations where law of moment plays an important role.
- Prepare models representing various types of supports (hinged, roller and fixed)
- Illustrate situations wherein friction is essential and not essential.
- Prepare models in the form of geometrical figures and solids and locate centroid and centre of gravity of them.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About *15-20% of the topics/sub-topics* which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
- Guide student(s) in undertaking *micro-projects*.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an *integration* of PrOs, UOs and ADOs. The micro-project could be industry application based, *internet-based*, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than *16 (sixteen) student engagement hours* during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

- Types of Forces:** Prepare chart showing real-life examples indicating various types of forces
- Lifting Machine:** Collect photographs of specific simple lifting machine and relate these machines with the machines being studied and prepare models of simple lifting machines using tools in "MECHANO" and "MECHANIX"
- Types of support:** Prepare chart showing actual and corresponding schematic diagram of various type of support
- Beams:** Prepare models of beam subjected to point loads, uniformly distributed loads, simply supported, overhang and cantilever type beam.
- Friction:** Prepare chart regarding type of friction in various field conditions and collect data regarding coefficient of friction by referring books, Determine coefficient of friction for three different types of surfaces
- Centre of Gravity:** Prepare a chart of situations wherein concept of Centre of Gravity is vital.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Applied Mechanics	Khurmi, R.S.	S Chand & Co. New Delhi 2014 ISBN: 9788121916431
2	Engineering Mechanics	Ramamrutham, S.	S Chand & Co. New Delhi 2008 ISBN:9788187433514
3	Foundations and Applications of Applied Mechanics	Ram, H. D.; Chauhan, A. K.	Cambridge University Press, Thomson Press India Ltd., New Delhi, 2015, ISBN: 9781107499836
4	Engineering Mechanics- Statics, Vol. I	Meriam, J. L.; Kraige, L.G.	Wiley Publication, New Delhi, ISBN: 978-81-265-4396

14. SOFTWARE/LEARNING WEBSITES

- <http://www.asnu.com.au>
- www.youtube.com for videos regarding machines and applications, friction
- www.nptel.ac.in
- www.discoveryforengineers.com



Program Name : Civil Engineering Program Group
Program Code : CE/CR/CS
Semester : Second
Course Title : Civil Engineering Workshop and Practice
Course Code : 22008

1. RATIONALE

General Civil Engineering Practices is a basic engineering course. The knowledge of basics of civil Engineering operations like masonry, mixing, concreting, finishing works is essential for technician to perform his/her duties in industries. Therefore, an opportunity is created through this course to develop basic skills with the safety aspects required for the same. Students should be able to supervise construction activities and use quality control techniques and maintain tools and equipments with safety to self, co-workers and the constructed components of the building. Working in field develops the attitude of team working and safety awareness. This course provides the unique experience of field work.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Perform basic civil engineering jobs using relevant tools.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following **industry oriented** COs associated with the above mentioned competency:

- Identify the various construction activities at site.
- Perform masonry job activities.
- Perform plumbing job activities.
- Identify finishing jobs related to building construction.
- Identify the various components of typical civil structures like road, culvert/bridges.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme											
L	T	P		Theory						Practical					
				Paper Hrs.	ESE		PA		Total	ESE		PA		Total	
					Max	Min	Max	Min		Max	Min	Max	Min		Max
-	-	4	4	--	--	--	--	--	--	50#	20	50~	20	100	40

(~): For the **practical only courses**, the PA has two components under practical marks i.e. the assessment of practicals (seen in section 6) has a weightage of 60% (i.e.30 marks) and micro-project assessment (seen in section 12) has a weightage of 40% (i.e.20 marks). This is designed to facilitate attainment of COs holistically, as there is no theory ESE.

Legends: L-Lecture; T-Tutorial/Teacher Guided Theory Practice; P-Practical; C-Credit; ESE-End Semester Examination; PA-Progressive Assessment.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

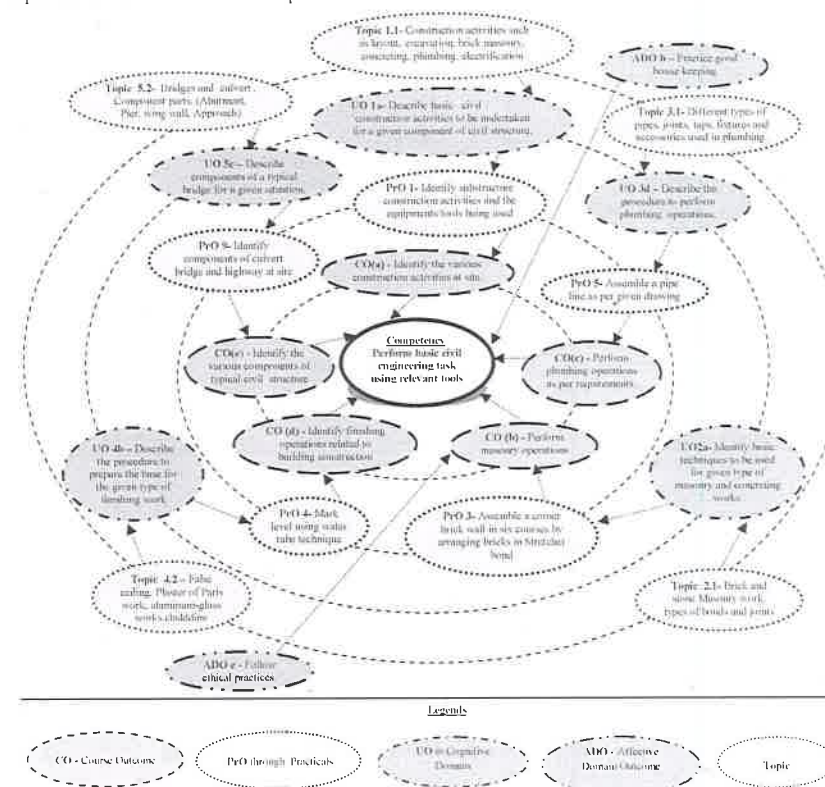


Figure 1 - Course Map

6. SUGGESTED PRACTICAL LEARNING OUTCOMES/TUTORIALS

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Identify the substructure construction activities and the equipments/tools being used at site during the visit. Part I	I, II	02*
2	Identify the substructure construction activities and the equipments/tools being used at site during the visit. Part II	I, II	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
3	Identify the substructure construction activities and the equipments/tools being used at site during the visit. Part III	I, II	02
4	Identify the substructure construction activities and the equipments/tools being used at site during the visit. Part IV	I, II	02
5	Assemble a corner brick wall in six courses by arranging bricks in Stretcher bond. Ensure that wall is in line, plumb and at right angle to a existing wall (Group of 10 students)	II	02*
6	Assemble a corner brick wall in six courses by arranging bricks in Stretcher bond. Ensure that wall is in line, plumb and at right angle to a existing wall (Group of 10 students). Part I	II	02
7	Assemble a corner brick wall in six courses by arranging bricks in Stretcher bond. Ensure that wall is in line, plumb and at right angle to a existing wall (Group of 10 students). Part II	II	02
8	Assemble a corner brick wall in six courses by arranging bricks in Stretcher bond. Ensure that wall is in line, plumb and at right angle to a existing wall (Group of 10 students). Part III	II	02
9	Assemble a corner brick wall in six courses by arranging bricks in Stretcher bond. Ensure that wall is in line, plumb and at right angle to a existing wall (Group of 10 students) Part IV	II	02
10	Identify the superstructure construction activities and the equipments/tools being used at site during the visit Part I	III, IV	02*
11	Identify the superstructure construction activities and the equipments/tools being used at site during the visit Part II	III, IV	02
12	Identify the superstructure construction activities and the equipments/tools being used at site during the visit Part III	III, IV	02
13	Identify the superstructure construction activities and the equipments/tools being used at site during the visit Part IV	III, IV	02
14	Mark level of given height from ground level at different locations in the specified location using water pipe technique. Part I (Group of 10 students)	II, IV	02*
15	Mark level of given height from ground level at different locations in the specified location using water pipe technique. Part II (Group of 10 students)	II, IV	02
16	Mark level of given height from ground level at different locations in the specified location using water pipe technique. Part III (Group of 10 students)	II, IV	02
17	Mark level of given height from ground level at different locations in the specified location using water pipe technique. Part IV (Group of 10 students)	II, IV	02
18	Assemble a pipe line as per given drawing using pipes of one inch diameter, pipes of half inch diameter, nipple, reducer, union, valves T, elbow and then dissemble this pipe line. Part I	III	02*
19	Assemble a pipe line as per given drawing using pipes of one inch diameter, pipes of half inch diameter, nipple, reducer, union, valves T, elbow and then dissemble this pipe	III	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
	line Part II		
20	Assemble a pipe line as per given drawing using pipes of one inch diameter, pipes of half inch diameter, nipple, reducer, union, valves T, elbow and then dissemble this pipe line. Part III	III	02
21	Assemble a pipe line as per given drawing using pipes of one inch diameter, pipes of half inch diameter, nipple, reducer, union, valves T, elbow and then dissemble this pipe line. Part IV	III	02
22	Test the quality of cement on site/Laboratory. Part I	IV	02*
23	Test the quality of cement on site/Laboratory. Part II	IV	02
24	Test the quality of cement on site/Laboratory. Part III	IV	02
25	Identify types of bent up bar and stirrups at site during the field visit for the reinforcement for beams, column and slab. Part I	IV	02*
26	Identify types of bent up bar and stirrups at site during the field visit for the reinforcement for beams, column and slab. Part II	IV	02
27	Carry out field test on bricks at site. Part I	IV	02*
28	Carry out field test on bricks at site. Part II	IV	02
29	Carry out field test on bricks at site. Part III	IV	02
30	Identify the various components of the culvert at site	V	08*
31	Identify the various components of the bridge at site	V	08
32	Identify the various components of the highways at site	V	08
Total			64

Note

- i. A suggestive list of **PrOs** is given in the above table. More such **PrOs** can be added to attain the **COs** and competency. A judicious mix of minimum 24 or more practical **LOs/tutorials** need to be performed, out of which, the **practicals** marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- ii. Hence, the 'Process' and 'Product' related skills associated with each **PrO** of the laboratory/workshop/field work are to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and Recording	10
5	Interpretation of result and Conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
Total		100

The above **PrOs** also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:



- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

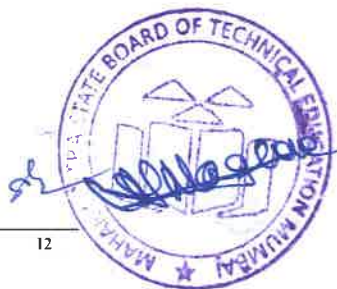
The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Exp. No.
1	Raw material such as bricks of standard size 230 mm x 115 mm x 75 mm.	3,8
2	Trowels (Brick, Buttering, Pointing), triangular, ranging in size up to about 11 inches (279.40 mm) long and from 101.6 mm to 203.2 mm wide i.e. (4 to 8 inches wide).	3
3	Portable Hammer, Spade, Pans (ghamela), Thread, lime	3
4	Square, mason's level, and straightedge 28.57 mm to 38.10 mm and the middle portion of the top edge from 152.40 mm to 254 mm wide	3
5	Levels and mason's line, brushes.	3
6	String, Level / Water tube, Plumb bob, Right Angle	4
7	The mason's level to establish "plumb" and "level" lines	4
8	Plumbing materials such as pipes and accessories for different sizes and materials, pipe wrench	5
9	Pipe Bending Machine	5
10	Pipe Vice – 100 mm	5
11	Pipe Cutter- 50 mm	5
12	Ordinary Portland Cement	3,6
13	Reinforcement bar, 10 mm dia., binding wire and bending tool	7
14	Bricks of standard size 230 mm x 115 mm x 75 mm.	3,8

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop LOs in cognitive domain for achieving the COs to attain the identified competency.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Overview of Constructi on activities	1a. Describe basic construction activities to be undertaken for the given component of civil structure. 1b. Identify the construction activities at the given site. 1c. Identify the tools used for the given type of foundation layout. 1d. Describe different safety precautions to be taken at the given construction site.	1.1. Construction activities such as layout, excavation, brick masonry, concreting, plumbing, electrification, Interdependency of various activities 1.2. Workmanship and Safety precautions
Unit – II Masonry and Concreting	2a. Identify the basic techniques to be used for the given type of masonry and concreting works with justification. 2b. Identify the relevant quality control measures to be adopted in operations related to the given type of masonry and concreting with justification. 2c. Describe the methods of plastering and pointing to be undertaken in the given situation. 2d. Describe the methods of the formwork for the given type of building. 2e. Identify type of bonds in the given type of brickwork.	2.1 Brick and stone Masonry work, Types of bonds and joints (vertical and horizontal). 2.2 Line dori, plumb bob, right angle and water level tube. 2.3 Plastering, Pointing. 2.4 Proper mixing of concrete, concrete laying. 2.5 Use of concrete Mixtures and Vibrators, different types of Vibrators. 2.6 Formwork, Scaffolding. 2.7 Centring and Shuttering.
Unit- III Plumbing Services	3a. Identify the plumbing tools and fixtures in the given situation with justification. 3b. Select the pipe fittings, hand tools and machinery for the given type of work with justification. 3c. Select the type of plumbing tools and machinery for the given situation with justification. 3d. Describe the procedure to perform plumbing operations for the given condition. 3e. Describe the safety precautions to be undertaken for the given site.	3.1 Different types of pipes, joints, taps, fixtures and accessories used in plumbing. 3.2 Components (pipes, valves, bends,) used in water supply/sanitary/sewerage lines.
Unit- IV Finishing Works	4a. Describe the operations to be undertaken related to the given situation of false ceiling, aluminum partitions, plastering work. 4b. Describe the procedure to prepare the	4.1 Flooring, skirting and dado. 4.2 False ceiling, Plaster of Paris (POP) work, aluminum – glass works, cladding. 4.3 Whitewash and painting;



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	base for the given type of finishing /painting work. 4c. Choose the relevant aluminum section for the given type of work with justification. 4d. Describe whitewashing and Painting procedure for the given type of walls/steel frames/wooden structure.	Tools required, brush, roller and spray painting, preparation of surface for timber and steel members for painting.
Unit- V Constructi on of Road, culverts/ bridges	5a. Identify relevant materials for the given type of road construction with justification. 5b. Describe the types and components of road for the given situation. 5c. Describe the components of typical bridge for the given situation. 5d. Describe the components of a typical Culvert in the given situation. 5e. Identify relevant materials for construction of given type of bridge/culvert.	5.1 Types of road, components of road, (carriage way, shoulder, camber, gradient). 5.2 Bridges and Culvert, component parts. (Abutment, Pier, Wing wall, Approach).

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

- Not applicable -

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

- Undertake a market survey of local dealers for procurement of civil engineering materials, plumbing materials and finishing items
- Organize a visit to Construction sites of different types such as simple residential buildings, malls, multistoried buildings. Observe the course/topic based practices on the field.
- Teacher guided self-learning activities
- Course/ library /internet based mini-projects.
- Develop Power point presentation or animation for activities seen during field visit.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.

- About *15-20% of the topics/sub-topics* which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
 - Guide student(s) in undertaking micro-projects.
 - Arrange visit to nearby construction sites for understanding various construction stages and construction activities.
 - Show video/animation films to explain various processes like, excavation, foundation, brickwork, plastering, laying water supply and sewer pipe line.
 - Prepare construction activity chart for various civil engineering stages.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than *16 (sixteen) student engagement hours* during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

- Bill Preparation** (Group of 4-5 students) – Prepare bill of materials for given pipeline layout
- Masonry and concreting** - Each student will collect the information regarding the IS provisions for the construction materials like cement, bricks, reinforcement and sand.
- Finishing Work** – Collect the information from local market regarding the types, thickness, manufacturer, cost of various brands and make of aluminum extruded sections along with its specifications laid in IS code. (Individual activity)
- Plumbing** – Download the specifications for plumbing tools such as bench vice, hammers, pipe wrench and pipe accessories.
- Masonry and concreting** – Undertake a market survey of cement aggregate and sand of various specifications from local dealers (Group of five students)
- Plumbing** – Collect the technical information for various plumbing accessories such as GI/PVC pipes, bend, union, couplings of various dimensions and write a brief reports (Individual activity)
- Masonry and concreting (Individual activity)** –
 - Collect five samples of bricks from different suppliers and test them in field to assess its quality and write a report on it with reference to its constituents and process of manufacturing.
 - Prepare a mud /cement mortar of various proportions 1:3 and apply plaster on a plain wall of 120 mm X 90 mm and observe the line, level and plumb
 - Prepare a cement concrete of proportion 1:2:4, 1:3:6 and 1:4:8 and prepare a cubical block of it to determine its strength. (Individual activity)



- iv. Masonry and concreting –Collect the list of available brand of flooring tiles with their IS specifications and make a report of it.
- f. **Masonry and concreting** (Group of five students) – Undertake the local survey for various shuttering material along with its specifications.
- g. **Masonry and concreting** .(Group of ten students) – Assemble and dissemble the shuttering material for a beam of given dimension using appropriate material as directed by concern teacher
- h. **Finishing Work** (Individual activity) - Undertake the survey for different brands of paint, painting tools and prepare a report with reference to the following points:
 - i. Constituents of paint material
 - ii. Coverage area of finishing surface.
 - iii. Cost.
 - iv. Durability and aesthetic features.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	PWD- Standard Data Book for Building Work	PWD	PWD, Government of Maharashtra, Mumbai.
2	CPWD Specifications (Vol.-I and II)	CPWD	CPWD, Govt. of India, New Delhi.
3	The Practical design of Structural Elements in Timber	Bull, J.W.	Gower Press, London, 1989, ISBN: 9780566090288
4	Basic Plumbing With Illustrations	Massey, Howard C.	Craftsman Book Co; California, ISBN: 9780934041997
5	Modern Plumbing	Baker, E.Keith Blanken	Goodheart-Willcox Co. ISBN: 978-1590703502
6	District Schedule of rates, (DSR)	PWD	PWD, Government of Maharashtra, Mumbai.
7	A To Z Of Practical Building Construction & its Management	Mantri Sandeep	Satya Prakashan, New Delhi; 2015; ISBN : 9788176842051

14. SOFTWARE/LEARNING WEBSITES

- a. <http://www.asnu.com.au>
- b. <http://www.iamcivilengineer.com/-building-design-and.html>
- c. www.mahapwd.com/
- d. cpwd.gov.in/
- e. <https://wrd.maharashtra.gov.in/>



Program Name: All Branches of Diploma in Engineering and Technology.

Program Code: CE/CR/CS/CH/PS/CM/CO/IF/CW/DE/EJ/EN/EQ/ET/EX/IE/MU/EE/

EP/EU/IS/IC/AE/FG/ME/PG/PT/DC/TX/TC

Semester : Second

Course Title : Business Communication Using Computers

Course Code : 22009

1. RATIONALE

Communication is the key factor for smooth and efficient functioning of any industry or business activity. Effective business communication is the lifeblood of any organization and is required to maintain quality and progress. The efficacy of business communication skills are essential for engineering professionals for instructing, guiding and motivating subordinates to achieve desired goals at work place. It is very crucial for an entrepreneur to run organization successfully by communicating effectively and skillfully with employees, customers and investors. Thus this course has been designed to enhance the skills to 'Communicate effectively and skillfully at workplace.'

2. COMPETENCY

The aim of this course is to help the students to attain the following industry identified competency through various teaching learning experiences

- Communicate effectively and skillfully at workplace.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above-mentioned competency:

- Communicate effectively by avoiding barriers in various formal and informal situations.
- Communicate skillfully using non-verbal methods of communication.
- Give presentations by using audio-visual aids.
- Write reports using correct guidelines.
- Compose e-mail and formal business letters.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme											
L	T	P		Theory						Practical					
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total
				Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
--	--	2	2	--	--	--	--	--	--	35@^	14	15~	06	50	20

(~^): For only practical courses, the PA (15 marks) has two components under practical marks i.e. the assessment of practical has a weightage of 60% (i.e. 09 marks) and micro-project assessment has a weightage of 40% (i.e. 06 marks). This is designed to facilitate attainment of COs holistically, as there is no theory ESE.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

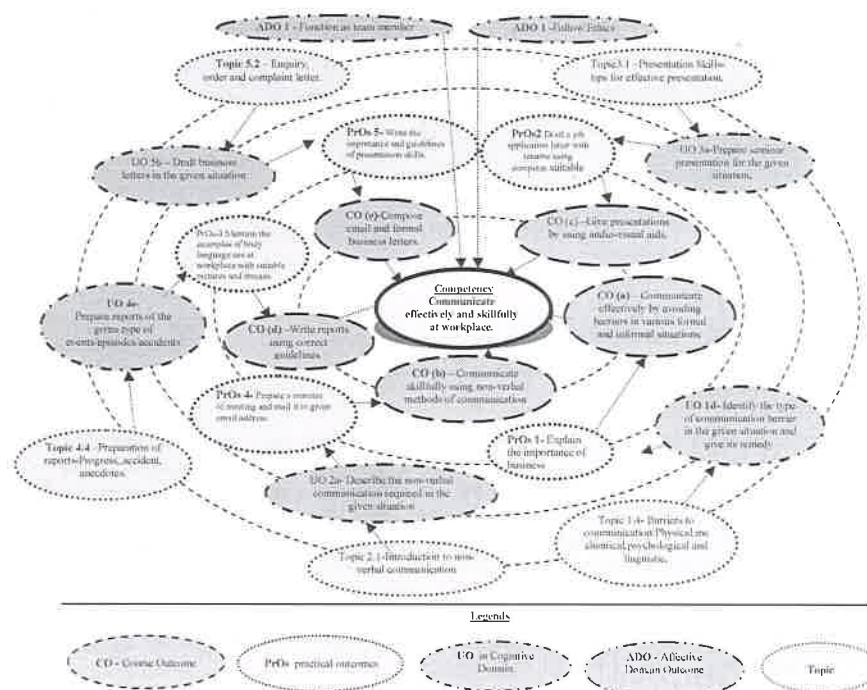


Figure 1 - Course Map

6. SUGGESTED PRACTICALS ACTIVITIES / EXERCISES (Integrate the theory in the laboratory when conducting practical)

The practical in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Explain the importance of business communication for an organization using case study	I	2*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
2	Draft a job application letter with resume using computer.	V	2*
3	Mention the examples of body language use at workplace with suitable pictures and images.	II	2*
4	Prepare a minutes of meeting and mail it to given email address.	VI	2
5	Write the importance and guidelines of presentation skills.	III	2*
6	Draft a detailed Progress Report.	IV	2*
7	Organize a debate on types of communication.	I & III	2
8	Summarize an industry report using techniques of summarizing.	IV	2
9	Draft a complaint letter on given topic.	V	2
10	Design PowerPoint presentation on any technical topic.	III	2*
11	Explain the eight principles of effective communication.	I	2*
12	Explain various non-verbal codes with examples.	II	2
13	Explain the importance of personal appearance stating tips of grooming for a professional.	II	2*
14	Draft a memo on given topic.	V	2
15	Present any Two barriers to communication using case study.	I	2*
16	Present a technical paper using IEEE format.	III	2*
			32

Note

i. A suggestive list of practical LOs is given in the above table, more such practical LOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical LOs/tutorials need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry. The size of batch for the practical should not exceed more than 21 students strictly for the maximum attainment of COs and PrOs.

ii. Hence, the 'Process' and 'Product' related skills associated with each LO of the laboratory/workshop/field work are to be assessed according to a suggested sample given below.

7. MAJOR EQUIPMENTS / INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Exp. S.No.
1	LCD Projector	All
2	Smart Board with networking	All
3	Language lab with internet	All
4	Printer	Wherever Applicable

**8. UNDERPINNING THEORY COMPONENTS**

The following topics/subtopics should be taught and assessed in order to develop UOs in cognitive domain for achieving the COs to attain the identified competency:

Unit	Unit Outcomes (UOs) (in cognitive domain)		Topics and Sub-topics
	Writing Skills	Speaking Skills	
Unit – I Introduction to Business Communication	1a. Describe the importance of the business communication in the given situation. 1b. Identify the missing element in the given communication process. 1c. Identify the type of communication in the given situation. 1d. Identify the type of communication barrier in the given situation and its remedy.	1e. Use different types of verbal and non-verbal communication for the given situation.	1.1 Introduction to Communication- Elements, Importance, Functions. 1.2 Types (meaning and importance) – Verbal (Oral-Written), Formal, Informal, Vertical, Horizontal and Diagonal communication. 1.3 Principles of effective communication. 1.4 Barriers to communication - Physical, mechanical, psychological and linguistic. 1.5 Business communication: Meaning, characteristics and importance.
Unit– II Non-Verbal Communication	2a. Describe the non-verbal communication required in the given situation. 2b. Describe personal appearance required in the given communication situation. 2c. Describe the given facial expressions.	2d. Use relevant facial expressions in the given situation. 2e. Answer questions after listening to presentations.	2.1 Introduction to Non-Verbal communication (Meaning and importance) 2.2 Body Language: Aspects of body language: gestures, eye contact, posture, facial expressions, personal appearance (dressing and grooming) vocalics. 2.3 Body language - positive and negative body language.
Unit– III Presentation skills	3a. Prepare seminar presentation for the given situation. 3b. Prepare debate points 'for' and 'against' the given topic. 3c. Prepare the points for computer presentation	3d. Make seminar presentation 3e. Participate in debate speaking 'for' or 'against' the given topic 3f. Make effective	3.1 Presentation skills- tips for effective presentation. 3.2 Guidelines for developing power point presentation. 3.3 Presenting Technical papers.

Unit	Unit Outcomes (UOs) (in cognitive domain)		Topics and Sub-topics
	Writing Skills	Speaking Skills	
	for the given topic.	computer presentations	
Unit- IV Office Drafting	4a. Draft the given notice using the relevant format. 4b. Draft the given memorandum using the relevant format. 4c. Prepare agenda for the given type of meetings. 4d. Prepare minutes of the given type of meetings. 4e. Prepare reports of the given type of events/episodes/ accidents	4f. Read the agenda of the given meeting. 4g. Read the report of the given event. 4h. Initiate telephone calls for given situation. 4i. Answer official phone calls for given situation.	4.1. Office drafting: Formats and Guidelines. 4.2. Formulating notices and memoranda. 4.3. Preparation of agenda and writing minutes of meetings. 4.4. Preparation of reports-progress reports, Accident reports, case study. 4.5. Summarizing techniques.
Unit-V Business Correspondence	5a. Respond to given job advertisements by writing your CV/ Resume. 5b. Draft business letters in the given situations. 5c. Draft complaint letters for the given situations. 5d. Compose E- mails with relevant for the given situation.		5.1 Business correspondence. 5.2 Enquiry, order and complaint letters. 5.3 E-mails- netiquettes. 5.4 Difference –Curriculum Vitae, Bio-data and Resume. 5.5 Job application and resume writing

Note: To attain the COs and competency, above listed Learning Outcomes (UOs) need to be undertaken to achieve the 'Application Level' of Blooms's 'Cognitive Domain Taxonomy' Theory related topic should be covered during practical hours using multimedia.

9. SUGGESTED SPECIFICATION TABLE FOR INTERNAL END SEMESTER EXAMINATION

Unit No.	Unit Title	Distribution of practical Marks			
		R Level	U Level	A Level	Total Marks
I	Introduction to Business Communication	02	02	01	05
II	Non-verbal Communication	02	01	02	05
III	Presentation Skills	02	01	02	05
IV	Office Drafting	02	04	04	10
V	Business Correspondence	02	04	04	10
Total		10	12	13	35

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)
Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of PrOs and UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED GUIDELINES FOR ASSESSMENT TOOL TO CONDUCT INTERNAL END SEMESTER EXAM (ESE) .

Weightage (20 Marks)	Weightage (15 Marks)	Total
A	B	
Assessment based on PrOs, practicals conducted during semester Based on computer and written skill. (Minimum four questions each five marks) Sample questions: Eg. I Draft an email to The manager regarding the shortage of raw material at production department. Note-submit the printout of mail. (Computer based) Eg. II Write job application with resume. (written)	Oral examination based on UOs Topics mentioned in syllabus. (Minimum five questions each two marks to be asked) Eg. I Explain the importance of communication in professional life. II. State any four guidelines of presentation skills.	(35 Marks) A+B Duration: 2 hours

SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

- Collect good articles from newspapers and magazines and read them with correct intonation.
- Listen to Business news on TV and radio.
- Watch videos of effective presentations on television and open learning sources for presentation skills and body language.
- Undertake micro-projects.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.



- b. 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c. About 15-20% of the topics/sub-topics which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
 - a. Arrange various communication activities using functional grammar.
 - b. Show video/animation films to develop listening skills and enhance vocabulary.
 - c. Use real life situations for explanation.
 - d. Prepare and give oral presentations.
 - e. Guide micro-projects in groups as well as individually.

12. SUGGESTED TITLES OF MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of CrAs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than 16 (sixteen) *student engagement* hours during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

- a. Study the personal appearance and grooming of employees visiting sales store, shopping mall in the vicinity.
- b. Comparative study of Bio-data, Resume and Curriculum vitae.
- c. A detailed study of guidelines required for presentation skills.
- d. Summarize technical content using English newspaper, magazines or online resources.
- e. Prepare a booklet on aspects of body language in pictorial form.
- f. A detailed study of the importance, of technical paper of technical paper presentation.
- g. Case study on the importance of Business communication in an organization.
- h. Report on various formal/business activities.
- i. Study of oral presentation of famous business leader.
- j. Detailed study of business etiquettes observed in organization.
- k. Summarize the business article with the help of English newspapers/magazines and other sources.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Effective Communication Skills	M Ashraf Rizvi	Tata McGraw-Hill



S. No.	Title of Book	Author	Publication
2	Communication Skills	Sanjay Kumar and Pushp Lata	Oxford University Press
3	Personality Development and Soft Skills	Barun K. Mitra	Oxford University Press

14. SOFTWARE/LEARNING WEBSITES

- a. <https://www.britishcouncil.in/english/learn-online>
- b. <http://learnenglish.britishcouncil.org/en/content>
- c. <http://www.talkenglish.com/>
- d. language-labsystem.com
- e. www.wordsworthelt.com
- f. www.notesdesk.com
- g. <http://www.tutorialspoint.com>
- h. www.studylecturenotes.com
- i. totalcommunicator.com
- j. www.speaking-tips.com



Maharashtra State Board Of Technical Education, Mumbai
Teaching and Examination Scheme for Post S.S.C. Diploma Courses

Program Name : Computer Engineering Groups

Program Code : CO/CM/IF/CW

Duration of Program : 6 Semesters

With Effect From Academic Year: 2017 - 18

Semester : Second

Duration : 16 Weeks

S. N.	Course Title	Course Abbre- viation	Course Code	Teaching Scheme			Credit (L+T+P)	Examination Scheme												Grand Total	
				L	T	P		Theory						Practical							
								Exam Duration in Hrs.	ESE		PA		Total		ESE		PA		Total		
									Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks		Min Marks
1	Elements of Electrical Engineering	EEC	22215	4	-	2	6	3	70	28	30*	00	100	40	25#	10	25	10	50	20	150
2	Applied Mathematics	AMI	22224	4	2	-	6	3	70	28	30*	00	100	40	--	--	--	--	--	--	100
3	Basic Electronics	BEC	22225	3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150
4	Programming in 'C'	PCI	22226	3	2	2	7	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150
5	Business Communication Using Computers	BCC	22009	-	-	2	2	--	--	--	--	--	--	--	35@^	14	15~	06	50	20	50
6	Computer Peripheral and Hardware Maintenance	CPH	22013	2	-	2	4	--	--	--	--	--	--	--	50#	20	50~	20	100	40	100
7	Web Page Designing with HTML	WPD	22014	2	-	2	4	--	--	--	--	--	--	--	50@	20	50~	20	100	40	100
Total				18	4	12	34	--	280	--	120	--	400	--	210	--	190	--	400	--	800

Student Contact Hours Per Week: **34 Hrs.**

Medium of Instruction: **English**

Theory and practical periods of 60 minutes each.

Total Marks : 800

Abbreviations: ESE- End Semester Exam, PA- Progressive Assessment, L - Lectures, T - Tutorial, P - Practical

@ Internal Assessment, # External Assessment, *# On Line Examination, ^ Computer Based Assessment

* Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment (5 marks each for Physics and Chemistry) to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain LOs required for the attainment of the COs.

~ For the courses having ONLY Practical Examination, the PA marks Practical Part - with 60% weightage and Micro-Project Part with 40% weightage

- **If Candidate not securing minimum marks for passing in the "PA" part of practical of any course of any semester then the candidate shall be declared as "Detained" for that semester.**



Program Name : Computer Engineering Program Group
Program Code : CO/CM/IF/CW/IF/DE/EJ/IE/IS
Semester : Second
Course Title : Elements of Electrical Engineering
Course Code : 22215

1. RATIONALE

A technologist is expected to have some basic knowledge of electrical engineering as they have to work in different engineering fields and deal with various types of electrical machines and equipment. Hence, it is necessary to understand magnetic circuits, AC fundamentals, polyphase circuits, different types of electrical machines, their principles and working characteristics. This course deals with the basic fundamentals of electrical engineering and working principles of commonly used AC and DC motors and their characteristics. The basic concepts of electrical engineering in this course will be very useful for understanding of other higher level courses.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Use electrical equipment in industrial applications.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Use principles of magnetic circuits.
- Use single phase AC supply for electrical and electronics equipment.
- Use three phase AC supply for industrial equipment and machines.
- Connect transformers and DC motors for specific requirements.
- Use FHP motors for diversified applications.
- Use relevant protective devices/switchgear for different requirements.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
4	-	2	6	3	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
					70	28	30*	00	100	40	25#	10	25	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit. ESE - End Semester Examination; PA - Progressive Assessment.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

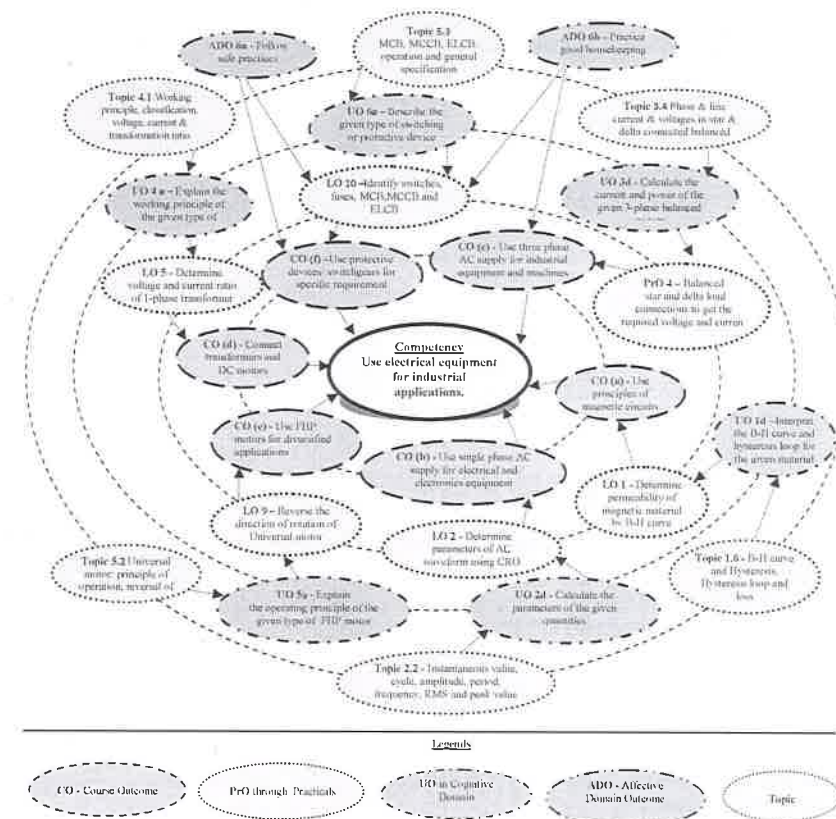


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Determine the permeability of magnetic material by plotting its B-H curve.	I	02*
2	Determine frequency, time period, peak value, rms value, peak factor and form factor of a sinusoidal A.C. waveform on C.R.O.	II	02*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	Part I		
3	Determine frequency, time period, peak value, rms value, peak factor and form factor of a sinusoidal A.C. waveform on C.R.O. Part II	II	02
4	Find the phase difference between voltage and current on C.R.O. for resistive, inductive and capacitive circuits. Part I	II	02
5	Find the phase difference between voltage and current on C.R.O. for resistive, inductive and capacitive circuits. Part II	II	02
6	Connect balanced star and delta load connections to get the required voltage and currents. Part I	III	02*
7	Connect balanced star and delta load connections to get the required voltage and currents. Part II	III	02
8	Determine voltage and current ratio of single phase transformer.	IV	02*
9	Operate the DC shunt motor using 3-point starter.	IV	02
10	Operate the DC shunt motor using 4-point starter.	IV	02
11	Reverse the direction of rotation of single phase induction motor.	V	02*
12	Reverse the direction of rotation of Universal motor.	V	02
13	Identify switches, fuses, switch fuse and fuse switch units, MCB, MCCB and ELCB.	VI	02
14	Connect the switches, fuses, switch fuse and fuse switch units, MCB, MCCB and ELCB in a circuit. Part I	VI	02
15	Test circuit using series lamp and multimeter.	VI	02*
16	Use the earth tester.	VI	02
17	Use the insulation tester.	VI	02
18	Use different types of digital clamp-on meters	VI	02
	Total		36

Note

- i. A suggestive list of **PrOs** is given in the above table. More such **PrOs** can be added to attain the **COs** and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- ii. The 'Process' and 'Product' related skills associated with each **PrO** is to be assessed according to a suggested sample given below:

S.No.	Performance Indicators	Weightage in %
1	Selection of suitable component, apparatus/instrument	20
2	Preparation of experimental set up	10
3	Setting and operation	10
4	Safety measures	10
5	Observations and Recording	10
6	Interpretation of result and Conclusion	20
7	Answer to sample questions	10
8	Submission of report in time	10
	Total	100



The above **PrOs** also comprise of the following social skills/attitudes which are Affective Domain Outcomes (**ADOs**) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical practices.

The **ADOs** are not specific to any one **PrO**, but are embedded in many **PrOs**. Hence, the acquisition of the **ADOs** takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the **ADOs** according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year.
- 'Organising Level' in 2nd year.
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Exp. S. No.
1	Single Phase Transformer: 1kVA, single-phase, 230/115 V, air cooled, enclosed type	1,5
2	Single phase auto transformer (Dimmerstat) - Single-Phase, Air cooled, enclosed model, Input: 0 ~ 230, 10A, Output: 0 ~ 270Volts	1,2,3,5
3	CRO – 20 MHz, Dual channel	2,3
4	Three phase Auto Transformer -15 kVA, Input 415 V, 3 phase, 50 Hz, Output 0-415 V, 30 A per Line, Cooling air natural	4
5	Loading Rheostat - 7.5 kW, 230V, 3 phase, 4 wire, Balanced load. (Each branch having equal load), Load : Wire Wound Fixed Resistors	4
6	Lamp Bank - 230 V 0-20 A	5
7	DC shunt motor coupled with DC shunt Generator	6,7
8	Single phase Induction motor – ½ HP, 230 V, 50 Hz, AC supply	8
9	Universal motor -1/4 Hp	9
10	Digital Multimeter - 3 1/2 digit	Comm on
11	DC and AC Ammeters: 0-5-10 Amp	
12	DC and AC Voltmeters: 0-150-300 V	
13	Tachometer: Non contact type, 0-10000 rpm	
14	Rectifier: solid state, Input- 415 V, 3-Phase, AC, Output – 230 V DC regulated, 20 Amp	

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics is to be taught and assessed in order to develop **UOs** for achieving the **COs** to attain the identified competency:



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Magnetic Circuits	1a. Describe the salient features of the given type of circuits. 1b. Apply Fleming’s left hand rule and Lenz’s law to determine direction of induced EMF in the given circuit. 1c. Explain the given type(s) of induced emf. 1d. Interpret the B-H curve and hysteresis loop for the given material.	1.1 Magnetic flux, flux density, magneto motive force, magnetic field strength, permeability, reluctance 1.2 Electric and magnetic circuits 1.3 Series and parallel magnetic circuits 1.4 Faraday’s laws of electromagnetic induction, Fleming’s right hand rule, Lenz’s law 1.5 Dynamically and statically induced emf, self and mutual inductance 1.6 B-H curve and hysteresis, hysteresis loop and hysteresis loss.
Unit– II AC Fundamentals	2a. Describe the salient features of the given type of power supply. 2b. Represent the given AC quantities by phasors, waveforms and mathematical equations. 2c. Explain the response of the given pure resistive, inductive and capacitive AC circuits with sketches 2d. Calculate the parameters of the given circuit. 2e. Calculate impedance, current, power factor and power of the given AC circuit.	2.1 A.C. and D.C. quantity, advantages of A.C. over D.C. 2.2 Single phase A.C. sinusoidal A.C. wave: instantaneous value, cycle, amplitude, time period, frequency, angular frequency, R.M.S. value, Average value for sinusoidal waveform, Form factor, Peak factor 2.3 Vector representation of sinusoidal A.C. quantity, Phase angle, phase difference, concept of lagging and leading – by waveforms, mathematical equations and phasors 2.4 Pure resistance, inductance and capacitance in A.C. circuit 2.5 R-L and R-C series circuits 2.6 Impedance and impedance triangle 2.7 Power factor and its significance 2.8 Power – active, reactive and apparent, power triangle
Unit– III Polyphase AC Circuits	3a. Describe the salient features of the given type of AC power supply. 3b. Explain the concept of symmetrical system and phase sequence of the given AC supply. 3c. Distinguish the characteristics of the given type(s) of star (or delta) connections with sketches. 3d. Calculate the current and power of the given three phase	3.1 3 phase system over 1 phase system 3.2 3-phase emf generation and its wave form 3.3 Phase sequence and balanced and unbalanced load 3.4 Phase and line current, phase and line voltage in star connected and delta connected balanced system 3.5 Current, power, power factor in a 3 phase balanced system 3.6 Star and delta connections

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	balanced system,	
Unit-IV Transformer and DC Motors	4a. Explain the working principle of the given type of transformer. 4b. Distinguish the construction of the given type of transformer. 4c. Describe the construction and working of the given type of DC motor. 4d. Select relevant type of DC motor for the given application with justification.	4.1 Transformer: Working principle, emf equation, Voltage ratio, current ratio and transformation ratio, losses 4.2 Auto-transformer – comparison with two winding transformer, applications 4.3 DC motor construction - parts its function and material used 4.4 DC motor -Principle of operation 4.5 Types of D.C. motors, schematic diagram, applications of dc shunt, series and compound motors
Unit –V Fractional Horse Power (FHP) Motors	5a. Explain the working principle of the given type of FHP motor. 5b. Select relevant FHP motor for the given application with justification. 5c. Describe the procedure to connect the given type of FHP motor for the given application with sketches. 5d. Describe the procedure to connect stepper motor for the given application with sketches.	5.1 FHP: Schematic representation, principle of operation and applications of: split phase Induction motor, capacitor start induction run, capacitor start capacitor run and permanent capacitor motors, shaded pole motors 5.2 Universal motor: principle of operation, reversal of rotation and applications 5.3 Stepper motor: types, principle of working and applications
Unit-VI Protective Devices and Switchgear	6a. Describe the features of the given type of protective device. 6b. Select the relevant protective device for the given application with justification 6c. Select suitable switchgear for the given situation with justification. 6d. State the I.E. rule related to be applied for the given type of earthing with justification.	6.1 Fuse: Operation, types 6.2 Switch Fuse Unit and Fuse Switch Unit: Differences 6.3 MCB, MCCB and ELCB: Operation and general specifications 6.4 Earthing: Importance of earthing, factors affecting earthing 6.5 Methods of reducing earth resistance, I.E rules relevant to earthing

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the ‘Application Level’ and above of Bloom’s ‘Cognitive Domain Taxonomy’.



9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Magnetic Circuits	10	02	04	04	10
II	AC fundamentals	10	02	04	04	10
III	Polyphase AC circuits	08	02	04	04	10
IV	Transformer and DC motors	14	04	04	06	14
V	Fractional Horse Power (FHP) motors	12	04	04	06	14
VI	Protective Devices and Switchgear	10	02	04	06	12
Total		64	16	24	30	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

- Market survey regarding commonly used electrical equipment which are not covered in the curriculum.
- Prepare power point presentation or animation for showing working of DC or AC motors.
- Undertake a market survey of different domestic electrical appliances based on the following points:
 - Manufacturers
 - Specifications/ratings
 - Salient features
 - Applications

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (MOOCs) may be used to teach various topics/sub topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About 15-20% of the topics/sub-topics which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
- Guide student(s) in undertaking micro-projects.



12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

- Magnetic circuits:** Each batch will collect B-H curves and hysteresis loops for various types magnetic and non magnetic materials from internet. Based on the permeability and shapes of the curves, each student will decide the suitability of each material for different applications.
- Magnetic circuits:** Each batch will prepare a coil without core. Students will note the deflection of galvanometer connected across the coil for: movement of the North Pole of permanent magnet towards and away from the coil (slow and fast movement), movement of the South Pole of permanent magnet towards and away from the coil (slow and fast movement). Students will demonstrate and prepare a report based on their observations.
- AC fundamentals:** Each batch will visit a nearby sub-station or industry and observe the arrangement for power factor correction/improvement. Each batch will prepare a report based on their observation.
- Polyphase circuits:** Each batch will observe the three phase power distribution panel in their own Institute/Commercial complex/mall etc. and draw single line diagram and prepare a report.
- Transformer:** Each batch will visit nearby pole mounted sub-station and prepare a report based on the following points:
 - Rating: kVA rating, primary and secondary voltage, connections
 - Different parts and their functions
 - Earthing arrangement
 - Protective devices
- Fractional horse power motor:** Each batch will select a FHP motor for a particular application (assume suitable rating). They will visit local electrical market (if the market is not nearby you may use the Internet) and prepare a report based on the following points:
 - Manufactures
 - Technical specifications
 - Features offered by different manufacturers
 - Price range
 Then select the motor which you would like to purchase. Give justification for your selection in short.
- Each batch will visit Institute workshop and prepare a report which includes the following points:
 - Different types of prime movers used, their specifications and manufacturers
 - Method of starting and speed control

- iii. Different protective and safety devices used
- iv. Maintenance
- h. Each batch will select any one electrical device/equipment which is not included in the curriculum and prepare a short power point presentation for the class based on the following points: construction, working, salient features, cost, merits, demerits, applications, manufacturers etc.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Electrical Technology Vol – I	Theraja, B. L.	S. Chand and Co., New Delhi, ISBN: 9788121924405
2	Electrical Technology Vol – II	Theraja, B. L.	S. Chand and Co., New Delhi, ISBN: 9788121924375
3	Basic Electrical Engineering	Mittle and Mittal	McGraw Hill, New Delhi, ISBN: 978-0-07-0088572-5
4	Fundamentals of Electrical Engineering	Saxena, S. B. Lal	Cambridge University Press, New Delhi, ISBN : 9781107464353
5	Basic Electrical and Electronics Engineering	Jegathesan, V.	Wiley India, New Delhi, ISBN : 97881236529513

14. SOFTWARE/LEARNING WEBSITES

- a. Scilab
- b. SIMULINK (MATLAB)
- c. PSIM
- d. P-SICE (student version)
- e. Electronics Workbench
- f. www.nptel.iitm.ac.in
- g. www.onlinelibrary.wiley.com
- h. xiendianqi.en.made-in-china.com/
- i. ewh.ieee.org/soc/es/
- j. www.electrical-technologies.com/
- k. www.howstuffworks.com.



Program Name : Computer Engineering Program Group
Program Code : CO/CM/IF/CW
Semester : Second
Course Title : Applied Mathematics
Course Code : 22224

1. RATIONALE

The core technological studies can be understood with the help of potential of mathematics. This course is being introduced into diploma course to provide mathematical background. The course will give them the insight to understand and analyze engineering problems scientifically using calculus, integration, differential equations and numerical methods. This subject enhances the multidimensional, logical thinking and reasoning capabilities. It also improves the systemic approach in computer programming language.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Solve computer related broad-based engineering problems using principles of applied mathematics.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Calculate the equation of tangent, maxima, minima, radius of curvature by differentiation.
- Solve the given problems of integration using suitable methods.
- Apply the concept of integration to find area and volume.
- Solve the differential equation of first order and first degree using suitable methods.
- Apply the concepts of numerical methods in computer programming languages.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme				Examination Scheme											
L	T	P	Credit (L+T+P)	Theory						Practical					
				Paper Hrs.	ESE		PA		Total	Max	Min	ESE		PA	
					Max	Min	Max	Min				Max	Min	Max	Min
4	2	--	6	3	70	28	30*	00	100	40	--	--	--	--	--

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P-Practical; C – Credit, ESE -End Semester Examination; PA - Progressive Assessment.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

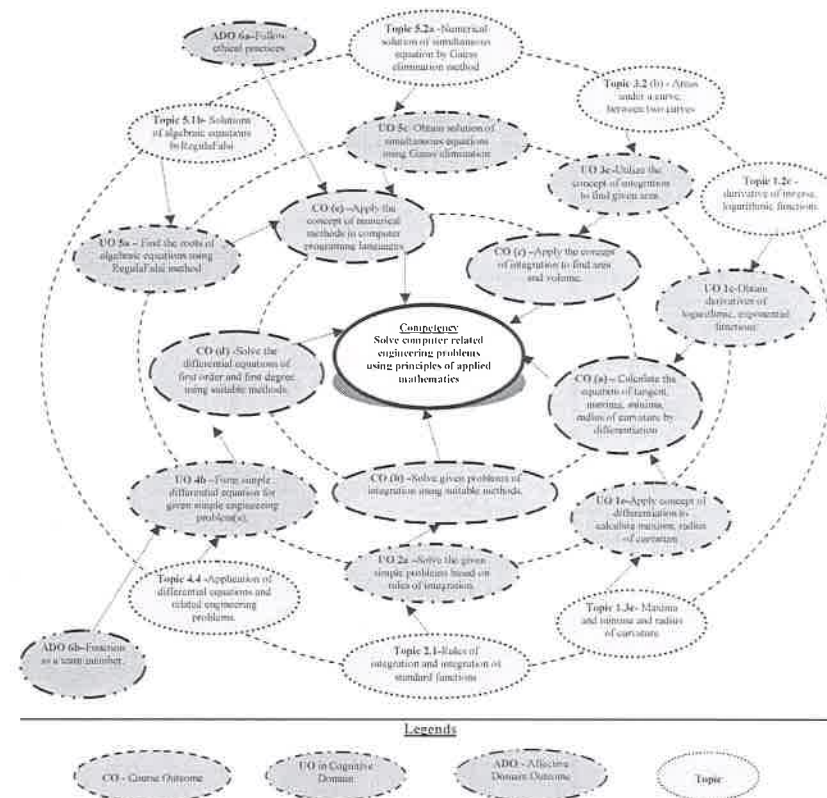
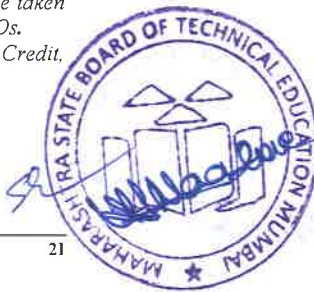


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The tutorials in this section are sub-components of the COs to be developed and assessed in the student to lead to the attainment of the competency.

S. No.	Tutorials	Unit No.	Approx. Hrs. Required
1	Solve problems based on finding value of the function at different points.	I	2
2	Solve problems to find derivatives of implicit function and parametric function	I	2
3	Solve problems to find derivative of logarithmic and	I	2



S. No.	Tutorials	Unit No.	Approx. Hrs. Required
	exponential functions.		
4	Solve problems based on finding equation of tangent and normal.	I	2
5	Solve problems based on finding maxima, minima of function and radius of curvature at a given point.	I	2
6	Solve the problems based on standard formulae of integration.	II	2
7	Solve problems based on methods of integration, substitution, partial fractions.	II	2
8	Solve problems based on integration by parts.	II	2
9	Solve practice problems based on properties of definite integration.	III	2
10	Solve practice problems based on finding area under curve, area between two curves and volume of revolutions.	III	2
11	Solve the problems based on formation, order and degree of differential equations.	IV	2
12	Develop a model using variable separable method to related engineering problem.	IV	2
13	Develop a model using the concept of linear differential equation to related engineering problem.	IV	2
14	Solve problems based on finding the roots of algebraic equations using Regula Falsi Method.	V	2
15	Solve problems based on finding the roots of transcendental equations using Newton Raphson's Method.	V	2
16	Solve problems based on solution of system of equations using Gauss elimination method and Gauss Seidal Method.	V	2
Total			32

Note: The above tutorial sessions are for guideline only. The remaining tutorial hours are for revision and practice.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED:

- Not applicable -

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics is to be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Differential Calculus	1a. Solve the given simple problems based on functions. 1b. Solve the given simple problems based on rules of differentiation. 1c. Obtain derivatives of given logarithmic, exponential functions. 1d. Apply the concept of differentiation to find equation of	1.1 Functions and Limits: a) Concept of function and simple examples b) Concept of limits without examples. 1.2 Derivatives : a) Rules of derivatives such as sum, product, quotient of functions. b) Derivatives of inverse, logarithmic



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	tangent and normal for given problem. 1e. Apply the concept of differentiation to calculate maxima and minima and radius of curvature for the given problem.	and exponential functions. 1.3 Applications of derivative: a) Second order derivative without examples. b) Equation of tangent and normal c) Maxima and minima d) Radius of curvature
Unit– II Integral Calculus	2a. Solve the given simple problem(s) based on rules of integration. 2b. Obtain the given simple integral(s) using substitution method. 2c. Integrate given simple functions using the integration by parts. 2d. Evaluate the given simple integral by partial fractions.	2.1 Simple Integration: Rules of integration and integration of standard functions. 2.2 Methods of Integration: a) Integration by substitution. b) Integration by parts c) Integration by partial fractions.
Unit– III Applications of Definite Integration	3a. Solve given simple problems based on properties of definite integration. 3b. Apply the concept of definite integration to find the area under the given curve (s). 3c. Utilize the concept of definite integration to find area between given two curves. 3d. Invoke the concept of definite integration to find the volume of revolution of given surface.	3.1 Definite Integration: a) Simple examples b) Properties of definite integral (without proof) and simple examples. 3.2 Applications of integration : a) Area under the curve. b) Area between two curves. c) Volume of revolution.
Unit-IV First Order First Degree Differential Equations	4a. Find the order and degree of given differential equation(s). 4b. Form simple differential equations for given simple engineering problems 4c. Solve given differential equations using the method of variable separable. 4d. Solve the given simple problem(s) based on linear differential equations.	4.1 Concept of differential equation. 4.2 Order, degree and formation of differential equation. 4.3 Solution of differential equation a. Variable separable form. b. Linear differential equation. 4.4 Application of differential equations and related engineering problems.
Unit –V Numerical methods	5a. Find the roots of given algebraic equations using Bisection method and Regula falsi method. 5b. Determine the roots of given nonlinear equation(s) using Newton's-Raphson method.	5.1 Solutions of algebraic equations: a. Bisection Method. b. Regula falsi Method. c. Newton Raphson Method. 5.2 Numerical solutions of simultaneous equations:

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	5c. Obtain the solutions of given simultaneous equations using Gauss elimination method. 5d. Solve given system of linear equations using Jacobi's method and Gauss Seidal method.	a. Gauss elimination method b. Jacobi's Method. c. Gauss Seidal Method.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Differential calculus	20	04	08	12	24
II	Integral calculus	14	02	06	08	16
III	Applications of Definite Integration	10	02	02	04	08
IV	First Order First Degree Differential Equations	08	02	02	04	08
V	Numerical Methods	12	02	05	07	14
Total		64	12	23	35	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

- Identify engineering problems based on real world problems and solve with the use of free tutorials available on the internet.
- Use graphical software: EXCEL, DPLLOT, and GRAPH for related topics.
- Use Mathcad as Mathematical Tools and solve the problems of Calculus.
- Identify problems based on applications of differential equations and solve these problems.
- Prepare models to explain different concepts of applied mathematics.
- Prepare a seminar on any relevant topic based on applications of integration.
- Prepare a seminar on any relevant topic based on some Numerical methods.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.

- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Guide student(s) in undertaking micro-projects.
- Apply the mathematical concepts learnt in this course to branch specific problems.
- Use different instructional strategies in classroom teaching.
- Use video programs available on the internet to teach abstract topics.

12. SUGGESTED MICRO-PROJECTS

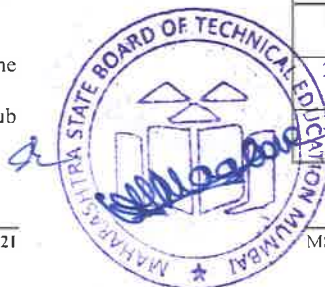
Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

- Prepare models using the concept of tangent and normal to bending of roads in case of sliding of a vehicle.
- Prepare models using the concept of radius of curvature to bending of railway track.
- Prepare charts displaying the area of irregular shapes using the concept of integration.
- Prepare charts displaying volume of irregular shapes using concept of integration.
- Prepare models using the concept of differential equations for mixing problem.
- Prepare models using the concept of differential equations for radio carbon decay.
- Prepare models using the concept of differential equations for population growth.
- Prepare models using the concept of differential equations for thermal cooling.
- Write algorithm to find the approximate roots of algebraic equations.
- Write algorithm to find the approximate roots of transcendental equations.
- Write algorithm to solve system of linear equations.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Higher Engineering Mathematics	Grewal, B.S.	Khanna publications, New Delhi, 2013 ISBN:8174091955
2	Advanced Engineering Mathematics	Krezig, Ervin	Wiley Publications, New Delhi, 2016 ISBN:978-81-265-5423-2.
	Advanced Engineering Mathematics	Das, H.K.	S. Chand Publications, New Delhi, 2008, ISBN-9788121903455



S. No.	Title of Book	Author	Publication
4	Engineering Mathematics, Volume 1 (4 th edition)	Sastry, S.S.	PHI Learning, New Delhi, 2009 ISBN: 978-81-203-3616-2,
5	Getting Started with MATLAB-7	Pratap, Rudra	Oxford University Press, New Delhi, 2009 ISBN: 0199731241
6	Engineering Mathematics (third edition).	Croft, Anthony.	Pearson Education, New Delhi, 2010 ISBN: 978-81-317-2605-1

14. SOFTWARE/LEARNING WEBSITES

- a. www.scilab.org/ - SCI Lab
- b. www.mathworks.com/products/matlab/ - MATLAB
- c. Spreadsheet applications
- d. www.dplot.com/ - DPlot
- e. www.allmathcad.com/ - MathCAD
- f. www.wolfram.com/mathematica/ - Mathematica
- g. <http://fossee.in/>
- h. <https://www.khanacademy.org/math?gclid=CNqHuabCys4CFdOJaAoddHoPig>
- i. www.easycalculation.com
- j. www.math-magic.com.



Program Name : Computer Engineering Program Group
 Program Code : CO/CM/IF/CW
 Semester : Second
 Course Title : Basic Electronics
 Course Code : 22225

1. RATIONALE

In today's world most of the consumer appliances are based on electronic circuits and devices. The foundation for working of computer or any of its peripherals are based on electronics. This course has been designed to develop skills to understand and test simple electronic components and circuits. After studying this course students will develop an insight to identify, build and troubleshoot simple electronic circuits.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Use simple electronic circuits of computer system.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Identify electronic components in electronic circuits.
- Use diodes in different applications.
- Interpret the working of junction transistor in the electronic circuits.
- Interpret the working of unipolar devices in the electronic circuits.
- Use sensors and transducers.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme				Examination Scheme											
L	T	P	Credit (L+T+P)	Theory								Practical			
				Paper Hrs.	ESE		PA		Total		Max	ESE		PA	
					Max	Min	Max	Min	Max	Min		Max	Min	Max	Min
3	+	2	5	3	70	28	30*	00	100	40	25@	10	25	10	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment



5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

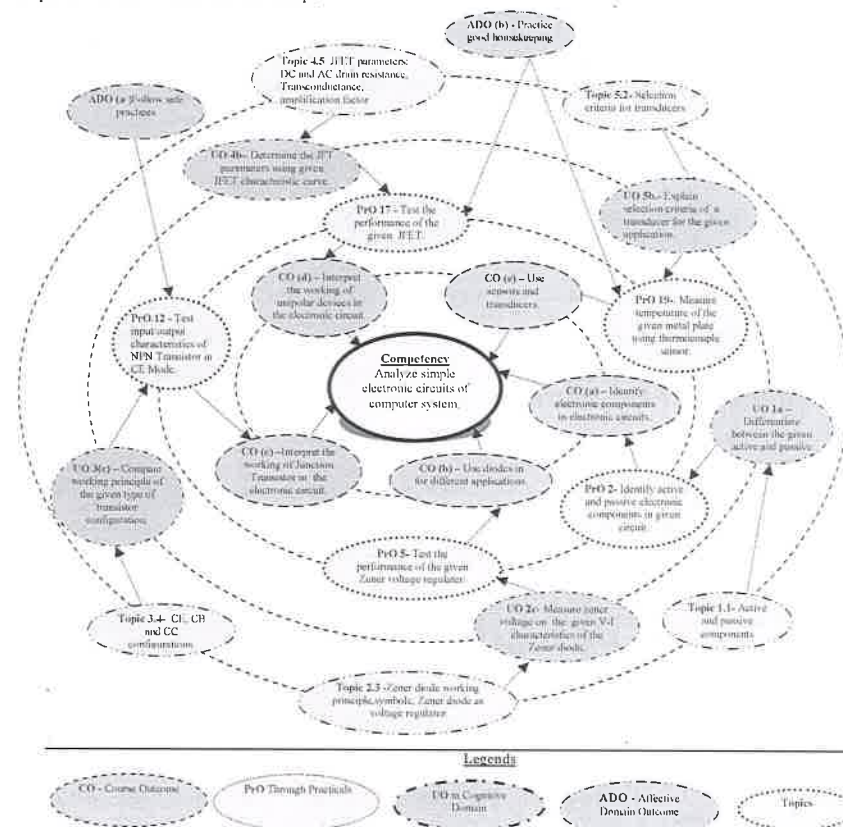


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Measure amplitude, time period and frequency of sine wave and square wave using CRO.	I	02*
2	Identify active and passive electronic components in the given	I	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	circuit.		
3	Test the performance of the given PN junction diode.	II	02*
4	Test the performance of the given Zener diode.	II	02
5	Test the performance of the given Zener voltage regulator.	II	02
6	Convert AC signal into DC signal using Half wave rectifier.	II	02
7	Convert AC signal into DC signal using full wave rectifier.	II	02
8	Use filters to get regulated DC.	II	02
9	Convert AC signal into DC signal through Bridge rectifier.	II	02
10	Test the performance of the given Bridge rectifier using filter.	II	02
11	Test input/output characteristics of NPN Transistor in CE Mode.	II	02
12	Test input/output characteristics of NPN Transistor in CB Mode.	III	02*
13	Test input/output characteristics of NPN Transistor in CC Mode.	III	02
14	Determine gain and bandwidth of Single stage RC coupled amplifier.	III	02
15	Determine gain and bandwidth of 2 stage RC coupled amplifier.	III	02
16	Test the performance of the given JFET & Determine the characteristics parameter of the given JFET.	III & IV	02*
17	Measure temperature of the given metal plate using thermocouple sensor.	IV	02
18	Test the performance of the given circuit consist of photoelectric sensor.	V	02*
Total			36

Note

- i. A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- ii. The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and recording	10
5	Interpretation of result and conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.

- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Exp. S.No.
1	Single/Dual regulated Power supply(0 to 15Volts).	3-18
2	Digital multimeter, 3 and ½ digit, separate range for resistances and capacitance, component tester, AC and DC measurement.	3 – 20
3	Dual trace CRO/DSO, 50MHz., with function generator and component tester.	1,4-18
4	Function generator, 20MHz.	1,4-18
5	Trainer kits / breadboard for Rectifiers, regulator, Transistors, JFET and RC coupled single / two stage amplifiers.	4-18
6	Heater, Thermocouple and photoelectric sensor	19,20

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics is to be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Electronic Components and Signals	1a. Differentiate between the given active and passive electronic components.	1.1 Active and passive components 1.2 Resistor, capacitor, inductor symbols, working principles, applications, colour codes, specifications.
	1b. Calculate value of the given resistor and capacitor using colour code.	1.3 Voltage and Current Source 1.4 Signal waveform, Time and frequency domain representation, Amplitude, Frequency, Phase, Wavelength
	1c. Compare the characteristics of the given voltage and current source.	1.5 Types of Signals: sinusoidal, triangular and square
	1d. Interpret with sketches the given signal.	1.6 Integrated Circuits – analog and digital.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit– II Diodes and Their Applications	2a. Explain with sketches working of the given diode using V-I characteristics. 2b. Measure zener voltage on the given V-I characteristics of the zener diode. 2c. Describe with sketches the working principle of given type of filter. 2d. Compare the salient features of the given type of rectifiers.	2.1 Symbol, construction and working principle of P-N junction diode 2.2 Rectifiers: Half wave, Full wave and Bridge Rectifier, working principle, circuit diagram, performance parameters PIV, ripple factor, efficiency, Need for filters: circuit diagram and working of 'L', 'C' and 'π' filter. 2.3 Zener diode working principle, symbols, as voltage regulator 2.4 Symbol, construction and working principle of light emitting diode (LED) 2.5 Working principle and block diagram of regulated power supply.
Unit– III Bipolar Junction Transistor	3a. Describe with sketches the construction and working of the given type of device. 3b. Explain with sketches the working principle of the given transistor configuration. 3c. Determine the current gain of the given transistor configuration. 3d. Explain with sketches the specified transistor parameter. 3e. Explain with sketches the concept of the specified transistor biasing.	3.1 Unipolar and Bipolar devices 3.2 Symbol, construction and working principle of NPN transistor. 3.3 Transistor as switch and amplifier. 3.4 CE, CB and CC configurations. 3.5 Regions – Cut-off, saturation and Active region. 3.6 Transistor parameters- alpha, beta, input and output resistance and relation between alpha and beta 3.7 Transistor biasing- DC load line, Q-point and Fixed bias and voltage divider biasing. 3.8 RC coupled amplifier.
Unit-IV Field Effect Transistors	4a. Explain with sketches the construction and working principle of the given type of FET. 4b. Determine the FET parameters from the given FET characteristic curve. 4c. Describe the specified JFET parameter. 4d. Describe the specified MOSFET parameter.	4.1 FET-Types: JFET and MOSFET 4.2 Classification of JFET 4.3 Symbol, construction and working principle of N-channel and P-channel JFET, Drain and transfer characteristics of JFET 4.4 JFET parameters: DC and AC drain resistance, Transconductance, amplification factor 4.5 Symbol, construction and working principle of MOSFET.
Unit –V Sensors and Transducers	5a. Differentiate between the given type of sensor and transducer	5.1 Working of sensors and transducers 5.2 Selection criteria for transducers 5.3 Active and passive transducers

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	5b. Explain selection criteria of a transducer for the given application. 5c. Describe with sketches the working of photodiode and photo transistor as control device for the given application. 5d. Describe the steps to measure the temperature of a given metal using the given transducer.	5.4 Inductive, capacitive, resistive pressure and Piezoelectric transducer 5.5 Photodiode and phototransistor transducers 5.6 Thermocouple and Proximity sensors.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Electronic Components and Signals	08	02	04	06	12
II	Diodes and Their Applications	10	04	04	08	16
III	Bipolar Junction Transistor	14	04	06	08	18
IV	Field Effect Transistor	08	02	03	06	11
V	Sensors and Transducers	08	03	04	06	13
Total		48	15	21	34	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

- Prepare journals based on practical performed in laboratory.
- Study of datasheet of electronic components.
- Prepare charts of symbols of Electronic components.
- Search information about Ratings and specifications of Regulator, diode transistors, CRO, function generator.
- Collect information of analog and digital ICs and prepare charts of the same.
- Collect information of passive transducers and prepare charts of the same.
- Prepare posters to illustrate the use of photoelectric sensors in remote controls.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)



These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course :

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Guide student(s) in undertaking micro-projects.
- Guide students in preparing charts and display boards.
- Guide students in searching information regarding datasheets and electronic components.
- Show Video/Animation clippings for functioning of instruments.
- Observe continuously and monitor the performance of students in lab.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

- Diode:** Build a circuit on general purpose PCB to clip a positive half cycle at 1.5 v of a waveform with input signal 5Vpp, and prepare the report.
- Diode:** Build a circuit on general purpose PCB to clamp a waveform at 3.0V using diode and passive components.
- FET:** Prepare chart on comparison of specifications of FETs using data sheets of at least three FET.
- FET:** Prepare a chart on FETs contains its symbol, advantages and applications.
- Rectifier:** Build a half wave rectifier for 6V, 500mA output current on general purpose PCB.
- Rectifier:** Build a full wave bridge rectifier with capacitor filter for 6V, 500mA output current on general purpose PCB.
- BJT:** Build a circuit to switch on and off the LED by using BJT as switching component.
- Photodiode:** Build a circuit on breadboard to turn the relay on and off by using photo diode and prepare a report.
- Voltage Regulator:** Build a circuit of DC regulated power supply on general purpose PCB for 9V and 500mA output.



- Transistor as a switch:** Build / test transistor switch circuit on breadboard/General purpose PCB for various input signal.
- Use of sensors for driving relays / output devices:** Students will build/test circuit on breadboard/General purpose PCB. Verify output of designed circuit by applying different inputs.
- Prepare display boards consisting of electronic components:** prepare display boards/ models/ charts/ Posters to visualize the appearance of electronic active and passive components.

13. SUGGESTED LEARNING RESOURCES

S.No.	Title of Book	Author	Publication
1	Electronic Instrumentation	Kalsi, H.S.	McGraw Hill Education, New Delhi, 2010, ISBN: 978-0070702066
2	Electronics Principles	Malvino, Albert Paul, David	McGraw Hill Education, New Delhi, ISBN: 978-0070634244
3	A text book of Applied Electronics	Sedha, R.S.	S.Chand and Co., New Delhi, 2008, ISBN 978-8121927833
4	A course in electrical and electronic measurements and instrumentation	Sawhney, A.K.	Dhanpat Rai & Company, New Delhi, 2014 edition, ISBN:- 978-8177001006
5	Principles of Electronics	Mehta, V.K. Mehta, Rohit	S. Chand and Co. Ram Nagar, New Delhi-110 055, 11 th Edition, 2014, ISBN 9788121924504

14. SOFTWARE/LEARNING WEBSITES

- <https://learn.sparkfun.com/tutorials/transistors>
- <http://www.pitt.edu/~qi4/Academic/ME2082/Transistor%20Basics.pdf>
- http://faculty.cord.edu/luther/physics225/Handouts/transistors_handout.pdf
- <http://www.technologystudent.com/elect/trans1.htm>
- <http://www.learningaboutelectronics.com/Articles/N-channel-JFET>
- <http://www.electrical4u.com/jfet-or-junction-field-effect-transistor>
- www.nptel.com
- <http://www.electronics-tutorials>

Program Name : Computer Engineering Program Group
Program Code : CO/CM/IF/CW/IF
Semester : Second
Course Title : Programming in 'C'
Course Code : 22226

1. RATIONALE

Diploma engineers (also called technologists) have to write programs to cater with various IT solutions. In order to develop a program to solve a given problem, they have to build logic, develop algorithms and flow charts. This course is designed keeping in view developing these skills. Besides its use to write codes for low level programming such as developing operating systems, drivers, and compilers, 'C' has been widely used as a general-purpose language to develop basic applications. This course deals with fundamental syntactic information about 'C' that will help the students to apply the basic concepts, program structure and principles of 'C' programming paradigm to build given application. The course is basically designed to create a base to develop foundation skills of programming language.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Develop 'C' programs to solve broad-based computer related problems.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Develop flowchart and algorithm to solve problems logically.
- Write simple 'C' programs using arithmetic expressions.
- Develop 'C' programs using control structure.
- Develop 'C' programs using arrays and structures.
- Develop/Use functions in C programs for modular programming approach.
- Develop 'C' programs using pointers.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
3	2	2	7	3	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
				3	70	28	30*	00	100	40	25@	10	25	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: L-Lecture; T- Tutorial/Teacher Guided Theory Practice; P- Practical; C- Credit
 ESE - End Semester Examination; PA - Progressive Assessment

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

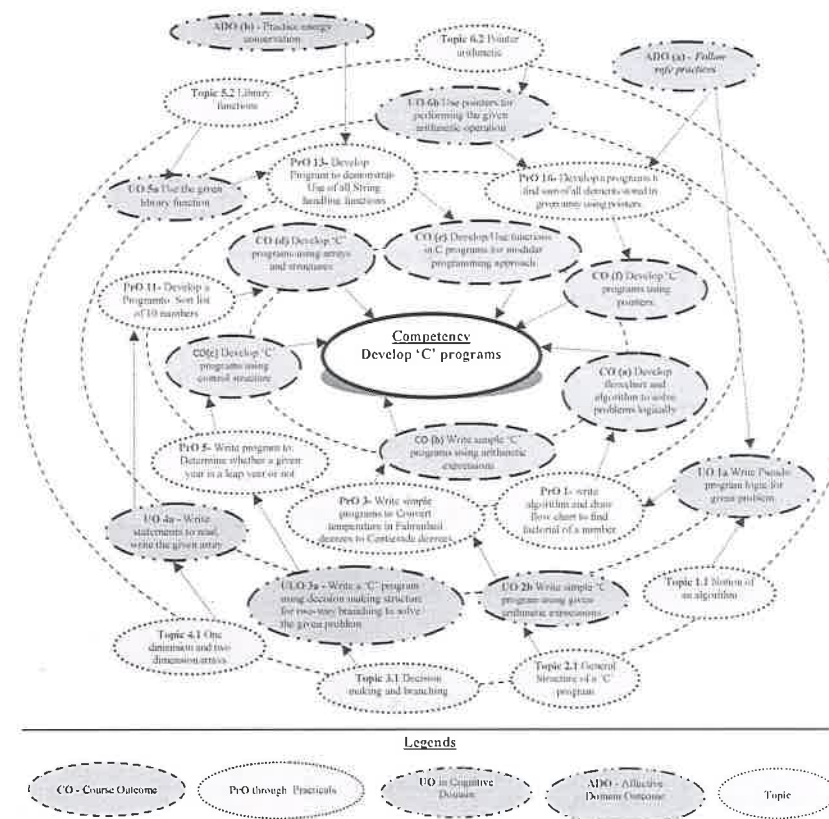


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Write/compile/execute simple 'C' program: Develop minimum 2 programs using Constants, Variables, arithmetic expression.	II	02
2	Write/compile/execute simple 'C' program: Develop minimum	II	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	2 programs increment/decrement operators, exhibiting data type conversion		
3	Write simple programs to convert temperature in Fahrenheit degrees to Centigrade degrees.	II	2
4	Write simple programs to calculate the area and perimeter of the rectangle, and the area & circumference of the circle	II	2
5	Decision Making and branching using if, if-else structure Write program to: (i) Determine whether a given year is a leap year or not. (ii) Determine whether a string is palindrome.	III	02*
6	Write program to: (i) Find the greatest of the three numbers using conditional operators (ii) Find if a given character is vowel.	III	02
7	Using switch statement: Write programs to: (i) Print day of week by taking number from 1 to 7. (ii) Print a student's grade by accepting percent marks.	III	02
8	Using switch statement: Write programs to check whether the triangle is isosceles, equilateral, scalene or right angled triangle	III	02
9	Looping: Write a program to: (i) Find sum of digits of a given number. (ii) Generate multiplication table up to 10 for numbers 1 to 5.	III	02
10	Write a program to: (iii) Find Fibonacci series for given number. (iv) Write a program to produce the following output: <pre> 1 2 3 4 5 6 7 8 9 10 </pre>	III	02
11	Array: Develop a Program to: (i) Sort list of 10 numbers. (ii) Perform addition of 3x3 matrix.	IV	02
12	Structure: Develop a Program to: (i) Create a structure called library to hold details of a book viz. accession number, title of the book, author name, price of the book, and flag indicating whether book is issued or not. Fetch some sample data and display the same. (ii) Develop and execute C Program to Add Two Distances given in kilometer-meter Using Structures	IV	02
13	Library Functions: Develop Program to demonstrate: (i) Use of all String handling functions. (ii) Use of few Mathematical functions. (iii) Use of few other miscellaneous functions.	V	02
14	User Defined Functions: Develop a Program to: (i) Create a function to find GCD of given number. Call this function in a program.	V	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	(ii) Find Factorial of given number using recursion.		
15	Pointers: Develop a Program to Print values of variables and their addresses.	VI	02
16	Develop a Program to Find sum of all elements stored in given array using pointers.	VI	02
Total			32

Note

- i. A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. All the above listed practical need to be performed compulsorily, so that the student reaches the 'Applying Level' of Blooms's 'Cognitive Domain Taxonomy' as generally required by the industry.
- ii. The 'Process' and 'Product' related skills associated with each PrO are to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
a.	Correctness of algorithm	40
b.	Debugging ability	20
c.	Quality of input and output displayed (messaging and formatting)	10
d.	Answer to sample questions	20
e.	Submit report in time	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Exp. S. No.
1	Computer system (Any computer system with basic configuration)	All
2	'C' Compiler	

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics is to be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency:

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Program Logic Development	1a. Write Pseudo program logic for the given problem. 1b. Identify the given symbols of a flow chart. 1c. Explain guidelines for preparing flowchart with example. 1d. Create flowchart to logically solve the given problem.	1.1 Fundamentals of algorithms: Notion of an algorithm, Pseudo-code conventions like assignment statements and basic control structures. 1.2 Algorithmic problems: Develop fundamental algorithms to solve simple problems such as: (i) solve simple arithmetic expression (ii) find the greatest of three numbers (iii) determine whether a given number is even or odd (iv) determine whether a given number is prime. 1.3 Flowchart: Flowchart, Symbols of flowchart, Guidelines for preparing Flowchart
Unit– II Basics of C program ming	2a. Identify the given building block of a C program. 2b. Write simple 'C' program using the given arithmetic expressions 2c. Write a simple 'C' Program demonstrating the given data type conversion 2d. Write I/O Statements for the given data.	2.1 Introduction to C: History of 'C' General Structure of a 'C' program: Header files, 'main' function. 2.2 Data Concepts: Character set, tokens, keywords, Identifiers, Variables, Constant, data types, C operators, Arithmetic operators, Arithmetic expression, declaring variables, and data type conversion. 2.3 Basic Input output: Input and Output statements, using printf() and scanf(), character input/output statements, Input/output formatting, Use of comments
Unit– III Control Structures	3a. Write a 'C' program using decision making structure for two-way branching to solve the given problem. 3b. Write a 'C' program using	3.1 Decision making and branching: Relational and logical operators, if statement, if else statement, nested if-else, if-else ladder' The switch statement

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	decision making structure for multi-way branching to solve the given problem. 3c. Write a 'C' program using loop statements to solve the given iterative problem. 3d. Use related statements to alter the program flow in the given loop.	3.2 Looping: While loop, Do... While loop For loop, Go to statement, Use of break and continue statements
Unit-IV Array and Structure	4a. Write statements to read, write the given array. 4b. Manipulate the given array of characters and numbers. 4c. Use the structure for solving the given problem. 4d. Write a sample program to demonstrate use of the given enumerated data type.	4.1 Characteristics of an array, One dimension and two dimension arrays 4.2 Array declaration and Initialization 4.3 Array of characters, Operation on array 4.4 Character and String input/output 4.5 Introduction and Features of Structures, Declaration and Initialization of Structures 4.6 Type def, Enumerated Data Type, using structures in C Program
Unit –V Functions	5a. Use the given Library function. 5b. Develop relevant user defined functions for the given problem. 5c. Write 'C' codes to pass the given function parameters using "call by value" and "call by reference" approach. 5d. Write recursive function for the given problem.	5.1 Concept and need of functions 5.2 Library functions: Math functions, String handling functions, other miscellaneous functions. 5.3 Writing User defined functions, scope of variables, 5.4 Parameter passing: call by value, call by reference. 5.5 Recursive functions
Unit-VI Pointers	6a. Use pointers to access memory locations using pointer to solve the given problem. 6b. Use pointers for performing the given arithmetic operation. 6c. Develop a program to access elements of the given array using pointers. 6d. Develop a program to access elements of the given structure using pointers.	6.1 Concepts of pointers: declaring, initializing, accessing. 6.2 Pointer arithmetic. 6.3 Handling arrays using pointers 6.4 Handling functions using pointers 6.5 Handling structures using pointers

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'



9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Program Logic Development	04	02	02	04	08
II	Basics of C programming	06	02	04	04	10
III	Control Structures	10	02	02	08	12
IV	Arrays and Structures	12	02	02	10	14
V	Functions	10	02	04	08	14
VI	Pointers	06	02	02	08	12
Total		48	12	16	42	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

- Prepare journal of practicals.
- Undertake micro-projects.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample *strategies*, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About 15-20% of the topics/sub-topics which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
- Guide student(s) in undertaking micro-projects.
- Demonstrate students thoroughly before they start doing the practice.
- Encourage students to refer different websites to have deeper understanding of the subject.
- Observe continuously and monitor the performance of students in Lab.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will

have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than 16 (sixteen) student engagement hours during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

- Prepare sample mark sheet for 10 students.
 - Generate salary slips of employees in an organization.
 - Develop book issue system of library.
 - Any other micro-projects suggested by subject faculty on similar line.
- (Use structure and other features of 'C' to develop above listed applications)

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Programming in ANSI C	Balgurusamy, E.	McGraw Hill Education, New Delhi 2012, ISBN: 978-1259004612
2	The C Programming Language	Brian, W. Kernighan, Ritchie Dennis	PHI Learning Private Limited, New Delhi 1990, ISBN: 978-8120305960
3	Let us C	Kanetkar, Yashawant	BP3 Publications, New Delhi 2016, ISBN:978-8183331630

14. SOFTWARE/LEARNING WEBSITES

- <http://nptel.ac.in/courses/106105085/4>
- www.w3schools.com
- www.programiz.com/c-programming
- <https://www.codecademy.com/courses/getting-started-v2/0/1>
- <http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-087-practical-programming-in-c-january-iap-2010/>
- <http://spoken-tutorial.org/>



Program Name: All Branches of Diploma in Engineering and Technology.

Program Code: CE/CR/CS/CH/PS/CM/CO/IF/CW/DE/EJ/EN/EQ/ET/EX/IE/MU/EE/

EP/EU/IS/IC/AE /FG/ME/PG/PT/DC/TX/TC

Semester : Second

Course Title : Business Communication Using Computers

Course Code : 22009

1. RATIONALE

Communication is the key factor for smooth and efficient functioning of any industry or business activity. Effective business communication is the lifeblood of any organization and is required to maintain quality and progress. The efficacy of business communication skills are essential for engineering professionals for instructing, guiding and motivating subordinates to achieve desired goals at work place. It is very crucial for an entrepreneur to run organization successfully by communicating effectively and skillfully with employees, customers and investors. Thus this course has been designed to enhance the skills to 'Communicate effectively and skillfully at workplace.'

2. COMPETENCY

The aim of this course is to help the students to attain the following industry identified competency through various teaching learning experiences

- Communicate effectively and skillfully at workplace.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above-mentioned competency:

- Communicate effectively by avoiding barriers in various formal and informal situations.
- Communicate skillfully using non-verbal methods of communication.
- Give presentations by using audio- visual aids.
- Write reports using correct guidelines.
- Compose e-mail and formal business letters.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme																
L	T	P		Theory						Practical										
				Paper Hrs.	ESE		PA		Total	ESE		Max	Min	PA		Max	Min	Total	Max	Min
					Max	Min	Max	Min		Max	Min			Max	Min					
--	--	2	2	--	--	--	--	--	--	35@^	14	15~	06	50	20					

(~^): For only practical courses, the PA (15 marks) has two components under practical marks i.e. the assessment of practical has a weightage of 60% (i.e.09 marks) and micro-project assessment has a weightage of 40% (i.e.06 marks). This is designed to facilitate attainment of COs holistically, as there is no theory ESE.



Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

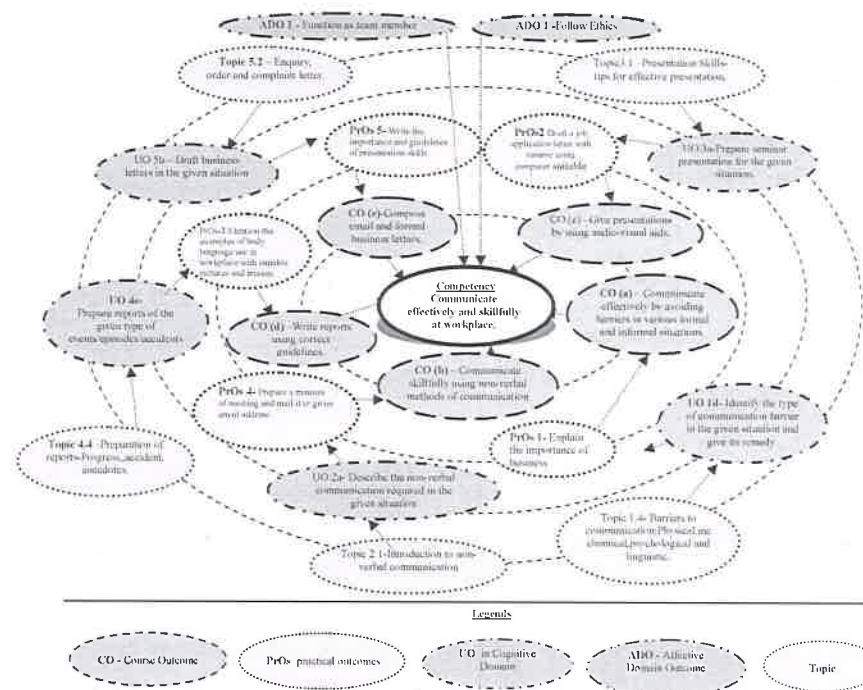


Figure 1 - Course Map

6. SUGGESTED PRACTICALS ACTIVITIES / EXERCISES (Integrate the theory in the laboratory when conducting practical)

The practical in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Explain the importance of business communication for an organization using case study	I	2*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
2	Draft a job application letter with resume using computer.	V	2*
3	Mention the examples of body language use at workplace with suitable pictures and images.	II	2*
4	Prepare a minutes of meeting and mail it to given email address	VI	2
5	Write the importance and guidelines of presentation skills.	III	2*
6	Draft a detailed Progress Report.	IV	2*
7	Organize a debate on types of communication.	I & III	2
8	Summarize an industry report using techniques of summarizing.	IV	2
9	Draft a complaint letter on given topic.	V	2
10	Design PowerPoint presentation on any technical topic.	III	2*
11	Explain the eight principles of effective communication.	I	2*
12	Explain various non-verbal codes with examples.	II	2
13	Explain the importance of personal appearance stating tips of grooming for a professional.	II	2*
14	Draft a memo on given topic.	V	2
15	Present any Two barriers to communication using case study.	I	2*
16	Present a technical paper using IEEE format	III	2*
			32

Note

i. A suggestive list of practical LOs is given in the above table, more such practical LOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical LOs/tutorials need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry. The size of batch for the practical should not exceed more than 21 students strictly for the maximum attainment of COs and PrOs.

ii. Hence, the 'Process' and 'Product' related skills associated with each LO of the laboratory/workshop/field work are to be assessed according to a suggested sample given below:

7. MAJOR EQUIPMENTS / INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Exp. S.No.
1	LCD Projector	All
2	Smart Board with networking	All
3	Language lab with internet	All
4	Printer	Wherever Applicable

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs in cognitive domain for achieving the COs to attain the identified competency:

Unit	Unit Outcomes (UOs) (in cognitive domain)		Topics and Sub-topics
	Writing Skills	Speaking Skills	
Unit – I Introduction to Business Communication	1a. Describe the importance of the business communication in the given situation. 1b. Identify the missing element in the given communication process. 1c. Identify the type of communication in the given situation. 1d. Identify the type of communication barrier in the given situation and its remedy.	1e. Use different types of verbal and non-verbal communication for the given situation.	1.1 Introduction to Communication- Elements, Importance, Functions. 1.2 Types (meaning and importance) – Verbal (Oral-Written), Formal, Informal, Vertical, Horizontal and Diagonal communication. 1.3 Principles of effective communication. 1.4 Barriers to communication - Physical, mechanical, psychological and linguistic. 1.5 Business communication: Meaning, characteristics and importance.
Unit– II Non-Verbal Communication	2a. Describe the non-verbal communication required in the given situation. 2b. Describe personal appearance required in the given communication situation. 2c. Describe the given facial expressions.	2d. Use relevant facial expressions in the given situation. 2e. Answer questions after listening to presentations.	2.1 Introduction to Non-Verbal communication (Meaning and importance) 2.2 Body Language: Aspects of body language: gestures, eye contact, posture, facial expressions, personal appearance (dressing and grooming) vocalics. 2.3 Body language - positive and negative body language.
Unit– III Presentation skills	3a. Prepare seminar presentation for the given situation. 3b. Prepare debate points 'for' and 'against' the given topic. 3c. Prepare the points for computer presentation	3d. Make seminar presentation 3e. Participate in debate speaking 'for' or 'against' the given topic. 3f. Make effective	3.1 Presentation skills- tips for effective presentation. 3.2 Guidelines for developing power point presentation. 3.3 Presenting Technical papers.

Unit	Unit Outcomes (UOs) (in cognitive domain)		Topics and Sub-topics
	Writing Skills	Speaking Skills	
	for the given topic.	computer presentations	
Unit- IV Office Drafting	4a. Draft the given notice using the relevant format. 4b. Draft the given memorandum using the relevant format. 4c. Prepare agenda for the given type of meetings. 4d. Prepare minutes of the given type of meetings. 4e. Prepare reports of the given type of events/episodes/accidents	4f. Read the agenda of the given meeting. 4g. Read the report of the given event. 4h. Initiate telephone calls for given situation. 4i. Answer official phone calls for given situation.	4.1. Office drafting: Formats and Guidelines. 4.2. Formulating notices and memoranda. 4.3. Preparation of agenda and writing minutes of meetings. 4.4. Preparation of reports-progress reports, Accident reports, case study. 4.5. Summarizing techniques.
Unit-V Business Correspondence	5a. Respond to given job advertisements by writing your CV/ Resume. 5b. Draft business letters in the given situations. 5c. Draft complaint letters for the given situations. 5d. Compose E- mails with relevant for the given situation.		5.1 Business correspondence. 5.2 Enquiry, order and complaint letters. 5.3 E-mails- netiquettes. 5.4 Difference –Curriculum Vitae, Bio-data and Resume. 5.5 Job application and resume writing

Note: To attain the COs and competency, above listed Learning Outcomes (UOs) need to be undertaken to achieve the 'Application Level' of Blooms's 'Cognitive Domain Taxonomy' Theory related topic should be covered during practical hours using multimedia.

9. SUGGESTED SPECIFICATION TABLE FOR INTERNAL END SEMESTER EXAMINATION

Unit No.	Unit Title	Distribution of practical Marks			
		R Level	U Level	A Level	Total Marks
I	Introduction to Business Communication	02	02	01	05
II	Non-verbal Communication	02	01	02	05
III	Presentation Skills	02	01	02	05
IV	Office Drafting	02	04	04	10
V	Business Correspondence	02	04	04	10
Total		10	12	13	35

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of PrOs and UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED GUIDELINES FOR ASSESSMENT TOOL TO CONDUCT INTERNAL END SEMESTER EXAM (ESE).

Weightage (20 Marks)	Weightage (15 Marks)	Total
A	B	
Assessment based on PrOs, practicals conducted during semester Based on computer and written skill. (Minimum four questions each five marks) Sample questions: Eg. I Draft an email to The manager regarding the shortage of raw material at production department. Note-submit the printout of mail. (Computer based) Eg. II Write job application with resume. (written)	Oral examination based on UOs Topics mentioned in syllabus. (Minimum five questions each two marks to be asked) Eg. I Explain the importance of communication in professional life. II. State any four guidelines of presentation skills.	(35 Marks) A+B Duration: 2 hours

SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

- Collect good articles from newspapers and magazines and read them with correct intonation.
- Listen to Business news on TV and radio.
- Watch videos of effective presentations on television and open learning sources for presentation skills and body language.
- Undertake micro-projects.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.



- b. 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c. About 15-20% of the topics/sub-topics which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
 - a. Arrange various communication activities using functional grammar.
 - b. Show video/animation films to develop listening skills and enhance vocabulary.
 - c. Use real life situations for explanation.
 - d. Prepare and give oral presentations.
 - e. Guide micro-projects in groups as well as individually.

12. SUGGESTED TITLES OF MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of CrAs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than 16 (sixteen) *student engagement* hours during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

- a. Study the personal appearance and grooming of employees visiting sales store, shopping mall in the vicinity.
- b. Comparative study of Bio-data, Resume and Curriculum vitae.
- c. A detailed study of guidelines required for presentation skills.
- d. Summarize technical content using English newspaper, magazines or online resources.
- e. Prepare a booklet on aspects of body language in pictorial form.
- f. A detailed study of the importance, of technical paper of technical paper presentation.
- g. Case study on the importance of Business communication in an organization.
- h. Report on various formal/business activities.
- i. Study of oral presentation of famous business leader.
- j. Detailed study of business etiquettes observed in organization.
- k. Summarize the business article with the help of English newspapers/magazines and other sources.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Effective Communication Skills	M Ashraf Rizvi	Tata McGraw-Hill

S. No.	Title of Book	Author	Publication
2	Communication Skills	Sanjay Kumar and Pushp Lata	Oxford University Press
3	Personality Development and Soft Skills	Barun K. Mitra	Oxford University Press

14. SOFTWARE/LEARNING WEBSITES

- a. <https://www.britishcouncil.in/english/learn-online>
- b. <http://learnenglish.britishcouncil.org/en/content>
- c. <http://www.talkenglish.com/>
- d. [language-labsystem.com](http://www.language-labsystem.com)
- e. www.wordsworthelt.com
- f. www.notesdesk.com
- g. <http://www.tutorialspoint.com>
- h. www.studylecturenotes.com
- i. [totalcommunicator.com](http://www.totalcommunicator.com)
- j. www.speaking-tips.com



Program Name : Computer Engineering Program Group
Program Code : CO/CM/IF/CW
Semester : Second
Course Title : Computer Peripheral and Hardware Maintenance
Course Code : 22013

1. RATIONALE

Maintenance and troubleshooting of computer system and its peripherals is an important skill to upkeep the computer systems and peripherals. Diploma pass out must be able to use and maintain these system peripherals authentically. They must also possess basic skills of assembling desktop computers, interfacing with peripheral devices, installing new devices and carry out preventive and breakdown maintenance and troubleshooting. This course is designed to develop these vital skills in them through lab based activities to solve problems associated with computer hardware.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain computer hardware and peripherals.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Identify different types of computer systems.
- Troubleshoot common motherboard problems.
- Select processors required for relevant systems.
- Partition/format hard disk drives.
- Troubleshoot peripherals and networks.
- Test power supplies.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme				Examination Scheme											
L	T	P	Credit (L+T+P)	Theory						Practical					
				Paper Hrs.	ESE	PA	Total	ESE	PA	Total	ESE	PA	Total	ESE	PA
2	-	2	4	--	--	--	--	50#	20	50~	20	100	40		

(~): For the practical only courses, the PA has two components under practical marks i.e. the assessment of practicals (seen in section 6) has a weightage of 60% (i.e. 30 marks) and micro-project assessment (seen in section 12) has a weightage of 40% (i.e. 20 marks). This is designed to facilitate attainment of COs holistically, as there is no theory ESE.

Legends: L-Lecture; T-Tutorial/Teacher Guided Theory Practice; P-Practical; C-Credit. ESE-End Semester Examination; PA-Progressive Assessment.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

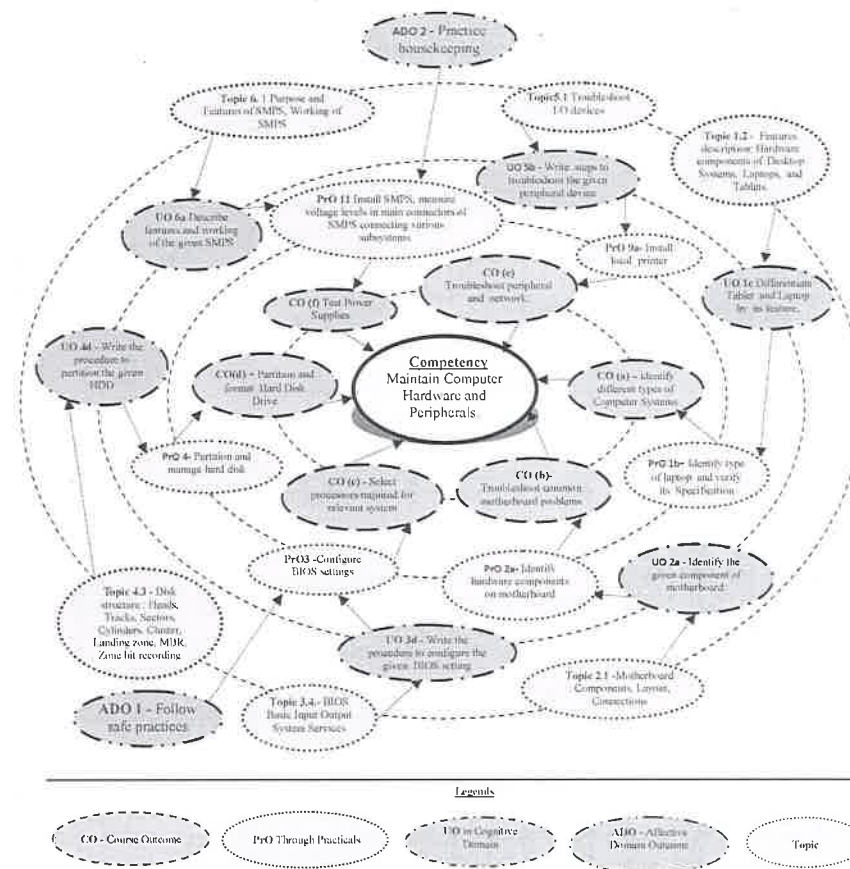


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
a.	Identify desktop and server by its type and verify its	I	2*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	specifications		
	b. Identify type of laptop and verify its Specification		
2	a. Identify hardware components on motherboard	II	2*
	b. Troubleshoot common problems of motherboard		
3	Configure BIOS settings	III	2*
4	Partition and manage hard disk: format hard drives with different file systems. (Part-I)	IV	2*
5	Partition and manage hard disk: format hard drives with different file systems. (Part-II)	IV	2
6	Install Operating System – Windows family (such as Windows 7/ Windows 10, Windows server 12)	IV	2
7	Install Operating System –Unix family (such as Linux/Ubuntu/Centos)	IV	2
8	Troubleshoot Hard disk problems.	IV	2
9	a. Install local printer (Software configuration settings on printer and troubleshooting)	V	2*
	b. Share Printer in Network(Software configuration settings on printer and troubleshooting)		
10	Set keyboard, mouse, monitor, Speaker, Microphone and LCD Projector	V	2
11	Install SMPS, measure voltage levels in main connectors of SMPS connecting various subsystems.	VI	2*
12	Assemble and Disassemble Desktop System (Part-I)	VI	2
13	Assemble and Disassemble Desktop System (Part-I)	VI	2
14	Troubleshoot computer system by diagnosing the problem	VI	2
15	Use diagnostic software for fault finding and viruses	VI	2
16	Undertake Preventive Maintenance of PC using vacuum cleaner and simple tools.	VI	2
Total			32

Note

- i. A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. All the above listed practical need to be performed compulsorily, so that the student reaches the 'Applying Level' of Bloom's 'Cognitive Domain Taxonomy' as generally required by the industry.
- ii. The 'Process' and 'Product' related skills associated with each PrO are to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
a.	Use of Appropriate tool to solve the problem	10
b.	Operate equipment skillfully	30
c.	Follow Safety measures	10
d.	Completed the exercise in stipulated time	30
e.	Answer to sample questions	10
f.	Submit report in time	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Follow ethical practices.

- The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year.
- 'Organising Level' in 2nd year.
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Exp. S.No.
1	Computer system with all necessary components like; motherboard, random access memory (RAM), read-only memory (ROM), Graphics cards, sound cards, internal hard disk drives, DVD drive, network interface card	All
2	LCD/DLP Projector	Student Activity
3	Mouse :Mechanical, Optical, Opto-Mechanical	8
4	Laptop	All
5	Bluetooth based wireless mouse and keyboard or any other device	8
6	Dot Matrix Printer, Laser Printer, Inkjet Printer	7
7	Computer Maintenance kit	All
8	Logic probe, logic pulser, current tracer	11
9	Digital voltmeter	9
10	Operating systems	5,6,7,8,11,12
11	Power Supply	All
12	Diagnostics Software	12
13	Vacuum Cleaner/Blower	13

Note: There are no specifications fixed for the above listed equipments. devices and instruments. Depending on the availability in the institute they can be utilized for the purpose.

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics are to be taught and assessed in order to develop UCs for achieving the COs to attain the identified competency:



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Features of Computer Hardware	1a. Explain characteristics of the given type of computer systems. 1b. Describe features of the given desktop systems. 1c. Describe features of the given Tablet systems. 1d. Describe features of the given server systems.	1.1 Computers: Desktop Computers, Tablet, Laptop, Mainframe, Supercomputer. 1.2 Features description: Hardware components of Desktop Systems, Laptops, and Tablets. 1.3 Types of Servers, Server Feature descriptions and its applications.
Unit– II Motherboard	2a. Identify the given component of motherboard. 2b. Describe features of the given motherboard. 2c. Differentiate hardware based and software based problems of motherboard. 2d. Describe the procedure to identify the given type of motherboard problems.	2.1 Motherboard : Components, Layout, Connections 2.2 Motherboards : Types and Features 2.3 Enhancing features of motherboard: Adding and or replacing components. 2.4 Troubleshooting problems of a motherboard.
Unit– III Processor and BIOS	3a. Describe architecture of given type of Multi-core processors. 3b. Explain the purpose of the given type of co-processors. 3c. Explain the level and purpose of cache memory. 3d. Write the procedure to configure the given BIOS setting.	3.1 Processor : Common Features, Types of Processors, Basic Structure of CPU, Different levels of cache, system bus, clock speed, packaging 3.2 Multiple Core Processors: Description, Two core processor architecture and multi-core processor architecture 3.3 Co-processors: Graphics, Math. 3.4 BIOS: Basic Input Output System Services, Bios Interaction, date and time, Boot device priority, boot setting configuration, password security.
Unit– IV Hard Disk	4a. Describe features of the given type of hard disk interface. 4b. Describe features of the given type of disk structure. 4c. Explain characteristics of the given disk performance parameter. 4d. Write the procedure to partition the given HDD. 4e. Describe the given type of file system.	4.1 Hard Disk Drive 4.2 Hard Disk Interfaces: EIDE, Serial ATA, SCSI, USB and IEEE 1394 (Firewire), RAID, Solid State Drive (laptop) 4.3 Disk structure : Heads, Tracks, Sectors, Cylinders, Cluster, Landing zone, MBR, Zone bit recording 4.4 Disk performance parameters Characteristics: Seeks and Latency, Data Transfer Rate 4.5 File system: FAT16, FAT32, NTFS, Unix file system, EXT2/EXT3, RAID

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit– V I/O and Modem	5a. Describe features of the given I/O device. 5b. Write steps to troubleshoot the given peripheral device 5c. Explain use of the given I/O cable. 5d. Explain features of given type of Interface. 5e. Describe the procedure to troubleshoot the given network problem.	5.1 Troubleshoot I/O devices: Keyboard, Switches, Mouse, Scanners, Webcam, Monitors, Printers, Speaker and Mike, LCD Projector 5.2 I/O Cables: Specification of I/O Cables, Types of I/O cables, Types of I/O Ports, Internal and External modem, Block diagram and specifications. 5.3 Network Interface: Definition of network interface, Types of network interface, troubleshooting of network connectivity, Antivirus
Unit–VI Power Supply	6a. Describe features and working of the given SMPS 6b. Describe features and working of the given UPS. 6c. Differentiate the salient features of the specified type of UPS. 6d. Describe the steps to troubleshoot the given tpe of SMPS.	6.1 Purpose and Features of SMPS, Working of SMPS 6.2 Fault finding in power supply 6.3 Uninterrupted Power Supply: Characteristics of UPS, Types of UPS, online and offline 6.4 Preventive Maintenance of Power Supply

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN -Not Applicable --

10. SUGGESTED STUDENT ACTIVITIES

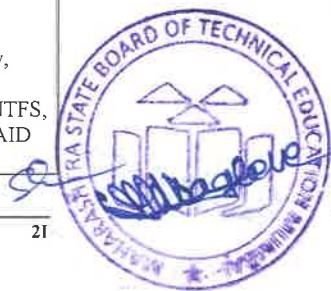
Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

- Prepare specification chart of different types/family of processors (Ex. Intel/AMD)
- Prepare journal of practical.
- Prepare a presentation to display Layout of different motherboards and different System components and present it in groups.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
- '*L*' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About *15-20% of the topics/sub-topics* which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the



- development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
 - Guide student(s) in undertaking micro-projects.
 - Demonstrate students thoroughly before they start doing the practice
 - Show video/animation films to explain handling/functioning of different instruments.
 - Continuously observe and monitor the performance of students in Lab/Workshop

12. SUGGESTED MICRO-PROJECTS

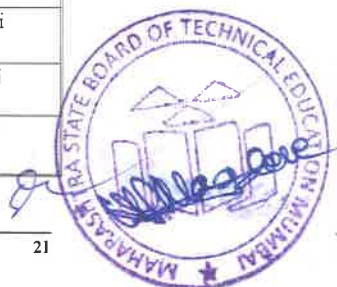
Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours during the course**.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

- SMPS:** List down the components available in SMPS. Measure different output voltages from SMPS.
- Computer motherboard:** Prepare brief report by identifying different electronics components in a given motherboard. Classify them in passive and active components.
- Microprocessor:** Prepare a small report of different microprocessors being used in industry (Any four) by doing market survey.
- Computer Specifications:** Prepare a small report on major specification of different types of computer systems available in your lab.
- Peripheral Specifications:** Prepare a small report based on technological differences and installation procedure of printers and scanners.
- Network Layout:** Prepare a small report by doing survey of computer labs. List various networking devices/components with its application.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	The computer hardware installation, interfacing, troubleshooting and maintenance	James, K.L.	PHI Learning, New Delhi, 2014 ISBN: 978-81-203-4798-4
2.	Comdex: Hardware and Networking Course Kit	Gupta, Vikas	Dreamtech Press, New Delhi ISBN: 978-93-5119-265-7
3.	The Complete PC Upgrade And maintenance Guide	Minasi, Mark	BPB Publication, New Delhi ISBN: 978-81-265-0627-9
4.	Computer Architecture and Maintenance Vol I	Kadam, Sachin	Shroff Publication, Mumbai ISBN: 978-9350230244



14. SOFTWARE/LEARNING WEBSITES

- <http://www.howstuffworks.com/>
- <http://www.gcflearnfree.org/computerbasics/keeping-your-computer-clean/1/>
- <https://www.youtube.com/watch?v=4iaxOUYalJU>
- <http://www.instructables.com/id/Computer-Assembly/>

Program Name : Computer Engineering Program Group
Program Code : CO/CM/IF/CW
Semester : Second
Course Title : Web Page Designing With HTML
Course Code : 22014

1. RATIONALE

Website design is a broad term that encompasses a wide variety of tasks, all involved in the formation of web pages. There are essentially two types of web design approaches, which are dynamic and static design. Static web design is typically based on basic HTML code. It is essential for diploma student to learn HTML since the task of static website design is performed by using HTML coding. Even in dynamic websites, the task of presentation of content is handled through HTML coding. This course introduce web page design using HTML5 and also give emphasis on learning Cascading Style Sheets (CSS) which is a style sheet language used for describing the presentation of a document written in a markup language for formatting and styling of content. This learning enables students to design static web sites and host it on Internet/Intranet.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Develop static interactive web-sites.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Use block level formatting tags to present content on web page.
- Use text level formatting tags to present content on web page.
- Apply hyper linking on web page.
- Organize the content using table and frames.
- Apply presentation schemes on content using CSS.
- Publish websites on Internet or Intranet.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
2	-	2	4	--	--	--	--	--	--	50@	20	50~	20	100	40	

(~): For the **practical only courses**, the PA has two components under practical marks i.e. the assessment of practicals (seen in section 6) has a weightage of 60% (i.e. 30 marks) and micro project assessment (seen in section 12) has a weightage of 40% (i.e. 20 marks). This is designed to facilitate attainment of COs holistically, as there is no theory ESE.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

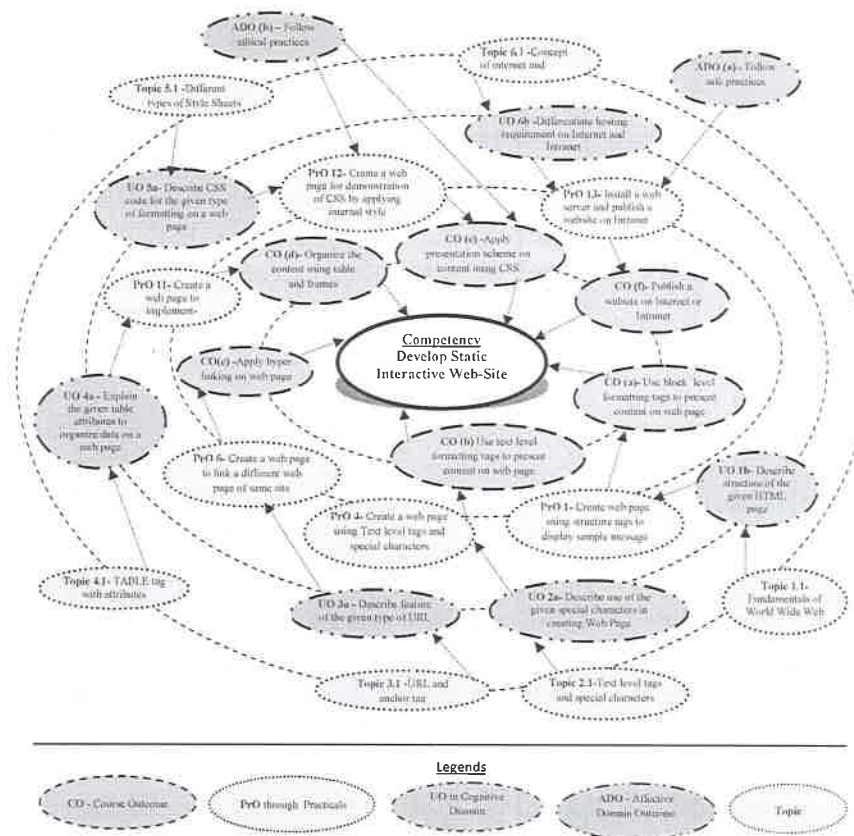


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs.
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			Required
1	Create web page using structure tags to display sample message.	I	02
2	Create a web page for displaying a paragraph using block level tags, HR tags (Part-I).	I	02*
3	Create a web page for displaying a paragraph using block level tags, HR tags (Part-II).	I	02
4	Create a Web Page using Text level tags and Special Characters.	II	02
5	Create a web page for implementing different types of Lists.	II	02*
6	Create a web page to link- a) A different web page of same site. b) A different location on the same web page. c) A specific location on different web page of same site.	III	02
7	i) Create a web page to link- a) An external page of different web site. b) To an email ID. ii) Write tags to change colors of links.	III	02*
8	Insert images on web page using various attributes.	III	02
9	Implement image as a button and set image as background.	III	02
10	Create a web page to implement Frame tags.	IV	02*
11	Create a web page to implement Table tags	IV	02
12	Create a web page for demonstration of CSS by applying Internal style.	V	02*
13	Create a web page for demonstration of CSS by applying External style.	V	02
14	Create a web page for demonstration of CSS by applying Inline style.	V	02
15	Install a web server and publish a website on Intranet.	VI	02
16	Publish a website on Internet by acquiring space on free hosting site.	VI	02*
Total			32

Note

- i. A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Applying Level' of Blooms's 'Cognitive Domain Taxonomy' as generally required by the industry.
- ii. The 'Process' and 'Product' related skills associated with each PrO are to be assessed according to a suggested sample given below.

S. No.	Performance Indicators	Weightage in %
a.	Debugging ability	20
b.	Quality of output achieved (Product)	40
c.	Complete the practical in stipulated time	10
d.	Answer to sample questions	20
e.	Submit report in time	10
Total		100



The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Exp. S. No.
1	Computer with a text editor and browser	ALL
2	Scanner : A4 size, supporting image quality 200 DPI or higher	7
3	Computer system with Internet connection	12
4	Web server.	12

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics are to be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency:

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Basics of HTML	1a. Differentiate characteristics of the given type of web sites. 1b. Describe structure of the given HTML page. 1c. Explain use of head tag and body tag in the given web page. 1d. Describe the procedure of using the given block level tag on a web page.	1.1 Fundamentals of World Wide Web(www): Information about Web Browsers, Web Servers and types of sites. Static vs. dynamic web sites Web page structure: DOCTYPE, head, body, title and other meta tags with attributes. 1.2 Block Level Tags And Horizontal Rules: Headings, Paragraphs, Breaks, Divisions, Centered Text, Block Quotes, Preformatted text, types of Address, HR tag
Unit– II Text	2a. Describe use of the given special characters in creating	2.1 Text Level Tags And Special Characters: Bold, Italic, Teletype.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Level Tags and List	Web Page, 2b. Use relevant tag to display the given special characters. 2c. Explain use of the given type of list in Web Pages. 2d. Describe the procedure of using the given text level tags in creating a Web Page.	Underline, Strikethrough, Superscript, Subscript, DIV tag, displaying special characters. 2.2 Lists: Ordered Lists, Unordered Lists, Definition Lists, Nested Lists.
Unit- III URL And Images	3a. Describe feature of the given type of URL. 3b. Describe the given image attribute on a web page. 3c. Explain process of using the given colors/images as page background on a Web Page. 3d. Describe the procedure for creating the given type of hyper linking.	3.1 URL And Anchor Tag: URL : Types of URLs, Absolute URLs, Relative URLs, pros and cons of relative and absolute URLs, Anchor Tag: Linking various documents for internal and external links. 3.2 Images, Colors And Backgrounds: Inserting Images, formatting image for sizing, alignment, Border and using other attributes with IMG tag. Inserting image as page background. Creating solid color page background.
Unit-IV Table And Frames	4a. Explain the given table attributes to organize data on a web page. 4b. Use the given table attribute to change default table setting. 4c. Describe the given type of 'frame' with examples. 4d. Describe the procedure to organize display as per given screen layout using frames.	4.1 Table: Table tag with attributes. TABLE, TR, TH, TD tags. Border, cell spacing, cell padding, width, align, bgcolor attributes. 4.2 Frames : Types of Frames with their attributes, Creating frames: FRAMESET tag – rows, cols attributes.
Unit –V Cascading Style sheets	5a. Describe CSS code for the given type of formatting on a web page. 5b. Describe the given style sheet properties. 5c. Explain the given property of CSS. 5d. Describe the procedure to create CSS for applying the given presentation scheme on a web page.	5.1 Cascading Style Sheets: Different types of Style Sheets, Benefits of using CSS. Adding style to the document: Linking to style sheets, Embedding style sheets, Using inline style, Selectors: CLASS rules, ID rules. 5.2 Style sheet properties: Font, text, box, color and background properties; Creating and Using a simple external CSS file; Using the internal and inline CSS; background and color gradients in CSS Setting font and text in style sheet using table layout.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit-VI Website Hosting	6a. Describe the procedure to configure a webserver. 6b. Differentiate hosting requirement on Internet and intranet 6c. Describe the procedure for hosting the given website. 6d. Explain process of uploading the given files on a website.	6.1 Website Hosting: Concept of Internet and Intranet. Publishing website on Intranet. Installing and configuring web server, uploading files on intranet site, access intranet based website; Publishing website site on Internet, hiring Web space, uploading files using FTP, Virtual Hosting, access internet based website

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN - Not Applicable-

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

- Prepare journals based on practical performed in laboratory.
- Browse and Observe features of different types of website.
- Identify different host servers for hosting static website.

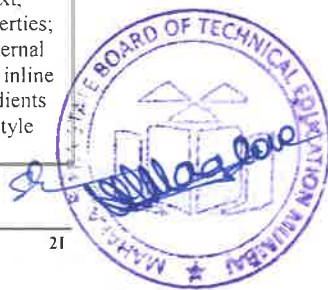
11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About *15-20% of the topics/sub-topics* which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
- Guide student(s) in undertaking micro-projects.
- Demonstrate students thoroughly before they start doing the practice.
- Encourage students to refer different websites to have deeper understanding of the subject.
- Observe continuously and monitor the performance of students in Lab.

The practical exercises as listed in point no. 6 above may be undertaken keeping in mind to develop a sample web site as final output. Some sample topics/domains are suggested below.

12. SUGGESTED MICRO-PROJECTS



Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty: Create sample website with minimum ten web pages Containing text, images, colors & background, frames, tables, and CSS with suitable hyper linking.

- a. Website for Universities or Colleges
- b. Web site for books shops, grocery store, others
- c. Web site for any Vehicle Showroom
- d. Website for Hospital facilities
- e. Web site for Travel and Tourism Agency
- f. Web site related to any Sports. (Ex. Cricket, Tennis,)

Any other suggested topic by subject teacher.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	HTML and XHTML – The complete reference	Powell, Thomas	Tata McGraw Hill, New Delhi, 2014, ISBN: 9780070701946
2.	Learning Web Design	Robbins	O'Reilly, London, 2012 ISBN 10:1-4493-1927-0
3.	Teach Yourself HTML & CSS in 24 Hours	SAMS	Pearson Education Publication, New Delhi, 2015, ISBN: 978-672336140
4.	HTML, XHTML and CSS	Bohem, Anne	Murach's Publication, New York, 2013, ISBN 13: 978-1890774578
5.	HTML 5 Black Book(second edition)	DT Editorial services	Dreamtech Publication, New Delhi, ISBN: 978-9350040959

14. SOFTWARE/LEARNING WEBSITES

- a. <http://www.w3schools.com/html>
- b. <http://www.html.net/>
- c. <http://www.2createawebsite.com>
- d. <http://webdesign.about.com>





Maharashtra State Board Of Technical Education, Mumbai
Teaching And Examination Scheme For Post S.S.C. Diploma Courses

Program Name : Electronics Engineering Group

Program Code : DE / EJ / ET / EX / EN / EQ

With Effect From Academic Year: 2017 - 18

Duration of Program : 6 Semesters

Duration : 16 Weeks

Semester : Second

Scheme - I

S. N.	Course Title	Course Abbre- viation	Course Code	Teaching Scheme			Credit (L+T+P)	Examination Scheme												Grand Total	
				L	T	P		Theory						Practical							
								Exam Duration in Hrs.	ESE		PA		Total		ESE		PA		Total		
									Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks		Min Marks
1	Applied Mathematics	AME	22210	4	2	-	6	3	70	28	30*	00	100	40	--	--	--	--	--	--	100
2	Elements of Electrical Engineering	EEC	22215	4	-	2	6	3	70	28	30*	00	100	40	25#	10	25	10	50	20	150
3	Basic Electronics	BEL	22216	4	-	4	8	3	70	28	30*	00	100	40	50#	20	50	20	100	40	200
4	Electronic Engineering Materials	EEM	22217	3	-	-	3	3	70	28	30*	00	100	40	--	--	--	--	--	--	100
5	C Programming Language	CPR	22218	4	-	4	8	3	70	28	30*	00	100	40	50@	20	50	20	100	40	200
6	Business Communication Using Computers	BCC	22009	-	-	2	2	--	--	--	--	--	--	--	35@^	14	15~	06	50	20	50
Total				19	2	12	33	--	350	--	150	--	500	--	160	--	140	--	300	--	800

Student Contact Hours Per Week: **33 Hrs.**

Medium of Instruction: **English**

Theory and practical periods of 60 minutes each.

Total Marks : 800

Abbreviations: ESE- End Semester Exam, PA- Progressive Assessment, L - Lectures, T - Tutorial, P - Practical

@ Internal Assessment, # External Assessment, *# On Line Examination, ^ Computer Based Assessment

* Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment (5 marks each for Physics and Chemistry) to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain LOs required for the attainment of the COs.

~ For the courses having ONLY Practical Examination, the PA marks Practical Part - with 60% weightage and Micro-Project Part with 40% weightage

➤ **If Candidate not securing minimum marks for passing in the "PA" part of practical of any course of any semester then the candidate shall be declared as "Detained" for that semester.**



Program Name : Electrical Engineering Program Group & Electronics Engineering Program Group
Program Code : DE/EE/EJ/IE/IS/MU/ET/EN/EX
Semester : Second
Course Title : Applied Mathematics
Course Code : 22210

1. RATIONALE

The core technological studies can be understood with the help of potential of applied mathematics. This course is an extension of Basic Mathematics of first semester which is designed for its applications in engineering and technology using the techniques of calculus, differentiation, integration, differential equations and in particular complex numbers and Laplace transform. Derivatives are useful to find slope of the curve, maxima and minima of the function, radius of curvature. Integral calculus helps in finding the area. In analog to digital converter and modulation system integration is important. Differential equation is used in finding the curve and its related applications for various engineering models like LCR circuits. This course further develops the skills and understanding of mathematical concepts which underpin the investigative tools used in engineering.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Solve electrical and electronics engineering related broad-based problems using the principles of applied mathematics.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Calculate the equation of tangent, maxima, minima, radius of curvature by differentiation.
- Solve the given problem(s) of integration using suitable methods.
- Apply the concepts of integration to find the area and volume.
- Solve the differential equation of first order and first degree using suitable methods.
- Use Laplace transform to solve first order first degree differential equations.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
4	2	--	6	3	70	28	30*	00	100	40	--	--	--	--	--	--

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P-Practical; C – Credit, ESE -End Semester Examination; PA - Progressive Assessment

5. COURSE MAP (with sample COs, Unit Outcomes i.e. UOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

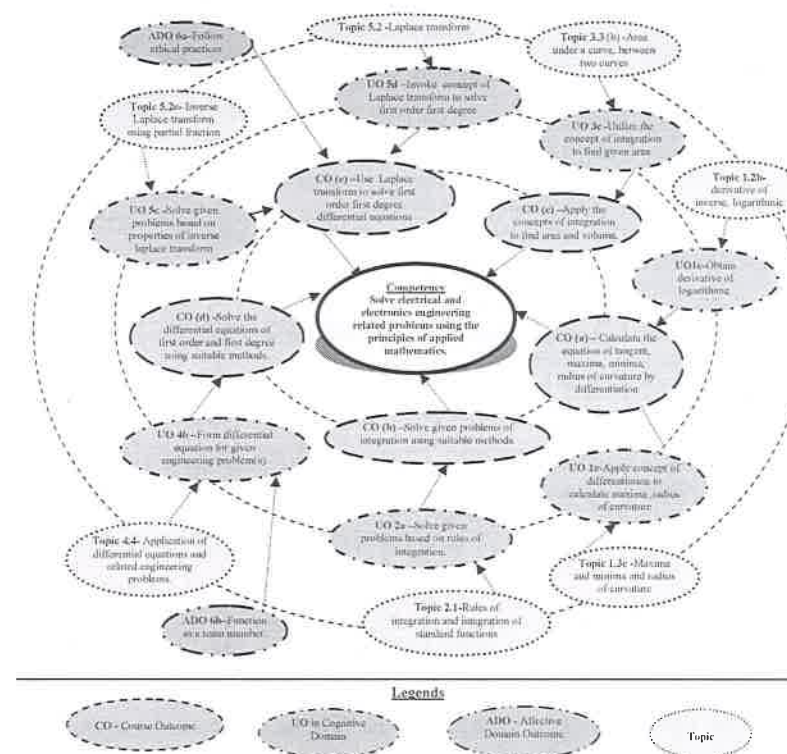


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The tutorials in this section are sub-components of the COs to be developed and assessed in the student to lead to the attainment of the competency.



S. No.	Tutorials	Unit No.	Approx. Hrs. Required
1	Solve problems based on finding value of the function at different points.	I	2
2	Solve problems to find derivatives of implicit function and parametric function	I	2
3	Solve problems to find derivative of logarithmic and exponential functions.	I	2
4	Solve problems based on finding equation of tangent and normal.	I	2
5	Solve problems based on finding maxima, minima of function and radius of curvature at a given point.	I	2
6	Solve the problems based on standard formulae of integration.	II	2
7	Solve problems based on methods of integration, substitution, partial fractions.	II	2
8	Solve problems based on integration by parts.	II	2
9	Solve practice problems based on properties of definite integration.	III	2
10	Solve practice problems based on finding area under curve, area between two curves and volume of revolutions.	III	2
11	Solve the problems based on formation, order and degree of differential equations.	IV	2
12	Develop a model using variable separable method to related engineering problem.	IV	2
13	Develop a model using the concept of linear differential equation to related engineering problem.	IV	2
14	Solve problems based on algebra of complex numbers.	V	2
15	Find Laplace transform and inverse Laplace transform using related properties.	V	2
16	Make use of concept of Laplace transform to solve first order first degree differential equation.	V	2
			32

Note: The above tutorial sessions are for guideline only. The remaining tutorial hours are for revision and practice.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

- Not applicable -

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics is to be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency:

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Differential Calculus	1a. Solve the given simple problems based on functions. 1b. Solve the given simple problems based on rules of differentiation. 1c. Obtain the derivatives of	1.1 Functions and Limits : a) Concept of function and simple examples b) Concept of limits without examples. 1.2 Derivatives : a) Rules of derivatives such as sum,

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	logarithmic, exponential functions. 1d. Apply the concept of differentiation to find equation of tangent and normal. 1e. Apply the concept of differentiation to calculate maxima and minima and radius of curvature of given problem.	product, quotient of functions. b) Derivative of composite functions (chain Rule), implicit and parametric functions. c) Derivatives of inverse, logarithmic and exponential functions. 1.3 Applications of derivative : a) Second order derivative without examples. b) Equation of tangent and normal c) Maxima and minima d) Radius of curvature
Unit– II Integral Calculus	2a. Solve the given problem(s) based on rules of integration. 2b. Obtain the given simple integral(s) using substitution method. 2c. Integrate given simple functions using the integration by parts. 2d. Evaluate the given simple integral by partial fractions.	2.1 Simple Integration: Rules of integration and integration of standard functions. 2.2 Methods of Integration: a) Integration by substitution. b) Integration by parts c) Integration by partial fractions.
Unit– III Applications of Definite Integration	3a. Solve given simple problems based on properties of definite integration. 3b. Apply the concept of definite integration to find the area under the given curve(s). 3c. Utilize the concept of definite integration to find area between given two curves. 3d. Invoke the concept of definite integration to find the volume of revolution of given surface.	3.1 Definite Integration: a) Simple examples b) Properties of definite integral (without proof) and simple examples. 3.2 Applications of integration : a) Area under the curve. b) Area between two curves c) Volume of revolution.
Unit-IV First Order First Degree Differential Equations	4a. Find the order and degree of given differential equations. 4b. Form simple differential equations for given engineering problem(s). 4c. Solve the given differential equations using the method of variable separable. 4d. Solve the given problems based on linear differential equations.	4.1 Concept of differential equation 4.2 Order, degree and formation of differential equation. 4.3 Solution of differential equation a. Variable separable form. b. Linear differential equation. 4.4 Application of differential equations and related engineering problems.



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit –V Complex Numbers and Laplace transform.	5a. Solve given problems based on algebra of complex numbers. 5b. Solve the given problems based on properties of Laplace transform 5c. Solve the given problems based on properties of inverse Laplace transform. 5d. Invoke the concept of Laplace transform to solve first order first degree differential equations.	5.1 Complex numbers: a. Cartesian, polar and exponential form of a complex number. b. Algebra of complex numbers. 5.2 Laplace transform: a. Laplace transform of standard functions (without proof). b. Properties of Laplace transform such as linearity, first and second shifting properties (without proof). c. Inverse Laplace transform using partial fraction method, linearity and first shifting property. d. Laplace transform of derivatives and solution of first order first degree differential equations.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the ‘Application Level’ and above of Bloom’s ‘Cognitive Domain Taxonomy’.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Differential calculus	20	04	08	12	24
II	Integral calculus	14	02	06	08	16
III	Applications of Definite Integration	10	02	02	04	08
IV	First Order First Degree Differential Equations	08	02	02	04	08
V	Complex numbers and Laplace transform	12	02	05	07	14
Total		64	12	23	35	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom’s Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

- Identify engineering problems based on real world problems and solve with the use of free tutorials available on the internet.
- Use graphical software’s: EXCEL, DPLOT, and GRAPH for related topics.
- Use Mathcad as Mathematical Tools and solve the problems of Calculus.

- Identify problems based on applications of differential equations and solve these problems.
- Prepare models to explain different concepts of applied mathematics.
- Prepare a seminar on any relevant topic based on applications of integration.
- Prepare a seminar on any relevant topic based on applications of Laplace transform to related engineering problems.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
- ‘L’ in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About 15-20% of the topics/sub-topics which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
- Guide student(s) in undertaking micro-projects.
- Apply the mathematical concepts learnt in this course to branch specific problems.
- Use different instructional strategies in classroom teaching.
- Use video programs available on the internet to teach abstract topics.

12. SUGGESTED MICRO-PROJECTS

Only *one micro-project* is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than 16 (*sixteen*) student engagement hours during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

- Prepare models using the concept of tangent and normal to bending of roads in case of sliding of a vehicle.
- Prepare models using the concept of radius of curvature to bending of railway track.
- Prepare charts displaying the area of irregular shapes using the concept of integration.
- Prepare charts displaying volume of irregular shapes using concept of integration.
- Prepare models using the concept of differential equations for mixing problem.
- Prepare models using the concept of differential equations for radio carbon decay.
- Prepare models using the concept of differential equations for population growth.
- Prepare models using the concept of differential equations for thermal cooling.
- Prepare models using the concept of Laplace transform to solve linear differential equations.



- j. Prepare models using the concept of Laplace transform to solve initial value problem of first order and first degree.
- k. Prepare charts displaying various algebraic operations of complex numbers in complex plane.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Higher Engineering Mathematics	Grewal, B.S.	Khanna publications, New Delhi , 2013 ISBN- 8174091955
2	Advanced Engineering Mathematics	Krezig, Ervin	Wiley Publications, New Delhi, 2016 ISBN:978-81-265-5423-2,
3	Advanced Engineering Mathematics	Das, H.K.	S. Chand Publications, New Delhi, 2008, ISBN-9788121903455
4	Engineering Mathematics, Volume 1 (4 th edition)	Sastry, S.S.	PHI Learning, New Delhi, 2009 ISBN-978-81-203-3616-2.
5	Getting Started with MATLAB-7	Pratap, Rudra	Oxford University Press, New Delhi, 2009 ISBN- 0199731241
6	Engineering Mathematics (third edition).	Croft, Anthony.	Pearson Education, New Delhi, 2010 ISBN 978-81-317-2605-1

14. SOFTWARE/LEARNING WEBSITES

- a. www.scilab.org/ - SCI Lab
- b. www.mathworks.com/products/matlab/ - MATLAB
- c. Spreadsheet applications
- d. www.dplot.com/ - DPlot
- e. www.allmathcad.com/ - MathCAD
- f. www.wolfram.com/mathematica/ - Mathematica
- g. <http://fossec.in/>
- h. <https://www.khanacademy.org/math?gclid=CNqHuabCys4CFdOJaAoddHoPig>
- i. www.easycalculation.com
- j. www.math-magic.com



Program Name : Electronics Engineering Program Group and Computer Engineering Program Group
Program Code : DE/EJ/IE/IS/CO/CM/CW/IF/ET/EN/EX
Semester : Second
Course Title : Elements of Electrical Engineering
Course Code : 22215

1. RATIONALE

A technologist is expected to have some basic knowledge of electrical engineering as they have to work in different engineering fields and deal with various types of electrical machines and equipment. Hence, it is necessary to understand magnetic circuits, AC fundamentals, polyphase circuits, different types of electrical machines, their principles and working characteristics. This course deals with the basic fundamentals of electrical engineering and working principles of commonly used AC and DC motors and their characteristics. The basic concepts of electrical engineering in this course will be very useful for understanding of other higher level courses.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Use electrical equipment in industrial applications.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

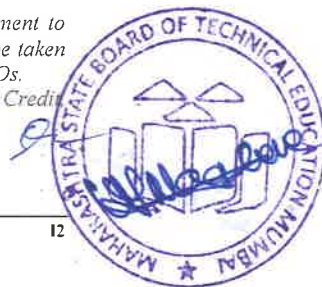
- Use principles of magnetic circuits.
- Use single phase AC supply for electrical and electronics equipment.
- Use three phase AC supply for industrial equipment and machines.
- Connect transformers and DC motors for specific requirements.
- Use FHP motors for diversified applications.
- Use relevant protective devices/switchgear for different requirements.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
4	-	2	6	3	70	28	30*	00	100	40	25#	10	25	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: L - Lecture; T - Tutorial/Teacher Guided Theory Practice; P - Practical; C - Credit
 ESE - End Semester Examination; PA - Progressive Assessment.



5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

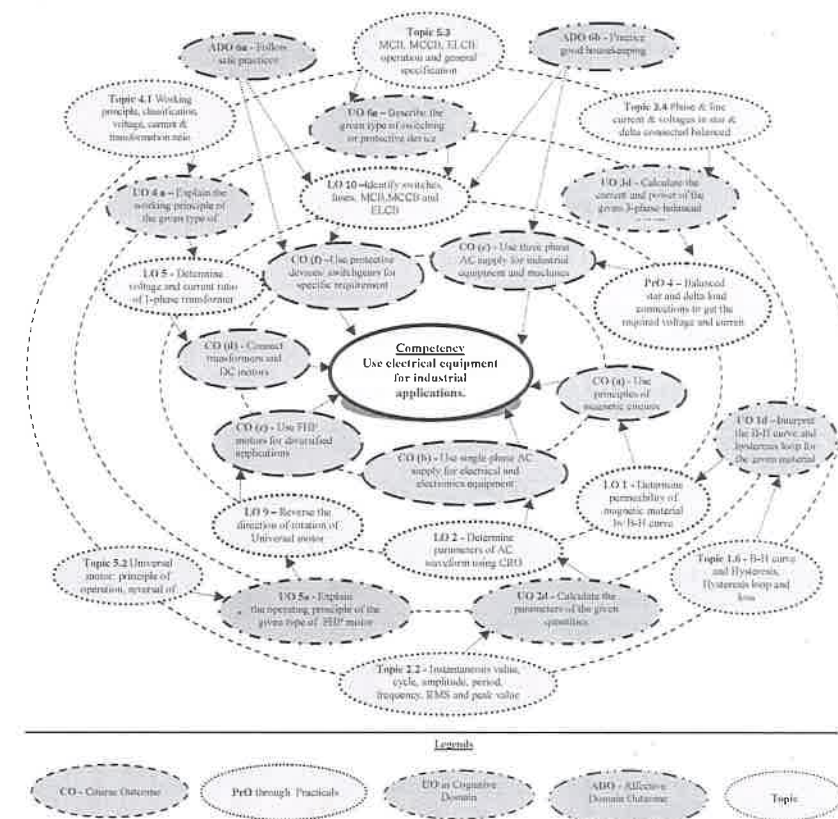


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Determine the permeability of magnetic material by plotting its B-H curve.	1	02*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
2	Determine frequency, time period, peak value, rms value, peak factor and form factor of a sinusoidal A.C. waveform on C.R.O. Part I	II	02*
3	Determine frequency, time period, peak value, rms value, peak factor and form factor of a sinusoidal A.C. waveform on C.R.O. Part II	II	02
4	Find the phase difference between voltage and current on C.R.O. for resistive, inductive and capacitive circuits. Part I	II	02
5	Find the phase difference between voltage and current on C.R.O. for resistive, inductive and capacitive circuits. Part II	II	02
6	Connect balanced star and delta load connections to get the required voltage and currents. Part I	III	02*
7	Connect balanced star and delta load connections to get the required voltage and currents. Part II	III	02
8	Determine voltage and current ratio of single phase transformer.	IV	02*
9	Operate the DC shunt motor using 3-point starter.	IV	02
10	Operate the DC shunt motor using 4-point starter.	IV	02
11	Reverse the direction of rotation of single phase induction motor.	V	02*
12	Reverse the direction of rotation of Universal motor.	V	02
13	Identify switches, fuses, switch fuse and fuse switch units, MCB, MCCB and ELCB.	VI	02
14	Connect the switches, fuses, switch fuse and fuse switch units, MCB, MCCB and ELCB in a circuit. Part I	VI	02
15	Test circuit using series lamp and multimeter.	VI	02*
16	Use the earth tester.	VI	02
17	Use the insulation tester.	VI	02
18	Use different types of digital clamp-on meters	VI	02
	Total		36

Note

- i. A suggestive list of **PrOs** is given in the above table. More such **PrOs** can be added to attain the **COs** and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- ii. The 'Process' and 'Product' related skills associated with each **PrO** is to be assessed according to a suggested sample given below:

S.No.	Performance Indicators	Weightage in %
1	Selection of suitable component, apparatus/instrument	20
2	Preparation of experimental set up	10
3	Setting and operation	10
4	Safety measures	10
5	Observations and Recording	10
6	Interpretation of result and Conclusion	20
7	Answer to sample questions	10

S.No.	Performance Indicators	Weightage in %
8	Submission of report in time	10
	Total	100

The above **PrOs** also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical practices.

The ADOs are not specific to any one **PrO**, but are embedded in many **PrOs**. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year.
- 'Organising Level' in 2nd year.
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Exp. S. No.
1	Single Phase Transformer: 1kVA, single-phase, 230/115 V, air cooled, enclosed type.	1,5
2	Single phase auto transformer (Dimmerstat) - Single-Phase, Air cooled, enclosed model, Input: 0 ~ 230, 10A. Output: 0 ~ 270Volts	1,2,3,5
3	CRO – 20 MHz, Dual channel	2,3
4	Three phase Auto Transformer -15 kVA, Input 415 V, 3 phase, 50 Hz, Output 0-415 V, 30 A per Line, Cooling air natural	4
5	Loading Rheostat - 7.5 kW, 230V, 3 phase, 4 wire, Balanced load. (Each branch having equal load). Load : Wire Wound Fixed Resistors	4
6	Lamp Bank - 230 V 0-20 A	5
7	DC shunt motor coupled with DC shunt Generator	6,7
8	Single phase Induction motor – ½ HP, 230 V, 50 Hz, AC supply	8
9	Universal motor -1/4 Hp	9
10	Digital Multimeter - 3 1/2 digit	Comm on
11	DC and AC Ammeters: 0-5-10 Amp	
12	DC and AC Voltmeters: 0-150-300 V	
13	Tachometer: Non contact type, 0-10000 rpm	
14	Rectifier: solid state, Input- 415 V, 3-Phase, AC, Output – 230 V DC regulated, 20 Amp	

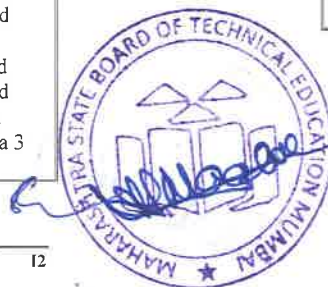
UNDERPINNING THEORY COMPONENTS

The following topics/subtopics is to be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency:

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Magnetic Circuits	1a. Describe the salient features of the given type of circuits. 1b. Apply Fleming's left hand rule and Lenz's law to determine direction of induced EMF in the given circuit. 1c. Explain the given type(s) of induced emf. 1d. Interpret the B-H curve and hysteresis loop for the given material.	1.1 Magnetic flux, flux density, magneto motive force, magnetic field strength, permeability, reluctance 1.2 Electric and magnetic circuits 1.3 Series and parallel magnetic circuits 1.4 Faraday's laws of electromagnetic induction, Fleming's right hand rule, Lenz's law 1.5 Dynamically and statically induced emf, self and mutual inductance 1.6 B-H curve and hysteresis, hysteresis loop and hysteresis loss.
Unit– II AC Fundamentals	2a. Describe the salient features of the given type of power supply. 2b. Represent the given AC quantities by phasors, waveforms and mathematical equations. 2c. Explain the response of the given pure resistive, inductive and capacitive AC circuits with sketches 2d. Calculate the parameters of the given circuit. 2e. Calculate impedance, current, power factor and power of the given AC circuit.	2.1 A.C. and D.C. quantity, advantages of A.C. over D.C. 2.2 Single phase A.C. sinusoidal A.C. wave: instantaneous value, cycle, amplitude, time period, frequency, angular frequency, R.M.S. value, Average value for sinusoidal waveform, Form factor, Peak factor 2.3 Vector representation of sinusoidal A.C. quantity, Phase angle, phase difference, concept of lagging and leading – by waveforms, mathematical equations and phasors 2.4 Pure resistance, inductance and capacitance in A.C. circuit 2.5 R-L and R-C series circuits 2.6 Impedance and impedance triangle 2.7 Power factor and its significance 2.8 Power – active, reactive and apparent, power triangle
Unit– III Polyphase AC Circuits	3a. Describe the salient features of the given type of AC power supply. 3b. Explain the concept of symmetrical system and phase sequence of the given AC supply. 3c. Distinguish the characteristics of the given type(s) of star (or delta) connections with	3.1 3 phase system over 1 phase system 3.2 3-phase emf generation and its wave form 3.3 Phase sequence and balanced and unbalanced load 3.4 Phase and line current, phase and line voltage in star connected and delta connected balanced system 3.5 Current, power, power factor in a 3 phase balanced system

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	3d. Calculate the current and power of the given three phase balanced system.	3.6 Star and delta connections
Unit-IV Transform er and DC Motors	4a. Explain the working principle of the given type of transformer. 4b. Distinguish the construction of the given type of transformer. 4c. Describe the construction and working of the given type of DC motor. 4d. Select relevant type of DC motor for the given application with justification.	4.1 Transformer: Working principle, emf equation, Voltage ratio, current ratio and transformation ratio, losses 4.2 Auto-transformer – comparison with two winding transformer, applications 4.3 DC motor construction - parts its function and material used 4.4 DC motor -Principle of operation 4.5 Types of D.C. motors, schematic diagram, applications of dc shunt, series and compound motors
Unit –V Fractional Horse Power (FHP) Motors	5a. Explain the working principle of the given type of FHP motor. 5b. Select relevant FHP motor for the given application with justification. 5c. Describe the procedure to connect the given type of FHP motor for the given application with sketches. 5d. Describe the procedure to connect stepper motor for the given application with sketches.	5.1 FHP: Schematic representation, principle of operation and applications of: split phase Induction motor, capacitor start induction run, capacitor start capacitor run and permanent capacitor motors, shaded pole motors 5.2 Universal motor: principle of operation, reversal of rotation and applications 5.3 Stepper motor: types, principle of working and applications
Unit-VI Protective Devices and Switchgear	6a. Describe the features of the given type of protective device. 6b. Select the relevant protective device for the given application with justification 6c. Select suitable switchgear for the given situation with justification. 6d. State the I.E. rule related to be applied for the given type of earthing with justification.	6.1 Fuse: Operation, types 6.2 Switch Fuse Unit and Fuse Switch Unit: Differences 6.3 MCB, MCCB and ELCB: Operation and general specifications 6.4 Earthing: Importance of earthing, factors affecting earthing 6.5 Methods of reducing earth resistance. I.E rules relevant to earthing

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.



9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Magnetic Circuits	10	02	04	04	10
II	AC fundamentals	10	02	04	04	10
III	Polyphase AC circuits	08	02	04	04	10
IV	Transformer and DC motors	14	04	04	06	14
V	Fractional Horse Power (FHP) motors	12	04	04	06	14
VI	Protective Devices and Switchgear	10	02	04	06	12
Total		64	16	24	30	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

- Market survey regarding commonly used electrical equipment which are not covered in the curriculum.
- Prepare power point presentation or animation for showing working of DC or AC motors.
- Undertake a market survey of different domestic electrical appliances based on the following points:
 - Manufacturers
 - Specifications/ratings
 - Salient features
 - Applications

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (MOOCs) may be used to teach various topics/sub topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About 15-20% of the topics/sub-topics which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
- Guide student(s) in undertaking micro-projects.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

- Magnetic circuits:** Each batch will collect B-H curves and hysteresis loops for various types magnetic and non magnetic materials from internet. Based on the permeability and shapes of the curves, each student will decide the suitability of each material for different applications.
- Magnetic circuits:** Each batch will prepare a coil without core. Students will note the deflection of galvanometer connected across the coil for: movement of the North Pole of permanent magnet towards and away from the coil (slow and fast movement), movement of the South Pole of permanent magnet towards and away from the coil (slow and fast movement). Students will demonstrate and prepare a report based on their observations.
- AC fundamentals:** Each batch will visit a nearby sub-station or industry and observe the arrangement for power factor correction/improvement. Each batch will prepare a report based on their observation.
- Polyphase circuits:** Each batch will observe the three phase power distribution panel in their own Institute/Commercial complex/mall etc. and draw single line diagram and prepare a report.
- Transformer:** Each batch will visit nearby pole mounted sub-station and prepare a report based on the following points:
 - Rating: kVA rating, primary and secondary voltage, connections
 - Different parts and their functions
 - Earthing arrangement
 - Protective devices
- Fractional horse power motor:** Each batch will select a FHP motor for a particular application (assume suitable rating). They will visit local electrical market (if the market is not nearby you may use the Internet) and prepare a report based on the following points:
 - Manufactures
 - Technical specifications
 - Features offered by different manufacturers
 - Price range
 Then select the motor which you would like to purchase. Give justification for your selection in short.
- Each batch will visit Institute workshop and prepare a report which includes the following points:
 - Different types of prime movers used, their specifications and manufacturers
 - Method of starting and speed control



- iii. Different protective and safety devices used
- iv. Maintenance
- h. Each batch will select any one electrical device/equipment which is not included in the curriculum and prepare a short power point presentation for the class based on the following points: construction, working, salient features, cost, merits, demerits, applications, manufacturers etc.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Electrical Technology Vol – I	Theraja, B. L.	S. Chand and Co., New Delhi, ISBN: 9788121924405
2	Electrical Technology Vol – II	Theraja, B. L.	S. Chand and Co., New Delhi, ISBN: 9788121924375
3	Basic Electrical Engineering	Mittle and Mittal	McGraw Hill, New Delhi, ISBN: 978-0-07-0088572-5
4	Fundamentals of Electrical Engineering	Saxena, S. B. Lal	Cambridge University Press, New Delhi, ISBN : 9781107464353
5	Basic Electrical and Electronics Engineering	Jegathesan, V.	Wiley India, New Delhi, ISBN : 97881236529513

14. SOFTWARE/LEARNING WEBSITES

- a. Scilab
- b. SIMULINK (MATLAB)
- c. PSIM
- d. P-SPIICE (student version)
- e. Electronics Workbench
- f. www.nptel.iitm.ac.in
- g. www.onlinelibrary.wiley.com
- h. xiendianqi.en.made-in-china.com/
- i. ewh.ieee.org/soc/es/
- j. www.electrical-technologies.com/
- k. www.howstuffworks.com



Program Name : Diploma in Electronics Program Group
Program Code : DE/EE/EJ/IE/IS/MU/ET/EN/EX
Semester : Second
Course Title : Basic Electronics
Course Code : 22216

1. RATIONALE

Diploma engineers have to deal with the various electronic components while maintaining various electronics equipment. The study of basic operating principles and handling of various electronics devices will help them to troubleshoot electronics equipment. This course is developed in such a way that, students will be able to apply the knowledge to solve broad electronic engineering application problems.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain electronic circuits comprising of discrete electronic components.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Use relevant diode in different electronics circuits.
- Maintain rectifiers comprising of diodes.
- Use BJT in electronics circuits.
- Use FET in electronics circuits.
- Maintain DC regulated power supply.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
			Max		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
4	-	4	8	3	70	28	30*	00	100	40	50#	20	50	20	100	40

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

Legends: L- Lecture; T- Tutorial/Teacher Guided Theory Practice; P- Practical; C- Credit, ESE - End Semester Examination; PA - Progressive Assessment

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

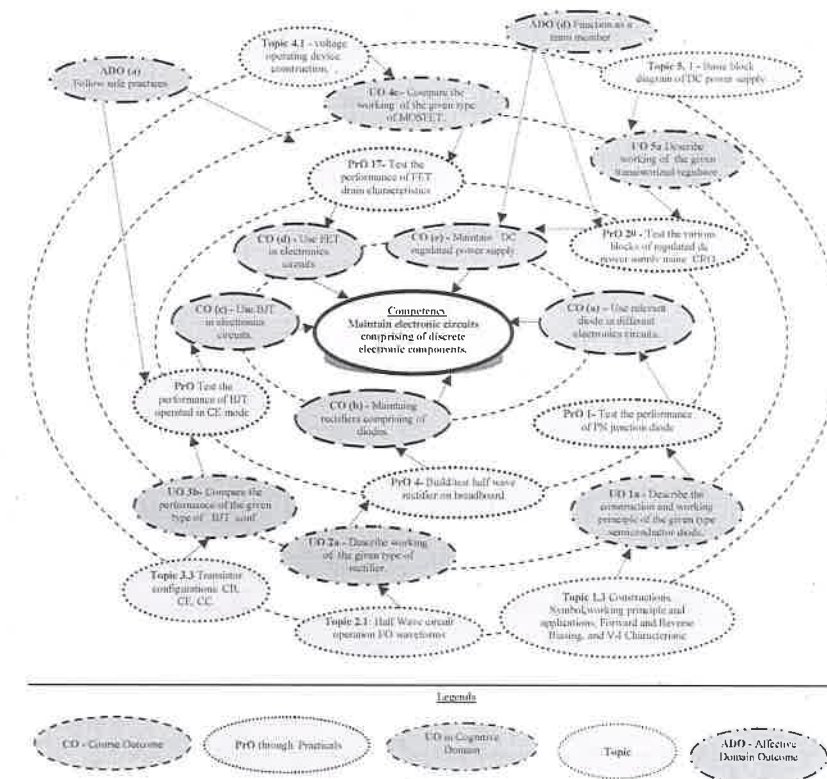


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes(PrOs)	Unit No.	Approx. Hrs. Required
1	Test the performance of PN junction diode.	1	2*
2	Test the performance of zener diode.	1	2
3	Test the performance of photo diode by varying the light intensity as well as distance of the light source.	1	2



S. No.	Practical Outcomes(PrOs)	Unit No.	Approx. Hrs. Required
4	Build/test half wave rectifier on breadboard	II	2
5	Build/test half wave rectifier on breadboard with filter- Part I	II	2*
6	Build/test half wave rectifier on breadboard with filter- Part II	II	2
7	Build/ test full wave rectifier on breadboard using two diodes.	II	2*
8	Build/ test full wave rectifier on breadboard using two diodes.	II	2
9	Build/ test full wave bridge rectifier on breadboard	II	2
10	Use LC filter with fullwave rectifier to measure ripple factor.	II	2
11	Use π filter with bridge rectifier to measure ripple factor.	II	2
12	Assemble positive clipper circuit on breadboard and test the performances.	II	2
13	Assemble Negative clipper circuit on breadboard and and test the performances.	II	2
14	Build the combinational Clipper on breadboard and test the performance. - Part I	II	2*
15	Build the combinational Clipper on breadboard and test the performance. - Part II	II	2
16	Build positive clamper on breadboard and test the performance. - Part I	II	2
17	Build positive clamper on breadboard and test the performance. - Part II	II	2
18	Build Negative clamper on breadboard test the performance.	II	2
19	Identify the terminals of the PNP and NPN transistor using different methods. - Part I	III	2*
20	Identify the terminals of the PNP and NPN transistor using different methods. - Part II	III	2
21	Find specifications of a given transistor using data sheets.	III	2
22	Test the performance of BJT working in CE mode.	III	2
23	Test the performance of BJT working in CB mode.	III	2
24	Test the assembled BJT voltage divider bias circuit for given input. - Part I	III	2
25	Test the assembled BJT voltage divider bias circuit for given input. - Part II	III	2
26	Test the performance of FET drain characteristics, transfer characteristics and calculate trans-conductance. - Part I	IV	2*
27	Test the performance of FET drain characteristics, transfer characteristics and calculate trans-conductance. - Part II	IV	2
28	Build / test zener voltage regulator for the given voltage.	V	2
29	Test the performance of transistorized series voltage regulator for the given load regulation.	V	2
30	Test the performance of transistorized shunt voltage regulator for the given load regulation	V	2
31	Test the various blocks of regulated dc power supply.	V	2
32	Find out faults at different stages of regulated dc power supply.	V	2
33	Trouble shoot given DC regulated power supply. - Part I	V	2*
34	Trouble shoot given DC regulated power supply. - Part II	V	2
Total			68

Note

- i. A suggestive list of **PrOs** is given in the above table. More such **PrOs** can be added to attain the **COs** and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- ii. The 'Process' and 'Product' related skills associated with each **PrO** is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and Recording	10
5	Interpretation of result and Conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
Total		100

The above **PrOs** also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical practices.

The ADOs are not specific to any one **PrO**, but are embedded in many **PrOs**. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year.
- 'Organising Level' in 2nd year.
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Exp. S. No.
1	Variable DC power supply 0- 30V, 2A, SC protection, display for voltage and current.	1,2,3,9,10, 12,13,15, 16,17,18, 19,20 21
2	Cathode Ray Oscilloscope Dual Trace 20Mhz, 1Mega Ω Input Impedance	4,5,6,7,8,9,10,11,12, 13,14, 22
3	Function Generator 0-2 MHz with Sine, square and triangular output with variable frequency and amplitude.	4,5,6,7,8,9,10,11,12, 13
4	Digital Multimeter : 3 1/2 digit display, 9999 counts digital	All

S. No.	Equipment Name with Broad Specifications	Exp. S. No.
	multimeter measures: V_{ac} , V_{dc} (1000V max), A_{dc} , A_{ac} (10 amp max), Resistance (0 - 100 M Ω), Capacitance and Temperature measurement	
5	Lux meter 3000 Lumen, Battery operated hand held type	3
6	Electronic Work Bench : Bread Board 840 -1000 contact points: Positive and Negative power rails on opposite side of the board , 0-30 V, 2 Amp Variable DC power supply, Function Generator 0-2MHz, CRO: 0-30 MHz, Digital Multimeter	All

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics is to be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency:

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Semiconductor Diode	1a. Describe the construction and working principle of the given type semiconductor diode. 1b. Differentiate between the given type of insulator, conductor and semiconductor based on energy band theory. 1c. Describe working principle, characteristics, and application of the given type of diode. 1d. Describe effect of temperature on the given type of diode.	1.1 Different types of Semiconductor Diodes and their materials 1.2 Energy band theory and effect of temperature 1.3 Construction, Symbol, working principle, applications, Forward and Reverse Biasing and V-I Characteristic of following diodes: PN junction, Zener, LED, Photo diode
Unit– II Applications of diodes	2a. Describe working of the given type of rectifier. 2b. Describe the need and working of the given type of rectifier filter circuit. 2c. Select clipper or clamper for obtaining the given waveform. 2d. Calculate ripple factor, PIV and efficiency of the given type of rectifier.	2.1 Types of Rectifiers: Half Wave, Full Wave Rectifier (bridge and center tapped): circuit operation I/O waveforms for voltage and current 2.2 Parameters of rectifier: Average DC value of current and voltage ripple factor, ripple frequency PIV of diode, TUF, efficiency of rectifier 2.3 Types of Filters: Shunt capacitor, Series inductor, LC and π filter, bleeder resistor 2.4 Clipper and Clamper circuits
Unit– III Bipolar Junction Transistor	3a. Describe the working principle of the given type of transistor. 3b. Compare the performance of the given type of transistor configurations. 3c. Justify the biasing method for the given circuit.	3.1 Current operating device 3.2 Different types of transistors: PNP, NPN 3.3 Transistor configurations: CB, CE, CC, Transistor characteristics (input, output,) in different transistor configurations

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	3d. Describe the procedure to minimize the thermal runaway effect for the given type of transistor biasing circuit.	3.4 BJT biasing: DC load line, operating point, stabilization, thermal runaway, types of biasing, fixed biasing, base bias with emitter feedback, voltage divider
Unit– IV Field Effect Transistor	4a. Explain the working of FET for the given application. 4b. Explain the given type of FET biasing method. 4c. Compare the working of the given type of MOSFET. 4d. Differentiate the working principle of FET and MOSFET on the basis of the given transfer characteristic curve.	4.1 Voltage operating device Construction of JFET (N-channel and P- channel), symbol, working principle and characteristics (Drain and Transfer characteristics) 4.2 FET Biasing: Source self bias, drain to source bias 4.3 Applications of FET 4.4 MOSFET: Construction, working principle and characteristics of Enhancement and depletion MOSFET, MOSFET handling
Unit– V Regulators and power supply	5a. Describe working of the given transistorized regulator. 5b. Describe the working of the given block of the DC regulated power supply in the block diagram. 5c. Calculate output voltage of the given zener voltage regulator circuit. 5d. Calculate load and line regulation of the given transistorized regulator.	5.1 Basic block diagram of DC regulated power supply 5.2 Load and Line regulation 5.3 Zener diode voltage regulator 5.4 Transistorized series and shunt regulator - circuit diagram and working

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Semiconductor Diode	12	3	4	7	14
II	Applications of diodes	14	3	6	7	16
III	Bipolar Junction Transistor	16	3	7	8	18
IV	Field Effect Transistor	12	3	4	5	12
V	Regulators and power supply	10	2	3	5	10
Total		64	14	24	32	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

- Prepare journals based on practical performed in laboratory.
- Test different diodes using CRO.
- Give seminar on any relevant topic.
- Library survey regarding different data books and manuals.
- Prepare power point presentation for wave shaping circuits.
- Undertake a market survey of different semiconductor components.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course :

- Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About 15-20% of the topics/sub-topics which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
- Guide student(s) in undertaking micro-projects.
- Use PPTs to explain the construction and working of rectifier.
- Use PPTs to explain the construction and working of wave shaping circuits.
- Guide students for using data manuals.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PROs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than 16 (sixteen) student engagement hours during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

- Diode:** Build a circuit on general purpose PCB to clip a positive half cycle at 1.5 V of a waveform with input signal 5Vpp, and prepare the report.

- Diode:** Build a circuit on general purpose PCB to clamp a waveform at 3.0V using diode and passive components.
- FET:** Prepare chart on comparison of specifications of FETs using data sheets of at least three FET.
- FET:** Prepare a chart on FETs contains its symbol, advantages and applications.
- Rectifier:** Build a half wave rectifier for 6V, 500mA output current on general purpose PCB.
- Rectifier:** Build a full wave bridge rectifier with capacitor filter for 6V, 500mA output current on general purpose PCB.
- BJT:** Build a circuit to switch on and off the LED by using BJT as switching component.
- Photodiode:** Build a circuit on breadboard to turn the relay on and off by using photo diode and prepare a report.
- Voltage Regulator:** Build a circuit of DC regulated power supply on general purpose PCB for 9V and 500mA output.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Electronic Devices and Circuit: An Introduction	Mottershead, Allen	PHI Learning, New Delhi, ISBN : 9788120301245
2	Electronic Devices and Circuit Theory	Boylestead Robert, Louis Neshelsky	Pearson Education, 10 th edition, New Delhi, 2009, ISBN: 978-8131727003
3	The Art of Electronics	Paul Horowitz Winfield Hill	Cambridge University Press, New Delhi 2015 ISBN: 9780521689175
4	Electronics Principles	Malvino, Albert Paul, David	McGraw Hill Education, New Delhi, ISBN: 978-0070634244
5	Principles of Electronics	Mehta, V.K. Mehta, Rohit	S. Chand and Company, Ram Nagar, New Delhi-110 055, 2014, ISBN: 9788121924504
6	Basic Electronic Engineering	Baru V., Kaduskar R., Gaikwad S.T.	Dreamtech Press, New Delhi, 2015 ISBN: 9789350040126
7	Fundamentals of Electronic Devices and Circuits	Bell, David	Oxford University Press, International edition, USA, 2015, ISBN : 9780195425239
8	A text book of Applied Electronics	Sedha, R.S.	S.Chand, New Delhi, 2008, ISBN: 978-8121927833

14. SOFTWARE/LEARNING WEBSITES

- www.nptel.iit.ac.in
- www.datasheetcafe.com
- www.williamson-labs.com
- www.futurlec.com
- www.bis.org.in
- www.learnerstv.com
- www.cadsoft.io
- www.khanacademy.com



Program Name : Diploma in Electronics and Telecommunication Engineering and
Diploma in Digital Electronics

Program Code : EJ/DE/ET/EN/EX

Semester : Second

Course Title : Electronic Engineering Materials

Course Code : 22217

1. RATIONALE

‘Electronic Engineering Materials’ is the basic course for the Electronics and Communication engineering and Digital Electronics engineering student. Material science have undergone radical changes, especially due to requirement of electronic component in variety of application area. This subject will enable the student to know and apply facts, concepts and working principles for the selecting material and components for various electronics engineering applications.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Select electronic engineering materials for specified electronics application.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency.

- Choose relevant metal on basis of conductivity property.
- Interpret the properties of dielectric materials.
- Select relevant magnetic materials for the specified electronics application.
- Select relevant semiconductor device fabrication materials.
- Select material for the relevant applications.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
3	-	-	3	3	70	28	30*	00	100	40	--	--	--	--	--	--

(*): Under the theory PA; Out of 30 marks, 10 marks of theory PA is for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: L-Lecture; T-Tutorial/Teacher Guided Theory Practice; P- Practical; C- Credit, ESE- End Semester Examination; PA- Progressive Assessment.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

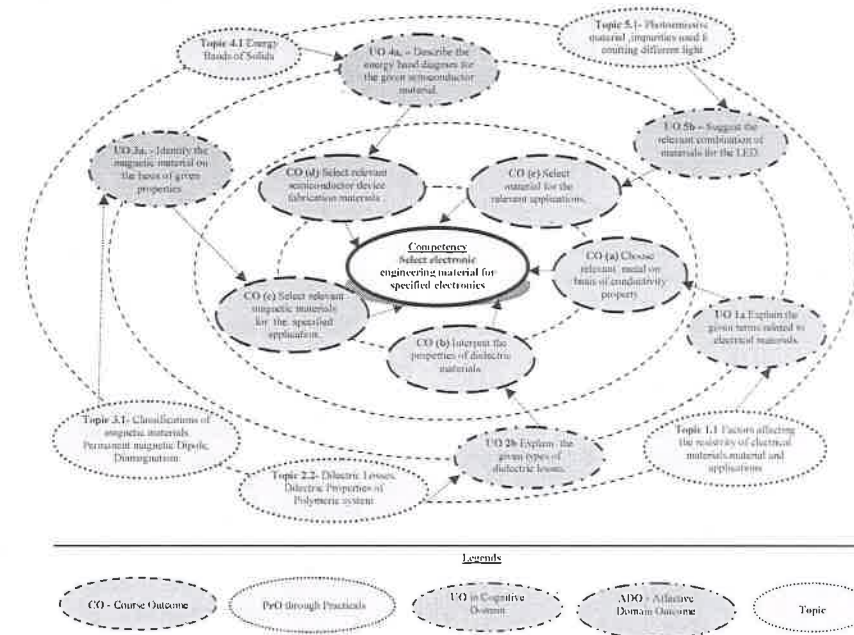


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

- Not applicable –

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

Not applicable –

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics is to be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency:

Unit	Unit Outcomes(UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Conductivity of Materials	1a. Explain the given terms related to electrical materials. 1b. Describe the effect on conductivity of metal on the basis of the given factor (s).	1.1 Terms and factors affecting the resistivity of electrical materials 1.2 Electron mobility, energy level diagram of a materials 1.3 Emission of electrons from metals

Unit	Unit Outcomes(UOs) (in cognitive domain)	Topics and Sub-topics
	1c. Explain the given mode(s) of electron emission from metals. 1d. Explain the effect of change in temperature on the conductivity of the given metal.	modes of emission – thermionic emission, photo electric emission, field emission, secondary emission, concept, material and applications 1.4 Effect of temperature on conductivity of metals, superconductivity, electrical and thermal conductivity of metals 1.5 Thermoelectric effect concept, material and applications
Unit-II Dielectric Materials	2a. Describe the effect on the capacitance on the given dielectric material on the basis of the given factor(s). 2b. Explain the given types of dielectric losses. 2c. Explain the concept of the given phenomenon of dielectric material.. 2d. Select the dielectric material for the given application.	2.1 Effect of dielectric on the behavior of capacitor, frequency dependence of electronic polarisability, frequency dependence of permittivity 2.2 Dielectric losses, dielectric properties of polymeric material 2.3 Insulating materials - breakdown in gaseous, liquid and solid dielectric materials, requirements of good insulating materials 2.4 Dielectric materials –mica, porcelain, polythene, bakelite, polyvinylcarboide (PVC),rubber ,cotton and silk ,glass ,paper and Boards, wood, enamel covering, transformer oil, polymers properties and applications . 2.5 Ferroelectricity and piezoelectricity concept, materials and applications
Unit- III Magnetic Properties of Materials	3a. Identify the magnetic material on the basis of given magnetic properties. 3b. Describe the given Hysteresis loop identifying the material. 3c. Describe the effect on permeability of the material due to the given factor (s). 3d. Explain the concept anti ferromagnetism.	3.1 Classifications of magnetic materials Permanent magnetic dipole, diamagnetism, paramagnetism, ferromagnetism ferromagnetic domain 3.2 Magnetisation curve hysteresis loop magnetosterection effect– application for ultrasonic generation, permeability and affecting factors 3.3 Magnetic material– iron and silicon iron alloy, nickel iron alloy, 3.4 Anti-ferromagnetism and ferrimagnetism
Unit- IV Semi Conductor Materials	4a. Describe the energy band diagram for the given semiconductor material. 4b. Select the material for given type of impurity add in semiconductor. 4c. Explain the given effect of	4.1 Energy bands of solids: conductors, semiconductors,nonconductors 4.2 Types of semiconductors, intrinsic material, impurity type and material for various impurities 4.3 Diffusion, hall effect,thermal and electrical conductivity of semi conductor

Unit	Unit Outcomes(UOs) (in cognitive domain)	Topics and Sub-topics
	semiconductor material and its application. 4d. Select the relevant material for the given semiconductor device fabrication with justification.	materials 4.4 Materials for fabrication of semiconductor devices – passive materials and process materials, substrate, metal, capacitance material, Junction coating, device potting, Packaging
Unit –V Micro- electronic components and special materials	5a. Explain with sketches the working of the given type of LASER. 5b. Suggest the relevant combination of materials for the LED of the given wavelength. 5c. Suggest the relevant material for the given type of antenna. 5d. Identify the relevant micro-device for the given application and the material of which it is made of.	5.1 Photoemissive material, impurities used to emit different colours of light/ wavelength; electroluminescence and junction LASERS 5.2 Material for flexible and wearable antennas 5.3 Photovoltaic material 5.4 Materials used and application micro motors, micro relay and micro switches.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Conductivity of Materials	10	06	06	06	18
II	Dielectric Materials	10	04	06	06	16
III	Magnetic Properties of Materials	10	04	06	06	16
IV	Semi Conductor Materials	10	04	04	04	12
V	Micro electronic components and special materials	08	02	02	04	08
Total		48	20	24	26	70

Legends: R=Remember, U=Understand. A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related extra-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in this course:



- Library /Internet survey of electrical /electronic material
- Prepare power point presentation or animation for understanding different material behavior.
- Access national digital Library for survey .

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- ‘L’ in item No. 4** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Use Flash/Animations to explain various theorems in circuit analysis
- Guide student(s) in undertaking micro-projects

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a group of 3-4 student assigned to them in the beginning of the semester. They ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours during the course**.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

- Prepare the chart of conducting materials
- Prepare the chart of dielectric materials
- Collect different samples of insulating material and prepare chart of their applications
- Collect different samples of conducting material and prepare chart of their applications
- Collect data for bifuel project erection
- Make survey for PV cell as per efficiency and pricing.
- Prepare chart for application of nanomaterial
- Demonstrate effect of various modes of magnetism.

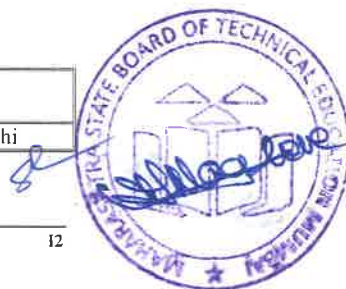
13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	An Introduction to	C S Indulkar and S.	S Chand Publishing New Delhi

S. No.	Title of Book	Author	Publication
	Electrical Materials by	Thiruvengadam S	ISBN 9788121906661
2	A course in Electrical engineering Materials	S.P. Seth and P.V. Gupta	Dhanpat Rai and Sons.
3	Material Science and Engg.	William D. Callister	WILEY India 2/e Edition ISBN 9788126541607

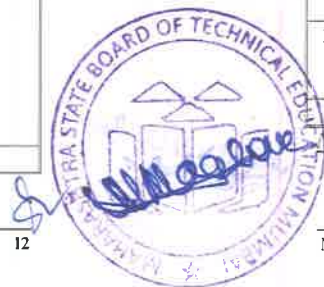
14. SOFTWARE/LEARNING WEBSITES

- https://www.youtube.com/watch?v=ooLJ_bGKmH
- <https://www.youtube.com/watch?v=emCqQdrSo3o>
- http://www.engineeringtoolbox.com/thermal-conductivity-metals-d_858.html





S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
2	Write a program to perform following operations: (a) Display the message "Hello World", name, address, date of birth and email_id using printf () function. (b) Logical operations: & (AND), (OR) for given values, Bitwise operations :<< (LEFT SHIFT), >> (RIGHT OPERATOR) for given values.	I	02
3	(a) Write a program to display current time and date using time.h header file. (b) Write a program to display addition of value of resistor R, Where, i. R series = $R1 + R2 + R3$ and ii. R parallel = $1/R1 + 1/R2 + 1/R3$ <i>Note. Use math.h header file.</i>	I	02*
4	(a) Write a program to calculate inductive resistance (F_L) with the help of given formula $F_L = 2 * \pi * f * L$. Where π , f, L are given data. (b) Write a program to calculate capacitive resistance (F_C) with the help of given formula $F_C = 1/(2 * \pi * f * C)$. Where π , f, C are given data. <i>Note. Develop above programs using local variables, global variables and arithmetic operators.</i>	I	02
5	Implement decision control statements in C using 'if' (a) Write a program to find whether given number is even or odd. (b) Write a program to find whether given number is Positive, negative or zero.	II	02*
6	(a) Write a program to find the largest among n numbers using 'if-else'. (b) Write a program to determine leap year using 'if-else'.	II	02
7	Implement decision control statements in 'C' using 'nested if-else' (a) Determine whether a string is palindrome. (b) Find the greatest of the three numbers using conditional operators.	II	02
8	Write a program to perform addition, subtraction; multiplication and division according to user's choice using switch case statement for given data.	II	02
9	Implement loop control statements in 'C' using 'for' loop (a) Write a program to print the table for given no. in one column. (b) Write a program to count the number of digit in a given number.	II	02
10	Implement loop control statements in 'C' (a) Find Fibonacci series for given number. (b) Write a program to produce the following output: <pre> 1 2 3 4 5 6 7 8 9 10 </pre>	II	02
11	(a) Print the Result sheet: Conditions given are: marks >=40%	II	02



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	pass, marks <40 % fail. marks 60>=first class, marks above 75 % distinction. marks >100 and marks < 0 not valid.		
12	(a) Write a program to declare, modify and print elements of a given data array. (b) Write a program to find highest marks in a class of n students using array.	III	02*
13	(a) Write a program to copy of one array into second array for given data elements. (b) Write a program to create an array by reversing the elements of the given array.	III	02
14	(a) Write a program to sort numbers in ascending and descending in a given array. (b) Write a program to add two matrices of size 3*3 store additions in third matrix for given data elements.	III	02
15	(a) Write a program that accept a string from user and print that string (b) Write a program that accept a string and compare it with existing string.	III	02*
16	(a) Write a program to accept and concatenate two strings. (b) Write a program to find length of a string.	III	02
17	Library Functions: Develop Program to demonstrate: (a). Use of all String handling functions. (b). Use of few Mathematical functions.	IV	02*
18	(a) Write a program to add two numbers using function. (b) Write a program to perform addition, subtraction, multiplication and division using switch case statement and user defined function for given data.	IV	02*
19	(a) Write a program to use address operator (&) and pointer operator (*) for given data (b) Write a program to add two integer numbers using pointer.	V	02*
20	(a) Write a program to calculate the sum of elements of given array using pointer. (b) Write a program to access the array elements using pointer.	V	02
21	(a) Write a program to interchange given values of two variables using call by value mechanism. (b) Write a program to interchange given values of two variables using call by reference mechanism.	V	02*
22	Write a program to exchange given values of two variables using pointer.	V	02
23	Create structure DATE using 'C' having members' day, month, year and assign initial values to that structure.	VI	02
24	Write a program to create a structure for student having data members like Roll No., Name, Class, marks in three subjects and calculate the % of marks.	VI	02
Total			48

i. A suggestive list of **PrOs** is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.

ii. The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S.No.	Performance Indicators	Weightage in %
1	Write algorithm and draw flow chart.	20
2	Use 'C' software tool for programming to create, edit, compile the 'C' programs/applications	40
3	Debug, test and execute the programs/applications	20
4	Able to answer oral questions.	10
5	Submission of report in time.	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Handle command prompt environment.
- Experiment with C / C++ environment.
- Plan, construct, compile, debug and test C programs.
- Demonstrate working as a leader / a team member.
- Maintain tools and equipment.
- Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year.
- 'Organising Level' in 2nd year.
- 'Characterising Level' in 3rd year.

1. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Expt. S. No.
1	Hardware: Personal computer, (i3-i5 preferable), RAM minimum 2 GB onwards.	For all Experiments
2	Operating system: Windows XP/Windows 7/LINUX onwards.	
3	Software: Turbo C, or Microsoft Visual Studio 2005 onwards (Optional).	

2. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics is to be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency:

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Overview of C Program ming	1a. Describe the given data type. 1b. Construct algorithm, flow chart for the given problem. 1c. Use pre-increment and post-increment operators in the given situation. 1d. Use bitwise operators in the given situation.	1.1 Structure of 'C' program, Assembler, Linker, Compiler, Interpreter. 1.2 'C' character set-keywords, identifiers, types of constants (Integer, single character, string, and real) variables, scope of variables, concept of ASCII. 1.3 Data types: integer- unsigned, signed, long, float- float, double, character-char, string, octal, hexadecimal 1.4 Algorithm and flow chart. 1.5 Formatted input and output statements. Input and output function. 1.6 Operators and expressions: a. Operators in 'C'- arithmetic, logical, assignment, relational, increment and decrement, conditional, bit wise, special operators b. Expressions c. Precedence and associativity.
Unit– II Decision control and Loop control	2a. Write a 'C' program using the given decision making structure for two-way branching. 2b. Write a 'C' program using the decision making structure for multi-way branching. 2c. Write a 'C' program using loop statements to solve the given iterative problem. 2d. Use related statements to alter the program flow in the given loop.	2.1 Decision making if statement (if, if-else, nested if-else), switch –case statement. 2.2 Repetition in 'C' (loop control statement) while, do-while and for loop, break and continue statement, nested loops.
Unit– III Array and Strings	3a. Write steps to access elements of the given array. 3b. Write steps to perform operation on the given array. 3c. Write steps to initialization and declaration of the given string in 'C' program. 3d. Apply relevant control statement on the given strings to manipulate its elements.	3.1 Introduction to Array and its types 3.2 Declaration, initialization of array, accessing elements of an array, adding, deleting, sorting & searching. 3.3 Introduction to string Initializing, declaring and display of string 3.4 String handling functions from standard library (strlen (), strcpy (), strcat (), strcmp(), strlen(),strupr()):



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit-IV Functions	4a. Use inbuilt functions for the given problem. 4b. Develop relevant user defined functions for the given problem. 4c. Write 'C' codes to Pass function parameters using the given approach. 4d. Write recursive function for the given problem.	4.1 Concept and need of functions 4.2 Library functions: Math functions, String handling functions, other miscellaneous functions. 4.3 Writing User defined functions, scope of variables. 4.4 Parameter passing: call by value, call by reference. 4.5 Recursive functions
Unit-V Pointers	5a. Use pointer for address access to manipulate the given data. 5b. Use pointers to access memory locations to solve the given problem. 5c. Use pointers for performing the given arithmetic operation. 5d. Develop a program to access array elements using the given pointers.	5.1 Concept of pointer and pointer variables, initialization of pointer, call-by-reference. 5.2 Pointer arithmetic. 5.3 Handling arrays using pointers 5.4 Handling functions using pointers
Unit-VI Structures	6a. Create a structure for the given data. 6b. Develop a program to access elements of structure using pointers. 6c. Use the structure for solving the given problem. 6d. Use of enumerated data type in structure to solve the given program.	6.1 Introduction and Features and Syntax of structure 6.2 Declaration and Initialization of Structures 6.3 Initializing, accessing structure members using pointers 6.4 Type def, Enumerated Data Type, using structures in C Program 6.5 Operations on structure.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Overview of C Programming	08	02	04	04	10
II	Decision control and Loop control	12	04	04	04	12
III	Array and Strings	14	04	06	06	16
IV	Functions	12	02	04	06	12
V	Pointers	10	02	04	04	10
VI	Structures	08	02	04	04	10
Total		64	16	26	28	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

This specification table also provides a general guideline for teachers to frame internal end semester practical theory exam paper which students have to undertake.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

- Prepare journals based on: practical performed in laboratory.
- Give seminar on relevant topic.
- Library/E-Book survey regarding 'C' used in electronics industries.
- Prepare power point presentation or animation for showing different types of 'C' applications.
- Find and Utilize android applications related to 'C'.
- Undertake a market survey of different 'C' application and compare with the following points.
 - Available applications.
 - Application profile.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Guide student(s) in undertaking micro-projects.
- No. of practical's selection to be performed should cover all units.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

- a. **Modern Periodic Table using 'C'** - Each group will prepare a periodic table using functions 'Void add()' and 'Void show()'
- b. **Simple Calculator** - Each batch will prepare a menu driven program to perform any five mathematical operations.
- c. **Employee Record System** - Each batch will prepare a menu driven program to perform following operations :
 - i. Add record
 - ii. List record
- d. **Digital clock using 'C'**
- e. **String Manipulation project** - Each batch will prepare a menu driven program to perform following operations (any five) :
 - i. Substrings
 - ii. Palindromes
 - iii. Comparison
 - iv. Reverse string
 - v. String to integer
 - vi. Sort a string
- f. **Matrix Operations** - Each batch will prepare a menu driven program to perform following operations:
 - i. Matrix addition
 - ii. Matrix multiplication
 - iii. Matrix transpose
 - iv. Sum of diagonal of a matrix.
- g. **Basic mathematic functions** - Each batch will prepare a menu driven program to perform following operations:
 - i. Pascal triangle
 - ii. Armstrong No.
 - iii. Floyd's triangle
 - iv. HCF and LCM.
- h. **Patterns** - Each batch will prepare a menu driven program to obtain following patterns (any three):

```

1      1      *      1
121    12     **     2 2
12321  123    ***    3 3 3
1234321 1234   **     4 4 4 4
          *
```

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Programming in 'C'	Balguruswamy, E.	Tata McGraw Hill May 2012, New Delhi ISBN:978-1-25-900461-2.
2	Let us 'C'	Kanetkar, Yashwant	BPB Publication July 2016, New Delhi. ISBN : 9788183331630,
3	Basic computation and programming with 'C'	Saha, Subrata ; Mukherjee, Subhodip	Cambridge 2016, New Delhi. ISBN: 978-1-316-60185-3

14. SOFTWARE/LEARNING WEBSITES

- a. Turbo C Editor
- b. Dosbox
- c. www.tutorialspoint.com/cprogramming
- d. www.cprogramming.com
- e. [www.sourcecodesworld.com/source/LanguageHome.asp?LangId=1](http://sourcecodesworld.com/source/LanguageHome.asp?LangId=1)
- f. <http://fresh2refresh.com/c-programming/c-basic-program/>
- g. <http://www.c4learn.com/c-programs/>
- h. <http://computer.howstuffworks.com/c2.htm>
- i. <http://www.programiz.com/c-programming/examples>
- j. www.indiastudycenter.com/studyguides/cs/default.asp
- k. Android application resources for 'C' programming from Google Play store.





Program Name: All Branches of Diploma in Engineering and Technology.

Program Code: CE/CR/CS/CH/PS/CM/CO/IF/CW/DE/EJ/EN/EQ/ET/EX/IE/MU/EE/

EP/EU/IS/IC/AE /FG/ME/PG/PT/DC/TX/TC

Semester : Second

Course Title : Business Communication Using Computers

Course Code : 22009

1. RATIONALE

Communication is the key factor for smooth and efficient functioning of any industry or business activity. Effective business communication is the lifeblood of any organization and is required to maintain quality and progress. The efficacy of business communication skills are essential for engineering professionals for instructing, guiding and motivating subordinates to achieve desired goals at work place. It is very crucial for an entrepreneur to run organization successfully by communicating effectively and skillfully with employees, customers and investors. Thus this course has been designed to enhance the skills to 'Communicate effectively and skillfully at workplace.'

2. COMPETENCY

The aim of this course is to help the students to attain the following industry identified competency through various teaching learning experiences

- Communicate effectively and skillfully at workplace.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above-mentioned competency:

- Communicate effectively by avoiding barriers in various formal and informal situations.
- Communicate skillfully using non-verbal methods of communication.
- Give presentations by using audio- visual aids.
- Write reports using correct guidelines.
- Compose e-mail and formal business letters.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme		Examination Scheme											
L	T	P	Credit (L+T+P)	Theory									
				Paper Hrs.	ESE				PA				Total
					Max	Min	Max	Min	Max	Min	Max	Min	
--	--	2	2	--	--	--	--	--	--	--	--	--	35@^
													14
													15~
													06
													50
													20

(~^): For only practical courses, the PA (15 marks) has two components under practical marks i.e. the assessment of practical has a weightage of 60% (i.e.09 marks) and micro-project assessment has a weightage of 40% (i.e.06 marks). This is designed to facilitate attainment of COs holistically, as there is no theory ESE.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit. ESE - End Semester Examination; PA - Progressive Assessment.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

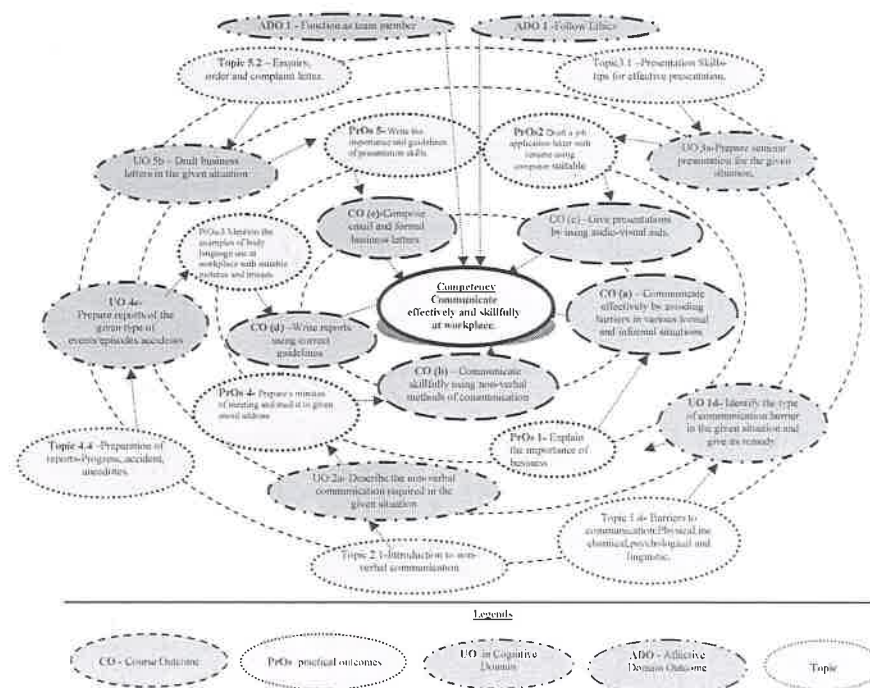
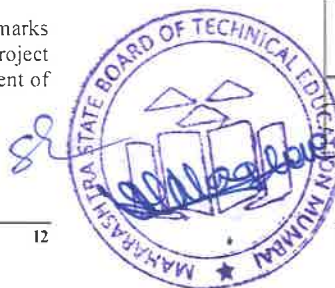


Figure 1 - Course Map

6. SUGGESTED PRACTICALS ACTIVITIES / EXERCISES (Integrate the theory in the laboratory when conducting practical)

The practical in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Explain the importance of business communication for an organization using case study	I	2*



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
2	Draft a job application letter with resume using computer.	V	2*
3	Mention the examples of body language use at workplace with suitable pictures and images.	II	2*
4	Prepare a minutes of meeting and mail it to given email address	VI	2
5	Write the importance and guidelines of presentation skills.	III	2*
6	Draft a detailed Progress Report.	IV	2*
7	Organize a debate on types of communication.	I & III	2
8	Summarize an industry report using techniques of summarizing.	IV	2
9	Draft a complaint letter on given topic.	V	2
10	Design PowerPoint presentation on any technical topic.	III	2*
11	Explain the eight principles of effective communication.	I	2*
12	Explain various non-verbal codes with examples.	II	2
13	Explain the importance of personal appearance stating tips of grooming for a professional.	II	2*
14	Draft a memo on given topic.	V	2
15	Present any Two barriers to communication using case study.	I	2*
16	Present a technical paper using IEEE format.	III	2*
			32

Note

i. A suggestive list of practical LOs is given in the above table, more such practical LOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical LOs/tutorials need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry. The size of batch for the practical should not exceed more than 21 students strictly for the maximum attainment of COs and PrOs.

ii. Hence, the 'Process' and 'Product' related skills associated with each LO of the laboratory/workshop/field work are to be assessed according to a suggested sample given below:

7. MAJOR EQUIPMENTS / INSTRUMENTS REQUIRED

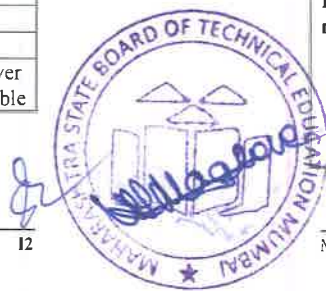
The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Exp. S.No.
1	LCD Projector	All
2	Smart Board with networking	All
3	Language lab with internet	All
4	Printer	Wherever Applicable

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs in cognitive domain for achieving the COs to attain the identified competency:

Unit	Unit Outcomes (UOs) (in cognitive domain)		Topics and Sub-topics
	Writing Skills	Speaking Skills	
Unit – I Introduction to Business Communication	1a. Describe the importance of the business communication in the given situation. 1b. Identify the missing element in the given communication process. 1c. Identify the type of communication in the given situation. 1d. Identify the type of communication barrier in the given situation and its remedy.	1e. Use different types of verbal and non-verbal communication for the given situation.	1.1 Introduction to Communication- Elements, Importance, Functions. 1.2 Types (meaning and importance) – Verbal (Oral-Written), Formal, Informal, Vertical, Horizontal and Diagonal communication. 1.3 Principles of effective communication. 1.4 Barriers to communication - Physical, mechanical, psychological and linguistic. 1.5 Business communication: Meaning, characteristics and importance.
Unit– II Non-Verbal Communication	2a. Describe the non-verbal communication required in the given situation. 2b. Describe personal appearance required in the given communication situation. 2c. Describe the given facial expressions.	2d. Use relevant facial expressions in the given situation. 2e. Answer questions after listening to presentations.	2.1 Introduction to Non-Verbal communication (Meaning and importance) 2.2 Body Language: Aspects of body language: gestures, eye contact, posture, facial expressions, personal appearance (dressing and grooming) vocalics. 2.3 Body language - positive and negative body language.
Unit– III Presentation skills	3a. Prepare seminar presentation for the given situation. 3b. Prepare debate points 'for' and 'against' the given topic. 3c. Prepare the points for computer presentation	3d. Make seminar presentation 3e. Participate in debate speaking 'for' or 'against' the given topic. 3f. Make effective	3.1 Presentation skills- tips for effective presentation. 3.2 Guidelines for developing power point presentation. 3.3 Presenting Technical papers.



Unit	Unit Outcomes (UOs) (in cognitive domain)		Topics and Sub-topics
	Writing Skills	Speaking Skills	
	for the given topic.	computer presentations	
Unit- IV Office Drafting	4a. Draft the given notice using the relevant format.	4f. Read the agenda of the given meeting.	4.1. Office drafting: Formats and Guidelines.
	4b. Draft the given memorandum using the relevant format.	4g. Read the report of the given event.	4.2. Formulating notices and memoranda.
	4c. Prepare agenda for the given type of meetings.	4h. Initiate telephone calls for given situation.	4.3. Preparation of agenda and writing minutes of meetings.
	4d. Prepare minutes of the given type of meetings.	4i. Answer official phone calls for given situation.	4.4. Preparation of reports-progress reports, Accident reports, case study.
	4e. Prepare reports of the given type of events/episodes/ accidents		4.5. Summarizing techniques.
Unit-V Business Correspondence	5a. Respond to given job advertisements by writing your CV/ Resume.		5.1 Business correspondence.
	5b. Draft business letters in the given situations.		5.2 Enquiry, order and complaint letters.
	5c. Draft complaint letters for the given situations.		5.3 E-mails- netiquettes.
	5d. Compose E- mails with relevant for the given situation.		5.4 Difference –Curriculum Vitae, Bio-data and Resume.
			5.5 Job application and resume writing

Note: To attain the COs and competency, above listed Learning Outcomes (UOs) need to be undertaken to achieve the 'Application Level' of Blooms's 'Cognitive Domain Taxonomy' Theory related topic should be covered during practical hours using multimedia.

9. SUGGESTED SPECIFICATION TABLE FOR INTERNAL END SEMESTER EXAMINATION

Unit No.	Unit Title	Distribution of practical Marks			
		R Level	U Level	A Level	Total Marks
I	Introduction to Business Communication	02	02	01	05
II	Non-verbal Communication	02	01	02	05
III	Presentation Skills	02	01	02	05
IV	Office Drafting	02	04	04	10
V	Business Correspondence	02	04	04	10
Total		10	12	13	35

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)
Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of PrOs and UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED GUIDELINES FOR ASSESSMENT TOOL TO CONDUCT INTERNAL END SEMESTER EXAM (ESE) .

Weightage (20 Marks)	Weightage (15 Marks)	Total
A	B	
Assessment based on PrOs, practicals conducted during semester Based on computer and written skill. (Minimum four questions each five marks) Sample questions: Eg. I Draft an email to The manager regarding the shortage of raw material at production department. Note-submit the printout of mail. (Computer based) Eg. II Write job application with resume. (written)	Oral examination based on UOs Topics mentioned in syllabus. (Minimum five questions each two marks to be asked) Eg. I Explain the importance of communication in professional life. II. State any four guidelines of presentation skills.	(35 Marks) A+B Duration: 2 hours

SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

- Collect good articles from newspapers and magazines and read them with correct intonation.
- Listen to Business news on TV and radio.
- Watch videos of effective presentations on television and open learning sources for presentation skills and body language.
- Undertake micro-projects.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.

- b. 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c. About 15-20% of the topics/sub-topics which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
 - a. Arrange various communication activities using functional grammar.
 - b. Show video/animation films to develop listening skills and enhance vocabulary.
 - c. Use real life situations for explanation.
 - d. Prepare and give oral presentations.
 - e. Guide micro-projects in groups as well as individually.

12. SUGGESTED TITLES OF MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of CrAs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than 16 (sixteen) *student engagement* hours during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

- a. Study the personal appearance and grooming of employees visiting sales store, shopping mall in the vicinity.
- b. Comparative study of Bio-data, Resume and Curriculum vitae.
- c. A detailed study of guidelines required for presentation skills.
- d. Summarize technical content using English newspaper, magazines or online resources.
- e. Prepare a booklet on aspects of body language in pictorial form.
- f. A detailed study of the importance, of technical paper presentation.
- g. Case study on the importance of Business communication in an organization.
- h. Report on various formal/business activities.
- i. Study of oral presentation of famous business leader.
- j. Detailed study of business etiquettes observed in organization.
- k. Summarize the business article with the help of English newspapers/magazines and other sources.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Effective Communication Skills	M Ashraf Rizvi	Tata McGraw-Hill

S. No.	Title of Book	Author	Publication
2	Communication Skills	Sanjay Kumar and Pushp Lata	Oxford University Press
3	Personality Development and Soft Skills	Barun K. Mitra	Oxford University Press

14. SOFTWARE/LEARNING WEBSITES

- a. <https://www.britishcouncil.in/english/learn-online>
- b. <http://learnenglish.britishcouncil.org/en/content>
- c. <http://www.talkenglish.com/>
- d. [languagelabsystem.com](http://www.languagelabsystem.com)
- e. www.wordsworthelt.com
- f. www.notesdesk.com
- g. <http://www.tutorialspoint.com>
- h. www.studylecturenotes.com
- i. [totalcommunicator.com](http://www.totalcommunicator.com)
- j. www.speaking-tips.com





Maharashtra State Board of Technical Education, Mumbai
Teaching and Examination Scheme for Post S.S.C. Diploma Courses

Program Name : Civil Engineering Groups

Program Code : CE/CR/ CS

With Effect From Academic Year: 2017 - 18

Duration of Program : 6 Semesters

Duration : 16 Weeks

Semester : Third

Scheme - I

S. N.	Course Title	Course Abbre- viation	Course Code	Teaching Scheme			Credit (L+T+P)	Examination Scheme												Grand Total	
				L	T	P		Theory						Practical							
								Exam Duration in Hrs.	ESE		PA		Total		ESE		PA		Total		
									Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks		Min Marks
1	Advanced Surveying	ASU	22301	3	-	4	7	3	70	28	30*	00	100	40	50#	20	50	20	100	40	200
2	Highway Engineering	HEN	22302	3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150
3	Mechanics of Structures	MOS	22303	3	2	2	7	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150
4	Building Construction	BCO	22304	3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150
5	Concrete Technology	CTE	22305	3	-	2	5	3	70	28	30*	00	100	40	25#	10	25	10	50	20	150
6	Computer Aided Drawing	CAD	22022	-	-	4	4	--	--	--	--	--	--	--	50@	20	50~	20	100	40	100
Total				15	2	16	33	--	350	--	150	--	500	--	200	--	200	--	400	--	900

Student Contact Hours Per Week: **33 Hrs.**

Medium of Instruction: **English**

Theory and practical periods of 60 minutes each.

Total Marks : 900

Abbreviations: ESE- End Semester Exam, PA- Progressive Assessment, L - Lectures, T - Tutorial, P - Practical

@ Internal Assessment, # External Assessment, *# On Line Examination, ^ Computer Based Assessment

* Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain LOs required for the attainment of the COs.

~ For the courses having ONLY Practical Examination, the PA marks Practical Part - with 60% weightage and Micro-Project Part with 40% weightage

➤ **If Candidate not securing minimum marks for passing in the "PA" part of practical of any course of any semester then the candidate shall be declared as "Detained" for that semester.**



Program Name : Civil Engineering Program Group
Program Code : CE/CR/CS
Semester : Third
Course Title : Advanced Surveying
Course Code : 22301

1. RATIONALE

In the era of globalization today, the technology has brought the significant advancements in surveying instruments and technology. Available precise digital surveying instruments are used currently due to their accuracy, speed and easy operation of the same. These equipments and the applications are extensively used in the fields of civil engineering, mining engineering, environmental engineering, transportation engineering and marine engineering. Since, Remote sensing and Geographic Information System (GIS) is a vital discipline and being widely used for plotting and storing spatial information, it is expected the students should know the basics of the same to apply it in field. Through this course students will develop the desired skills and competencies which are expected from them for survey related works.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Prepare plans, contour maps using Advanced Surveying equipment and techniques.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

- Prepare plans using Plane Table Surveys.
- Prepare plans using Theodolite surveys.
- Find distances and elevations using Tacheometer.
- Set out simple circular curves.
- Prepare plans using Total Station instrument.
- Locate coordinates of stations using GPS.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	4	7	3	70	28	30*	00	100	40	50#	20	50	20	100	40

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken



during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment.

1. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

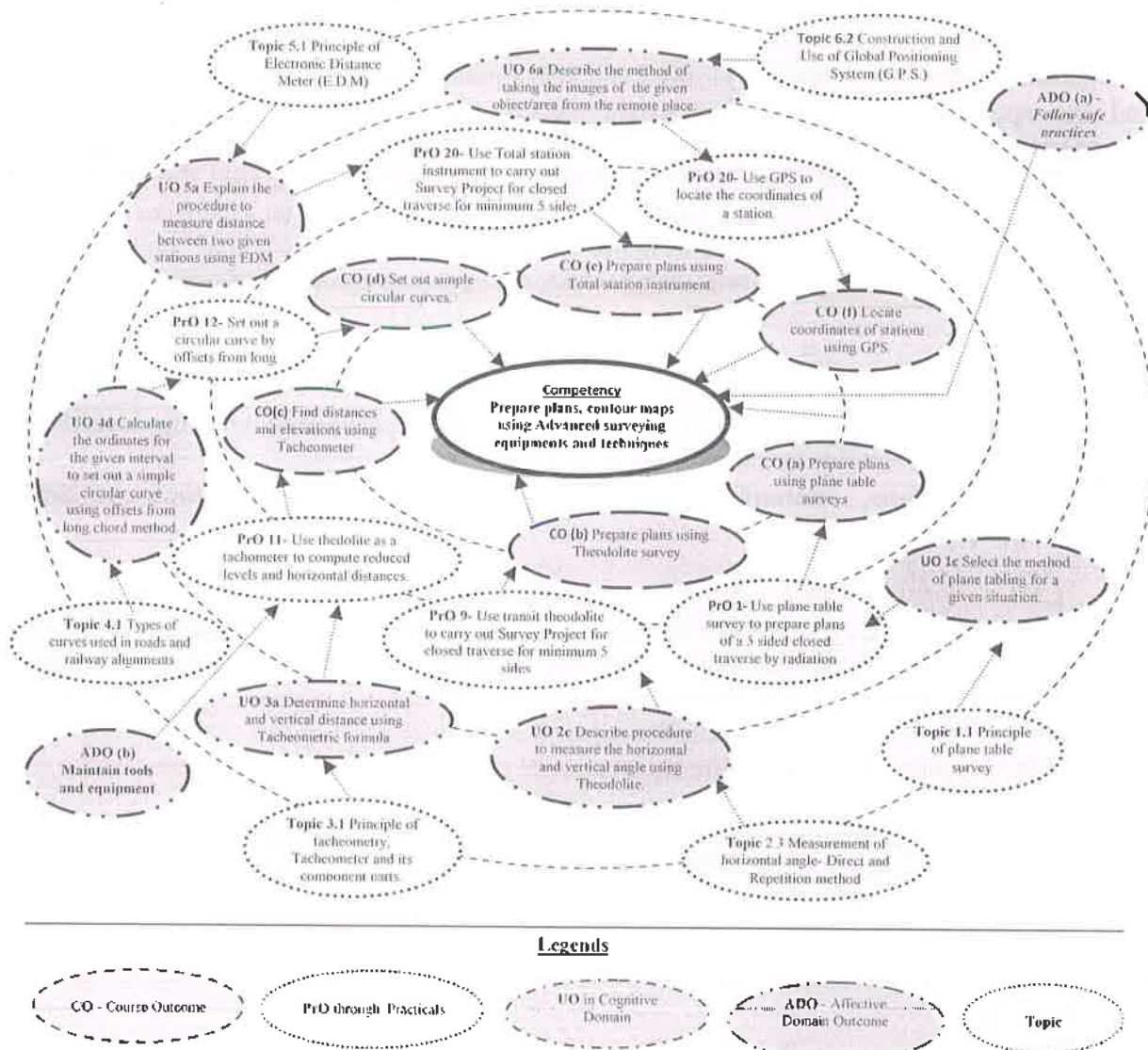


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency:



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Use Plane Table Survey to prepare plans of a 5 sided closed traverse by Radiation Method.	I	02*
2	Use plane table survey to prepare plans of a plot of 7 sided closed traverse by Radiation Method.	I	02
3	Use plane table survey to prepare plans locate details by Intersection Method	I	02*
4	Use plane table survey to prepare plans locate details by Traversing Method	I	02*
5	Use plane table survey to carry out Survey Project for closed traverse for minimum 5 sides around a building.(Compulsory)	I	Full day*
6	Set up the transit Theodolite	II	02
7	Use transit theodolite to measure Horizontal angle correctly by Direct Method.	II	02*
8	Use transit theodolite to measure Vertical angle correctly by Direct Method.	II	02*
9	Use transit theodolite to measure Horizontal angle correctly by method of Repetition.	II	02*
10	Use transit theodolite to measure Vertical angle correctly by method of Repetition	II	02
11	Use transit theodolite to carry out Survey Project for closed traverse for minimum 5 sides(Compulsory).	II	Full day*
12	Plot the traverse on A1 size imperial drawing sheet for the collected data from preceding Theodolite Survey Project.	II	02*
13	Plot the traverse on A1 size imperial drawing sheet for the collected data from preceding Theodolite Survey Project.	II	02*
14	Use theodolite as a Tacheometer to compute reduced levels and horizontal distances.	III	02*
15	Set out a circular curve by offsets from Long Chord Method.	IV	02*
16	Set out a circular curve by Rankine's Method of Deflection Angles.	IV	02
17	Use One Second Micro Optic Theodolite to Measure Horizontal angle by Direct Method	V	02
18	Use One Second Micro Digital Theodolite to Measure Horizontal angle by Direct Method	V	02
19	Use EDM to measure horizontal distance.(Part I)	V	02*
20	Use EDM to measure horizontal distance(Part II)	V	02
21	Set up the Total Station instrument. (Part I)	V	02*
22	Set up the Total Station instrument. (Part II)	V	02
23	Use Total station instrument to measure horizontal distances.	V	02*
24	Use Total station instrument to measure horizontal distances.	V	02
25	Use Total station instrument to measure horizontal distances.	V	02
26	Use Total station instrument to measure horizontal distances.	V	02
27	Use Total station instrument to measure horizontal angle.	V	02*
28	Use Total station instrument to measure horizontal angle.	V	02
29	Use Total station instrument to measure horizontal angle.	V	02
30	Use Total station instrument to measure vertical angle.	V	02*



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
31	Use Total station instrument to measure vertical angle.	V	02
32	Use Total station instrument to carry out Survey Project for closed traverse for minimum 5 sides.(Compulsory)	V	Full day*
33	Plot the traverse on A1 size imperial drawing sheet for the collected data from preceding Total Station Survey Project.	V	02*
34	Plot the traverse on A1 size imperial drawing sheet for the collected data from preceding Total Station Survey Project.		02*
35	Use GPS to locate the coordinates of a station.	V1	02*
	Total		64

Note

- A suggestive list of **PrOs** is given in the above table. More such **PrOs** can be added to attain the **COs** and competency. A judicious mix of minimum 24 or more practical **LOs/tutorials** need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- Hence, the 'Process' and 'Product' related skills associated with each **PrO** of the laboratory/workshop/field work are to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	10
2	Setting and operation	20
3	Safety measures	10
4	Observations and Recording	20
5	Interpretation of result and plotting.	20
6	Answer to sample questions	10
7	Submission of report in time	10
	Total	100

The above **PrOs** also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/ team member.
- Maintain tools and equipment.
- Follow ethical Practices.

The **ADOs** are not specific to any one **PrO**, but are embedded in many **PrOs**. Hence, the acquisition of the **ADOs** takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the **ADOs** according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.



7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. S. No.
1	Plane table with accessories- Plane and telescopic Alidade, Trough compass, U-fork, Spirit level.	1-5
2	Twenty Second Transit theodolite with accessories.	6-11
3	One second Micro optic Theodolite with accessories.	14,16,17
4	Electronic Digital Theodolite with accessories.	18
5	Electronic Distance meter (+or- 2mm accuracy) with accessories.	19,20
6	Total Station (+ or - 2mm accuracy) instrument with accessories	21-32
7	GPS instrument	35

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Plane Table Surveying	1a. Explain the functions and use of the given accessories of plane table. 1b. Describe the method of orienting the plane table in a given situation. 1c. Select the method of plane tabling for a given situation. 1d. Compare the given two methods of doing plane table survey.	1.1 Principle of plane table survey. 1.2 Accessories of plane table and their use, Telescopic alidade. 1.3 Setting of plane table; Orientation of plane table - Back sighting and Magnetic meridian method, True Meridian Method 1.4 Methods of plane table surveys- Radiation, Intersection and Traversing. 1.5 Merits and demerits of plane table survey.
Unit– II Theodolite Surveying	2a. Explain the given components of a transit Theodolite 2b. Describe the salient features and the relationship between the given fundamental axes. 2c. Describe the procedure to measure the horizontal and vertical angles using Theodolite for the given situation. 2d. Apply checks for determining the type of traverse using the given data. 2e. Compute Latitude, Departure, Consecutive co ordinates. Independent coordinates from the	2.1 Types and uses of Theodolite; Component parts of transit Theodolite and their functions, Reading the Vernier of transit Theodolite, 2.2 Technical terms- Swinging, Transiting, Face left, Face right, 2.3 Fundamental axes of transit Theodolite and their relationship 2.4 Temporary adjustment of transit Theodolite, 2.5 Measurement of horizontal angle- Direct and Repetition method, Errors eliminated by method of repetition,



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	<p>data given.</p> <p>2f. Select relevant method of Theodolite traversing for given condition.</p> <p>2g. Apply Bowditch's rule and Transit rule to balance the traverse for a given data.</p> <p>2h. Tabulate Gale's Traverse table for the given data.</p>	<p>2.6 Measurement of magnetic bearing of a line, Prolonging and ranging a line, deflection angle.</p> <p>2.7 Measurement of vertical Angle.</p> <p>2.8 Theodolite traversing by included angle method and deflection angle method.</p> <p>2.9 Checks for open and closed traverse, Calculations of bearing from angles.</p> <p>2.10 Traverse computation-Latitude, Departure, Consecutive co ordinates, Independent coordinates, Balancing the traverse by Bowditch's rule and Transit rule. Gale's Traverse table computation.</p>
Unit- III Tacheometric surveying	<p>3a. Explain the functions of the given component(s) of a Tacheometer.</p> <p>3b. Determine horizontal and vertical distances using Tacheometric formula in the given situation.</p> <p>3c. Calculate constants of tacheometer from the given data.</p> <p>3d. Determine RLs of stations and the distance between the stations using tachometric survey for the given data.</p>	<p>3.1 Principle of tacheometry, Tacheometer and its component parts, Anallatic lens.</p> <p>3.2 Tacheometric formula for horizontal distance with telescope horizontal and staff vertical.</p> <p>3.3 Field method for determining constants of tacheometer,</p> <p>3.4 Determining horizontal and vertical distances with tacheometer by fixed hair method and staff held vertical,</p> <p>3.5 Limitations of tacheometry.</p>
Unit- IV Curve setting	<p>4a. Propose the curves used in alignment of roads for given condition with justification.</p> <p>4b. Propose the types of curves used in alignment of railways for given condition with justification.</p> <p>4c. Label the figure of given simple circular curve.</p> <p>4d. Calculate the ordinates for the given interval to set out a simple circular curve using offsets from long chord method.</p> <p>4e. Tabulate the given data required for setting out a circular curve using Rankine's method of deflection angle.</p>	<p>4.1 Types of curves used in roads and railway alignments.</p> <p>4.2 Notations of simple circular curve Designation of the curve.</p> <p>4.3 Setting simple circular curve by offsets from long chord and Rankine's method of deflection angles.</p>

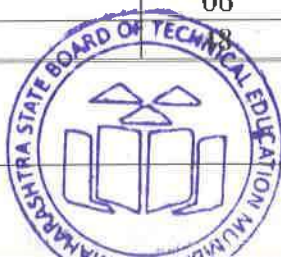


Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit –V Advanced surveying equipment s	5a. Explain the procedure to measure the distance between two given stations using EDM. 5b. Describe procedure to measure the horizontal angle using given Theodolite. 5c. Describe the procedure to measure the vertical angle using the given Theodolite. 5d. Explain the procedure to measure Horizontal and vertical angles between the given lines using Total Station instrument. 5e. Describe the procedure to measure distances and coordinates of the given points to prepare plans using Total Station instrument.	5.1 Principle of Electronic Distance Meter (EDM), its component parts and their Functions, use of EDM. 5.2 Construction and use of One Second Micro Optic Theodolite, Electronic Digital Theodolite. Features of Electronic Theodolite. 5.3 Construction and Use of Total Station, Temporary adjustments. 5.4 Use of function keys. 5.5 Measurements of Horizontal angles, vertical angles, distances and coordinates using Total Station. Traversing, Profile Survey and Contouring with Total Station.
Unit-VI Remote sensing, GPS and GIS	6a. Describe the method of taking the images of the given object/area from the remote place. 6b. Propose the relevant system of remote sensing to be used for given situation. 6c. Describe the procedure to find the coordinates of the given station using GPS. 6d. Explain the utility of GIS applications in given civil engineering problem.	6.1 Remote Sensing – Over view, Electro-Magnetic Energy, Remote sensing system-, Active and Passive system, Applications of remote sensing in Mining, land use / Land cover, mapping, disaster management and Environment. 6.2 Construction and use of Global Positioning System (G.P.S.) 6.3 Geographic Information System(GIS): Over view, Components, Applications, Soft wares for GIS, Sources of errors in GIS.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Plane Table Surveying	04	02	02	04	08
II	Theodolite Surveying	16	04	06	14	24
III	Tacheometric surveying	06	02	02	04	08
IV	Curve setting	06	02	02	04	08
V	Advanced surveying equipments	10	02	06	06	14
VI	Remote sensing and GIS	06	02	02	04	08
Total			14	20	36	70



Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Measure area of small open ground by plane tabling.
- Prepare a flex chart to explain one method of plane tabling.
- Measure the height of the flag post using Theodolite.
- Set the alignment of proposed road using Theodolite.
- Measure the height of the flag post using Theodolite as tacheometer.
- Plot the contours using Total station by direct method.
- Mark building layout using Total station.
- Measure distance between two distant(>500m) points using EDM
- Locate the coordinates of the campus using GPS
- Search and download the demo versions of various software and prepare a report stating the applications.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics**, which is relatively simpler or descriptive in nature, is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Guide student(s) in undertaking micro-projects..
- Arrange visit to nearby newly started site for understanding various surveying techniques.
- Show video/animation films to explain various instruments like EDM, Total Station, GPS
- Prepare maintenance charts for various instruments in survey laboratory.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so



that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

- Collect the relevant technical and commercial information of advanced survey instruments available in the market with specifications.
- Carry out comparative study of following survey instruments of different make and brands: Total station/ EDM/GPS/Micro optic theodolite.
- Set the profiles of curves at the changes in alignment of road in the premises of the institute.
- Determine the RLs of the existing structures like lintels, chajja, slab, and beam using Tacheometer and Total station in a multi-storeyed building and compare the results.
- Download specifications for Total station/ EDM/GPS/Micro optic theodolite and make a chart.
- Coordinate System –UTM (Universal Transverse Mercator Coordinate system
- Mobile devices used for distance measurement
- 360 degree lazer
- Information about Drone survey

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Surveying and Levelling Part I and II	Kanetkar, T. P. and Kulkarni, S. V.	Pune Vidyarthi Gruh Prakashan, Pune; ISBN: 13: 9788185825007
2	Surveying and Levelling	Basak, N. N.	McGraw Hill Education (India) Pvt. Ltd., Noida ISBN: 93-3290-153-8
3	Survey I and Survey II	Duggal, S. K.	Tata McGraw Hill Education Pvt. Ltd., Noida. ISBN:13: 978-1259029837
4	Surveying	Saikia, M D; Das B.M. and Das, M.M.	PHI Learning Pvt. Ltd., New Delhi ISBN: 978-81-203-3985-9
5	Surveying and Levelling	Subramanian, R.	Oxford University Press. New Delhi ISBN 13:978-0-19-808542-3
6	Surveying Vol. I and Surveying Vol. II	Punmia, B.C.; Jain, Ashok Kumar and Jain, Arun Kumar	Laxmi Publications Pvt. Ltd., New Delhi. ISBN: 13: 9788170088837
7	Textbook of Surveying	Rao, P. Venugopala and Akella, Vijayalakshmi	PHI Learning Pvt. Ltd., New Delhi ISBN: 978-81-203-4991-9
8	Textbook of Surveying	Venkatramaiah, C	Universities Press, Hyderabad ISBN: 978-81-737-1021-6
9	Surveying theory and	Anderson, James M	McGraw Hill Education, Noida



S. No.	Title of Book	Author	Publication
	practice	and Mikhail, Edward M.	ISBN:13-978-1-25-902564-8
10	Plane Surveying	De, Alak	S.Chand Publications, New Delhi ISBN:9788121917803

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

- a. <http://nptel.ac.in/courses/105107121/>
- b. <https://www.youtube.com/watch?v=QtEkZPEeeZk>
- c. <https://www.youtube.com/watch?v=KQgq5xqSTUw>
- d. <https://www.youtube.com/watch?v=zcRs3KTQzN0>
- e. <https://www.youtube.com/watch?v=6d4mERJFPpl>
- f. <https://www.youtube.com/watch?v=Dj06aUJ9Wjc>
- g. <https://www.youtube.com/watch?v=Ob8LLRfo0tA>
- h. https://www.youtube.com/watch?v=n_EMrTbDZak
- i. <https://www.youtube.com/watch?v=H2AQq2jshgg>
- j. <https://www.youtube.com/watch?v=C8UKJtZIAWE>
- k. https://www.youtube.com/watch?v=J6j_sJyyudl
- l. <http://www.asnu.com.au>
- m. www.oupinheonline.com



Program Name : Civil Engineering Program Group
Program Code : CE/CR/CS
Semester : Third
Course Title : Highway Engineering
Course Code : 22302

1. RATIONALE

Road Transportation is the most effective and economical means of transportation in our country. The need for travel to various places at faster speed has also increased. In order to professionally contribute to the field of highway engineering, the associated engineers and supervisors must have adequate knowledge and skills relating to technical aspects of continuously increasing volume of traffic flow, design of highway intersections/interchanges, geometric alignment and design, materials, structural design of pavement, new developments in road construction and use of modern and waste materials, techniques, design and maintenance of pavements. Agencies like NHAI and State Government and private organisation are intensely involved in improving and building road networks in India. Diploma Engineering students have good scope in jobs related to road construction as well as such infrastructural associated different projects works. This course provides scope of learning about various aspects of roads, carrying out survey, investigation, planning, design, construction and maintenance works related to road constructions.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Undertake construction and maintenance of pavements (Roads).

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

- Identify the types of roads as per IRC recommendations.
- Implement the geometrical design features of different highways.
- Perform different tests on road materials.
- Evaluate traffic flow characteristics.
- Implement hill road construction using relevant materials, techniques and methods.
- Undertake maintenance of roads and drainage.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Pap er Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20



(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

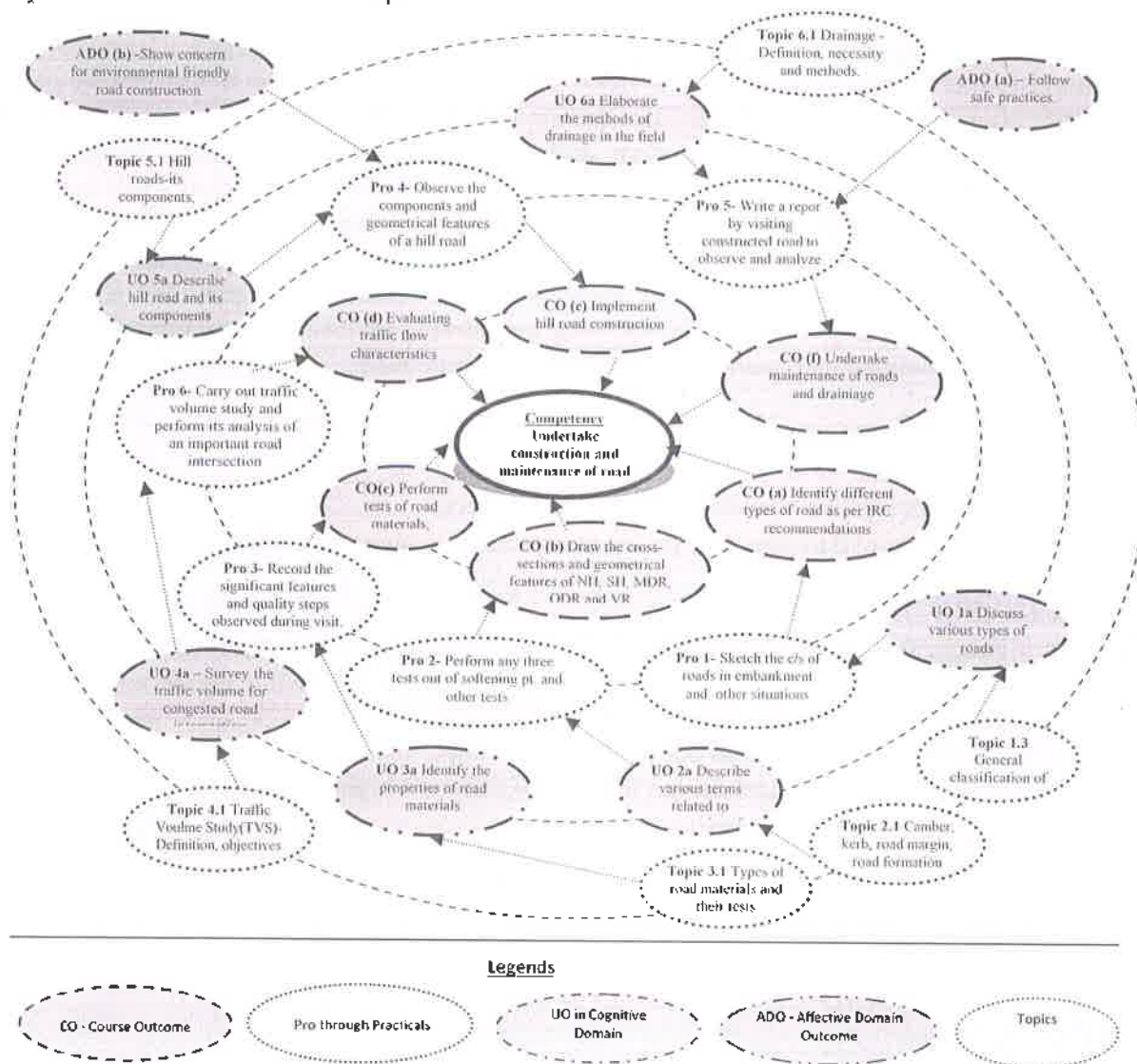


Figure 1 - Course Map

6. SUGGESTED PRACTICALS / EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Draw the sketches showing standard cross sections of NH/SH, MDR/ODR in embankment and cutting on A3 size sheets.	II	02*
2	Conduct Flakiness Index Test on the aggregates.	II	02*
3	Conduct Elongation Index Test on the aggregates.	II	02*
4	Conduct Angularity Number Test on the aggregates.	II	02
5	Conduct Softening point test on bitumen.	III	02*
6	Conduct Penetration test on bitumen.	III	02*
7	Conduct Flash and Fire Point test on bitumen.	III	02
8	Conduct Ductility test on Bitumen.	III	02
9	Visit the constructed road to suggest the possible remedial measures against the observed defects	III	02*
10	Prepare the photographic report containing details for experiment no. 9	III	02*
11	Carry out Traffic Volume Study (minimum two hours of peak period) for an important road intersection or roadway in your city/ town/ village.	IV	02*
12	Perform analysis of traffic volume data of experiment no. 11.	IV	02*
13	Draw the sketch of collision diagram for any one case.	IV	02*
14	Visit the hill road constructed site to understand its components and prepare the photographic report containing details.	V	02
15	Prepare the photographic report containing details for experiment no. 14.	V	02
16	Visit the road of any one type (flexible or rigid) to know the drainage condition.	VI	02
17	Prepare the photographic report suggesting possible repairs and maintenance for experiment no. 16.	VI	02
Total			34

Note

- A suggestive list of **PrOs** is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical LOs/tutorials need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- Hence, the 'Process' and 'Product' related skills associated with each PrO of the laboratory/workshop/field work are to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and Recording	10
5	Interpretation of result and Conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
Total		100



The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical Practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year.
- 'Organising Level' in 2nd year.
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Pro. No.
1	Thickness gauge containing openings for aggregate sizes 63, 50, 40, 31.5, 25, 20, 16, 12.5, 10 & 6.3mm as per IS:2386(Part I)-1963	2
2	Length gauge containing openings for aggregate sizes 63, 50, 40, 31.5, 25, 20, 16, 12.5, 10 & 6.3mm as per IS:2386(Part I)-1963	3
3	Ring and Ball test apparatus (Hot plate 160mm dia. with magnetic stirrer, brass ring, steel ball and glass vessel 600ml and glass thermometer +80 ⁰ c.	5
4	Standard Penetrometer with penetration needle 100gm weight, container 55mm dia. and 53mm ht. as per IS:1203.	6
5	Pensky Marten's Flash and Fire Point test apparatus 100x200x240mm with measurement range 0-95 as per IS:1209-1953	7
6	Ductility Testing Machine with ductility mould and base plate	8

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit—I Overview to Highway Engineering	1a. Describe key features of the given type of road. 1b. Explain significant aspects of the given road development plans as per IRC. 1c. Explain ideal road alignment	1.1 Scope and Importance of roads in India and its' Characteristics. 1.2 Different modes of transportation. 1.3 General classification of roads. 1.4 Road classifications in India (Nagpur plan) 1.5 Third road development



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	and its requirements. 1d. Prepare the list of factors affecting given type of road alignment. 1e. Suggest the ideal requirements of road alignment for the given road condition.	(Lucknow) plan. 1.5 Development of Urban roads. 1.6 Requirements of an ideal road alignment and the factors affecting road alignment.
Unit—II Geometric Design of Highway	2a. Explain various functional terms related to geometrics of the given type of highway with sketches. 2b. Describe the given type of road curves and their necessity. 2c. Calculate SSD, Super-elevation, and widening of roads required for the given road construction problem. 2d. Sketch the cross sections of roads in embankment and cutting for the given site condition.	2.1 Various terms used in Highway: Camber: Definition, purpose, types as per IRC – recommendations. 2.2 Kerbs: Road margin, road formation, right of way. 2.3 Design speed and various factors affecting design speed as per IRC – recommendations. 2.4 Gradient: Definition, types as per IRC – Recommendations. 2.5 Sight distance (SSD): Definition, types IRC – recommendations, simple numerical. 2.6 Curves: Necessity, types: Horizontal, vertical curves. 2.7 Widening of roads: types and problems 2.8 Super elevation: Definition, formula for calculating minimum and maximum Super elevation and method of providing super-elevation 2.9 Standards cross-sections of national highway in embankment and cutting.
Unit—III Construction of Road Pavements	3a. Describe the properties of given type of road materials 3b. Explain function/s of components of given type pavements with sketches/s. 3c. Describe with sketches the construction method for the given type of road pavement. 3d. Explain procedure for testing the given parameter of road construction. 3e. Describe with sketches the road construction method for the given situation.	3.1 Types of road materials and their Tests – Test on aggregates-Flakiness and Elongation Index test, Angularity Number test, test on Bitumen-penetration, Ductility, Flash and Fire point test and Softening point test. 3.2 Pavement Definition, Types, Structural Components of pavement and their functions 3.3 Construction of WBM road. Merits and demerits of WBM road. 3.4 Construction of Flexible pavement / Bituminous Road, Types of Bitumen and its properties, Emulsion, Cutback, Tar. Terms used in BR-prime coat, tack coat, seal coat, Merits and Demerits of



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		BR. 3.5 Construction of cement concrete- methods of construction-Alternate and Continuous Bay Method, Construction joints, filler and sealers, merits and demerits of concrete roads.
Unit—IV Traffic Engineering.	4a. Prepare survey plan for the traffic volume for congested road intersection. 4b. Interpret the observations recorded in traffic volume study to suggest the suitable solutions for traffic problems. 4c. Explain the given collision diagram to express various causes of accidents. 4d. Explain with sketches the working of various traffic control devices with their functions. 4e. Suggest suitability of traffic control device for the given situation with justification.	4.1 Traffic Volume Study(TVS)-Definition of Traffic Volume and Traffic Density. Objectives of TVS 4.2 Passenger Car Unit (PCU) and factors affecting it. 4.3 Traffic control devices – road signs, marking, Signals, Traffic island, Signals-Types, 4.4 Road signs-Types-Regulatory, Prohibitory and Informatory, Sketches of road signs. Types of road markings. 4.5 Traffic island-Types-Divisional, Channelizing, Pedestrian, Rotary. 4.6 Road intersections- Grade and grade separated intersections. 4.7 Accident studies with causes, Collision Diagram.
Unit—V Hill Roads	5a. Describe with sketches the given components of the hill road 5b. Suggest the drainage protective works on hill roads for the given situation with justification. 5c. Explain with sketches the causes of landslides in the given type of hill road. 5d. Suggest preventive measures to check landslide for the given condition with justification.	5.1 Hill roads, its components, functions 5.2 Types of hill road curves. 5.3 Drainage of hill roads: Side drains, catch water drains, cross drains, 5.4 Construction procedure of hill roads. 5.5 Landslides- Types and Causes 5.6 Prevention of landslides.
Unit—VI Drainage, Maintenance and Road Repair.	6a. Describe with sketches the relevant method of providing drainage in the given type of field. 6b. Interpret the information of the causes of failure of given type of pavement. 6c. Suggest suitable preventive measures for the given type of pavement.	6.1 Drainage-Definition, necessity and methods . 6.2 Surface drainage: side gutter, catch 6.3 Water drain. Subsurface drainage- Longitudinal and Cross drains. 6.4 Classification and necessity highway of maintenance. Causes of failure of flexible pavement-WBM road,



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	measures to avoid failures in the given type of pavement with justification. 6d. Suggest the maintenance and repair works of given type of defective road	Bituminous road. 6.5 Causes of failure of rigid pavement- Cement concrete road 6.6 Need for highway maintenance. Classification of maintenance. 6.7 Special repair of flexible and Rigid pavements.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to Highway Engineering	04	02	02	--	04
II	Geometric Design of Highway.	14	04	06	06	16
III	Construction of Road Pavements	10	04	06	06	16
IV	Traffic Engineering	08	04	04	06	14
V	Hill Roads	06	02	04	04	10
VI	Drainage, Maintenance and Road Repair.	06	02	04	04	10
Total		48	18	26	26	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity. also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Undertake micro-projects related to road construction.
- Observe the components of roadway and record the details of the same with necessary sketches.
- Collect the information of NH and SH constructed and under construction across the country.
- Visit the crowded area i.e. city/town/village and note down the traffic control devices to suggest the possible action for smooth traffic flow.
- Collect the typical samples of drawings and legal documents required for road project form PWD office.
- Search the software/freeware on the course content and prepare the detailed report stating their applications.



11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Guide student(s) in undertaking micro-projects.
- Demonstrate various concepts using videos of construction work of flexible and rigid pavement.
- Encourage students to refer different websites to have deeper understanding of new concepts of road works.
- Recommend the students to collect statistical and physiological data of present road conditions across the country.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PROs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

- Collect all the details of all types of existing NH, SH across the country.
- Evaluate the camber and gradient of any one road of each type of pavement in the vicinity of area of college.
- Develop the **photographic model** of typical pavement structure for actual visited site.
- Advance Techniques of repairs like CBTR, White topping, Preventive maintenance, overlays, MSA (Million Standard Axle Load), utility system, encroachment, forest land under roads
- Any other micro-projects suggested by subject faculty on similar line.

13. SUGGESTED LEARNING RESOURCES



S. No.	Title of Book	Author	Publication
1	Highway Engineering	Khanna S.K. , Justo, C E G and Veeraragavan, A.	Nem Chand and Brothers, Roorkee, 2010, ISBN 978-8185240800
2	Road, Railways, Bridge and Tunnel Engg	Birdi, Ahuja,	Standard Book House, New Delhi, March 2010, ISBN: 978- 8189401337
3	Traffic Engineering and Transport Planning	Kadiyali, L.R.	Khanna Publishers, New Delhi, 2008, ISBN: 978-8174092205
4	Principles, Practice and Design of Highway Engineering,	Sharma, S.K.	S. Chand Publication, New Delhi, 2012, ISBN:9788121901314
5	Laboratory Manual in Highway Engineering	Duggal, Ajay K. and Puri, V. P.	New Age International (P) Limited, Publishers, New Delhi, 2010, ISBN: 9788122403107

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

- <https://www.youtube.com/watch?v=1fc4NVP9wXk>
- <https://www.youtube.com/watch?v=m8U76Bm8kDY>
- <https://www.youtube.com/watch?v=IORIZ1shRIM>
- <https://www.youtube.com/watch?v=Xf89KDibIFE>



Program Name : Civil Engineering Program Group
Program Code : CE/CR/CS
Semester : Third
Course Title : Mechanics of Structures
Course Code : 22303

1. RATIONALE

Design and analysis of structure and its components, needs the basic understanding and application of mechanical properties of material and their behavior under different loading and stress conditions. Concepts and principles of structural analysis shall be well understood by students, which is important for design of reinforced cement concrete and steel structures and the same has been covered in this course. Analysis of determinate structure under action of transverse loading along with analysis of members under direct loading will also be studied in this course. The approach of teaching the course shall focus on development of students' analytical and critical thinking while solving structural problems. The experiments expected to be conducted in laboratory will integrate knowledge and required skills as regards to the structural behavior of components and materials.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Analyze structural components using different methods.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

- Articulate practical applications of moment of inertia of symmetrical and unsymmetrical structural sections.
- Interpret structural behaviour of materials under various loading conditions.
- Select material considering engineering properties for various structural applications.
- Interpret shear force and bending moment diagrams for various types of beams and loading conditions.
- Determine the bending and shear stresses in beams under different loading conditions.
- Check the column safety for various loading and end conditions.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	2	2	7	3	70	28	30*	00	100	40	25@	10	25	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks are the average of 2 tests to be taken



during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

Legends: L-Lecture; T Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

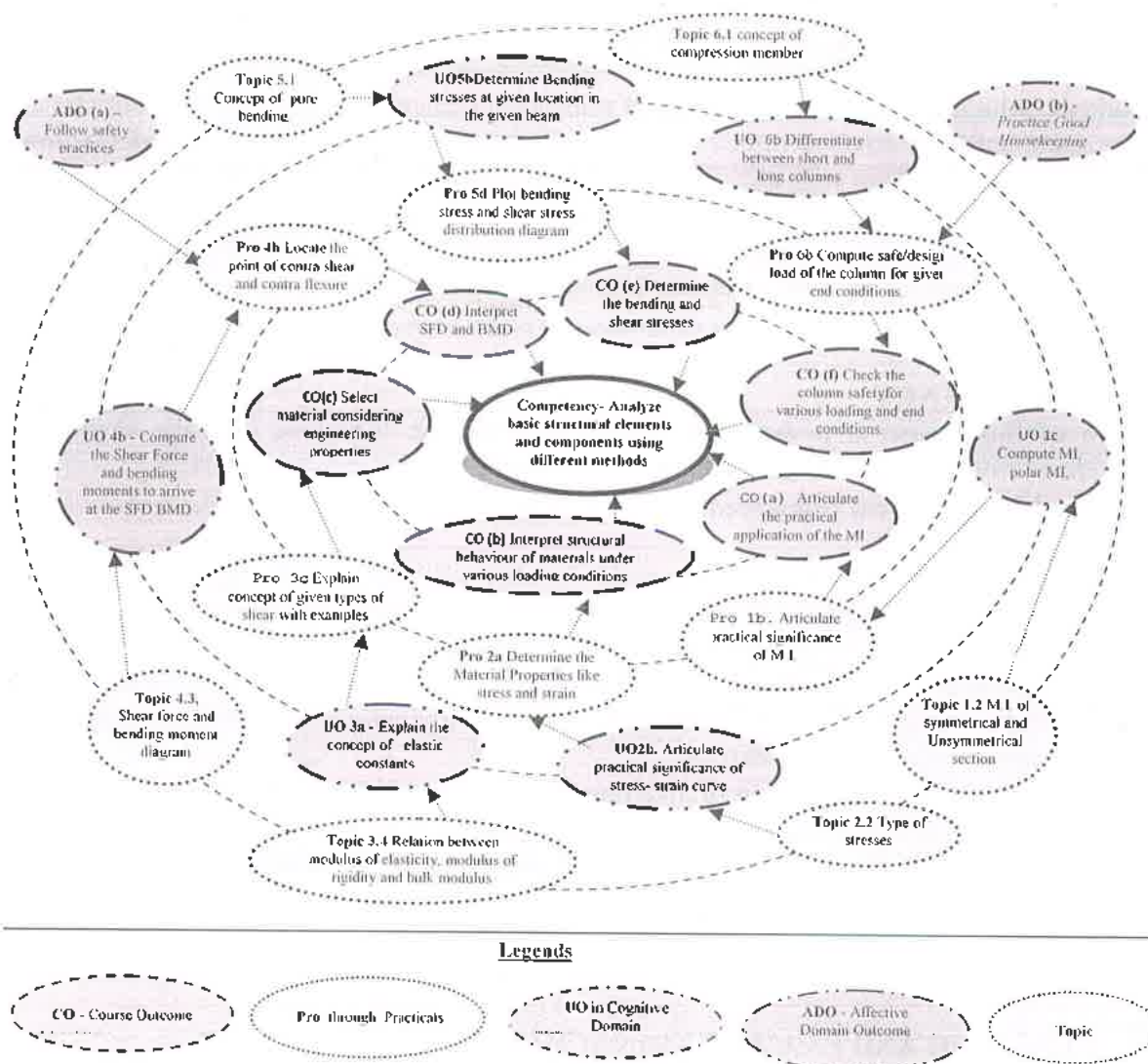


Figure 1 - Course Map



6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1.	Conduct compressive and tensile tests on sample test pieces using Universal Testing Machine along with introduction to other tests to be conducted on UTM.	II	02
2.	Conduct compression test on sample test piece using Compression Testing Machine.	II	02
3.	Perform Tension test on mild steel as per IS:432(1)	II	02*
4.	Perform tension test on Tor steel as per IS:1608,IS:1139	II	02
5.	Conduct Izod Impact test on three metals. E.g. mild steel/ brass/aluminum/ copper /cast iron etc as per IS:1598	II	02
6.	Conduct Charpy Impact test on three metals. E.g. mild steel/ brass/aluminum/ copper /cast iron etc as per IS:1757	II	02*
7.	Determine Water Absorption on bricks per IS:3495 (part II), IS:1077 or tile IS:1237	II	02*
8.	Determine Compressive strength of dry and wet bricks as per IS:3495(part I), IS:1077	II	04*
9.	Conduct Abrasion Test on flooring tiles (any one) e.g. Mosaic tiles, Ceramic Tiles as per IS: 13630(part7), Cement Tile as per IS: 1237	II	02
10.	Perform Single Shear and double shear test on any two metals e.g. Mild steel/ brass/aluminum/copper / cast iron etc as per IS:5242	III	02*
11.	Conduct Compression test on timber section along the grain and across the grain as per IS:2408	II,VI	02
12.	Plot Shear force and Bending Moment diagrams of cantilever, simply supported and overhanging beams for different types of loads two problems on each type of beam	IV	06
13.	Conduct Flexural test on timber beam on rectangular section in both orientation as per IS:1708, IS:2408	I,V	02*
14.	Conduct Flexure test on floor tiles IS:1237,IS:13630 or roofing tiles as per IS:654,IS:2690	V	02
15.	Field test on TMT bars.	II	02
	Total		34

Note

- A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S.No	Performance Indicators	Weightage in %
a.	Preparation of experimental set up	20
b.	Setting and operation	20



S.No	Performance Indicators	Weightage in %
c.	Safety measures	10
d.	Observations and recording	10
e.	Interpretation of results and conclusion	20
f.	Answer to sample question	10
g.	Submission of report in time	10
		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical Practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organizing Level' in 2nd year
- 'Characterizing Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S.No.	Equipment Name with Broad Specifications	PrO. S.No
1	Universal Testing machine of capacity 1000kN, 600 kN/400kN, analog type/digital type with all attachments and accessories.	1,3,4, 10,13
2	Extensometer with least count 0.01mm, maximum extension 25 mm with dial gauge/ digital display suitable for various gauge length.	3,4
3	Compression testing machine of capacity 2000kN/1000kN, analog /digital type with all attachments and accessories.	2,8,11
4	Tile abrasion testing machine confirming to IS:1237 and IS :1706 for determining resistance to wear and abrasion of flooring tiles complete with dial gauges , revolution counter. thickness measurement holder and abrasion powder.	9
5	Izod/Charpy impact testing machine confirming to IS: 1757.	5,6
6	Tile flexural testing machine confirming to IS:654,capacity 200Kg with uniform loading rate of 45 to 55 Kg/minute provided with lead shots	13
7	Hot Air Oven with thermostatic control having temp. range 100 to 105° C	7
8	Accessories: vernier caliper, meter scale, weighing balance, weights, punch, file, hammer, screw driver, pliers ,etc.	All

8. UNDERPINNING THEORY COMPONENTS



The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit- I Moment of Inertia	1a. Compute Moment of Inertia, polar moment of inertia section modulus of given section. 1b. Articulate practical significance of M.I. for given section and loading condition(s). 1c. Compute Moment of Inertia, polar moment of inertia, section modulus of given standard section. 1d. Compute Moment of Inertia of given unsymmetrical section.	1.1 Moment of inertia (M.I.): definition, M.I. of plane lamina, radius of gyration, section modulus, parallel and perpendicular axes theorems (without derivation), M.I. of rectangle, square, circle, semi circle, quarter circle and triangle section (without derivation). 1.2 M.I. of symmetrical and unsymmetrical I-section, channel section, T-section, angle section, and hollow sections and built up section about centroidal axes and any other reference axis. 1.3 Polar Moment of Inertia of solid circular sections.
Unit -II Simple Stresses and Strains	2a. Articulate practical significance of stress- strain curve for given materials under given loading conditions for their relevant use. 2b. Compute stresses and load shared by given Composite section subjected to direct load. 2c. Calculate modulus of elasticity, modulus of rigidity and axial deformation under given conditions for given material. 2d. Compute stresses induced in given homogeneous sections under temperature variations for given conditions.	2.1 Concept of rigid, elastic and plastic bodies, deformation of elastic body under various forces, definition of stress, strain, elasticity, Hook's law, elastic limit, modulus of elasticity, SI units. 2.2 Type of stresses-normal, direct, bending and shear and nature of stresses i.e. tensile and compressive stresses. 2.3 Standard stress strain curve for mild steel bar and for steel bar under tension test, Yield stress, proof stress, ultimate stress, breaking stress, and working stress, strain at various critical points, percentage elongation and Factor of safety. 2.4 Deformation of body due to axial force, forces applied at intermediate sections, deformation of body of stepped cross section due to axial load, maximum stress and minimum stress induced. 2.5 Concept of composite section, conditions to have a section composite, stresses induced and load shared by materials under axial loading. 2.6 Concept of temperature stresses and strain, stress and strain developed due to temperature variation in homogeneous simple bar.(no composite section) Introduction to strain energy and types of loadings such as gradually applied load,



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		suddenly applied load and impact load only.
Unit-III Elastic Constants	3a. Explain the concept of elastic constants for given situation and their significance. 3b. Calculate change in volume of members for given stress condition. 3c. Explain concept of given types of shear with examples. 3d. Compute shear stress, shear strain and modulus of rigidity for given section.	3.1 Longitudinal and lateral strain, Poisson's ratio, biaxial and triaxial stresses, volumetric strain, change in volume, Bulk modulus. 3.2 Shear stress and strain, modulus of rigidity, simple and complementary shear stress. 3.3 Concept of single shear, double shear and punching shear. 3.4 Relation between modulus of elasticity, modulus of rigidity and bulk modulus.
Unit-IV Shear Force and Bending Moment	4a. Interpret the given types of support(s) and load(s). 4b. Interpret with simple sketch(s) of the given type(s) of beam, load and end conditions, relevant to the actual field situations. 4c. Compute the Shear Force and bending moments to arrive at the Shear force diagram, Bending Moment Diagram for given beam and load conditions. 4d. Locate the point of contra shear and point of contra flexure for the given SFD and BMD.	4.1 Types of supports, beams and loads. 4.2 Concept and definition of shear force and bending moment, relation between load, shear force and bending moment 4.3 Shear force and bending moment diagram for cantilever and simply supported beams subjected to point loads, uniformly distributed loads and couple, point of contra shear and point of contra flexure. 4.4 Shear force and bending moment diagram for overhanging beams subjected to, point loads, uniformly distributed loads only. Point of contra shear and point of contra flexure.
Unit-V Bending and Shear Stresses in beams	5a. Identify with justification nature of bending stresses for given situation. 5b. Determine Bending stresses and shear stresses at given location in the given beam. 5c. Design the beam section for the given data. 5d. Plot bending and shear stress distribution diagram for given beam section and given type of loading.	5.1 Concept and theory of pure bending, assumptions, flexural, meaning of term used in equation, bending stresses and their nature, bending stress distribution diagram. 5.2 Concept of moment of resistance and using flexure equation. 5.3 Shear stress equation, meaning of term used in equation, relation between maximum and average shear stress for rectangular and circular section, shear stress distribution diagram. 5.4 Shear stress distribution for square, rectangular, circle, hollow square, octagonal, circle, angle sections, channel



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		section, I-section, T sections.
Unit-VI Columns	6a. Differentiate between short and long columns based on given criteria. 6b. Compute safe/design load of the column for given different end conditions. 6c. Calculate the limitations of Euler's theory for the given data. 6d. Compute safe/design load of long column using Rankin's formula for given conditions.	6.1 Concept of compression member, short column, long column, effective length, radius of gyration, slenderness ratio, type of end conditions for columns, buckling of axially loaded columns. 6.2 Euler's theory, assumptions made in Euler's theory and its limitations. application of Euler's equation to calculate buckling load. 6.3 Rankin's formula and its application to calculate crippling load. 6.4 Concept of working load/safe load, design load and factor of safety.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Moment of Inertia	08	02	04	04	10
II	Simple stress and strain	10	04	04	06	14
III	Elastic constants	06	02	02	04	08
IV	Shear force and bending moment	12	02	04	12	18
V	Bending and shear stresses in beams	08	02	06	06	14
VI	Columns	04	02	02	02	06
Total		48	14	22	34	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Compare stability of different geometric shapes.
- Correlate the actual field situations about members subjected to different types of loading.



- c. Select appropriate shape, type and material of member from day to day situations for various types of stress and strain.
- d. Correlate the actual field situations with various types of beams (such as cantilever means canopy of a building, overhanging beam means slab with balcony provision). Shapes of various structural components resembling with shear force and bending moment diagrams of simple structures subjected to different types of loading. Identify the type of failure with respect to the shape.
- e. Study the mode of failures due to flexure and shear from field situations and prepare a report.
- f. Visit site/ design office and collect the data from day to day situation about stability and strength of column for buckling load.
- g. Search the software / freeware on the course content and prepare the detailed report stating their applications.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- a. Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- b. '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c. About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- e. Guide student(s) in undertaking micro-projects.
- f. Assign unit wise tutorials to group of 4 to 5 students for solving problems unit wise.
- g. Assign micro projects to group of 4 to 5 students and let them prepare and present the project through PPT. Group shall submit a report which is limited to 5 pages.
- h. Use of video animation films to explain concept, Facts and applications related to Mechanics of Structures.
- i. In respect of item 10 above teacher needs to ensure to create opportunity and provisions for such co curricular activities.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.



A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

- Collect the IS related to methods of testing and specifications for five materials used in actual practice.
- Select ten materials from day to day life and compare their mechanical properties and present it in a format of report.
- Prepare prototype model of various types of support, beams and loading.
- Prepare a report about beam sections subjected to bending and shear stresses from actual field/design office along with photographs and its justification.
- Collect photographs along with justification about failure of short and long columns from actual field situations.

13. SUGGESTED LEARNING RESOURCES

S.No.	Title of Book	Author	Publication
1	Strength of Materials, Vol. I	Timoshenko, S.	CBS; 3 New Delhi; 2015, ISBN 978-8123910307
2	Strength of Materials	Khurmi, R.S.	S Chand and Co. Ltd. New Delhi, 2015, ISBN 978-8121928229
3	Strength of Materials	Ramamurtham, S	Dhanpat Rai and sons, New Delhi, 2015, ISBN 9788187433545
4	Strength of Materials	Punmia B C	Laxmi Publications (p) Ltd. New Delhi, 2015, ISBN-13: 978-8131809259
5	Strength of Materials	Rattan S.S.	McGraw Hill Education; New Delhi 2016, ISBN-13: 978-9385965517

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

- <https://www.youtube.com/watch?v=-JG9IEqRzQ4>
- <https://www.youtube.com/watch?v=4Vlhh6sGkrl>
- <https://www.youtube.com/watch?v=EcPGKLUE04I>
- <https://www.youtube.com/watch?v=ndT35aqDfAQ>
- https://www.youtube.com/watch?v=ZJn_Mj2HeNM
- <https://www.youtube.com/watch?v=KU1gHy8Adrc>
- www.slideshare.net/nell0511/columns-and-struts
- nptel.ac.in/courses/IIT-MADRAS/Strength_of_Materials/Pdfs/4_1.pdf
- <https://www.youtube.com/watch?v=nNcfzNjIifU>
extofvideo.nptel.iitm.ac.in/105105108/lec28.pdf
- http://nptel.ac.in/courses/Webcourse-contents/IIT-KANPUR/cngg_mechanics/ui/Course_home_9.htm



Program Name: Civil Engineering Program Group

Program Code : CE/CR/CS

Semester : Third

Course Title : Building Construction

Course Code : 22304

1. RATIONALE

Building Construction is a core subject in Civil Engineering, which deals with the construction processes of sub structure, super structure, Building Finishes and maintenance of buildings. This course essentially imparts the knowledge of construction technology along with the processes involved in it and various construction equipments used for effective execution of various construction activities. This knowledge shall be used for effective and efficient up keeping of building after construction. This will enable the students to undertake the activities in comparatively shorter period of time.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Implement safe building construction practices.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above-mentioned competency:

- Identify components of building structures.
- Propose suitable type of foundation for building structures.
- Select suitable type of masonry for building structures.
- Propose relevant means of communications for different types of buildings.
- Select the relevant material for finishing works.
- Execute safe practices in building construction activities.

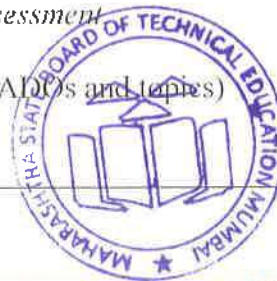
4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

Legends: L- Lecture; T- Tutorial/Teacher Guided Theory Practice; P- Practical; C- Credit, ESE - End Semester Examination; PA - Progressive Assessment

5. COURSE MAP (with sample COs, PrOs, UOs, AOs and topics)



This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

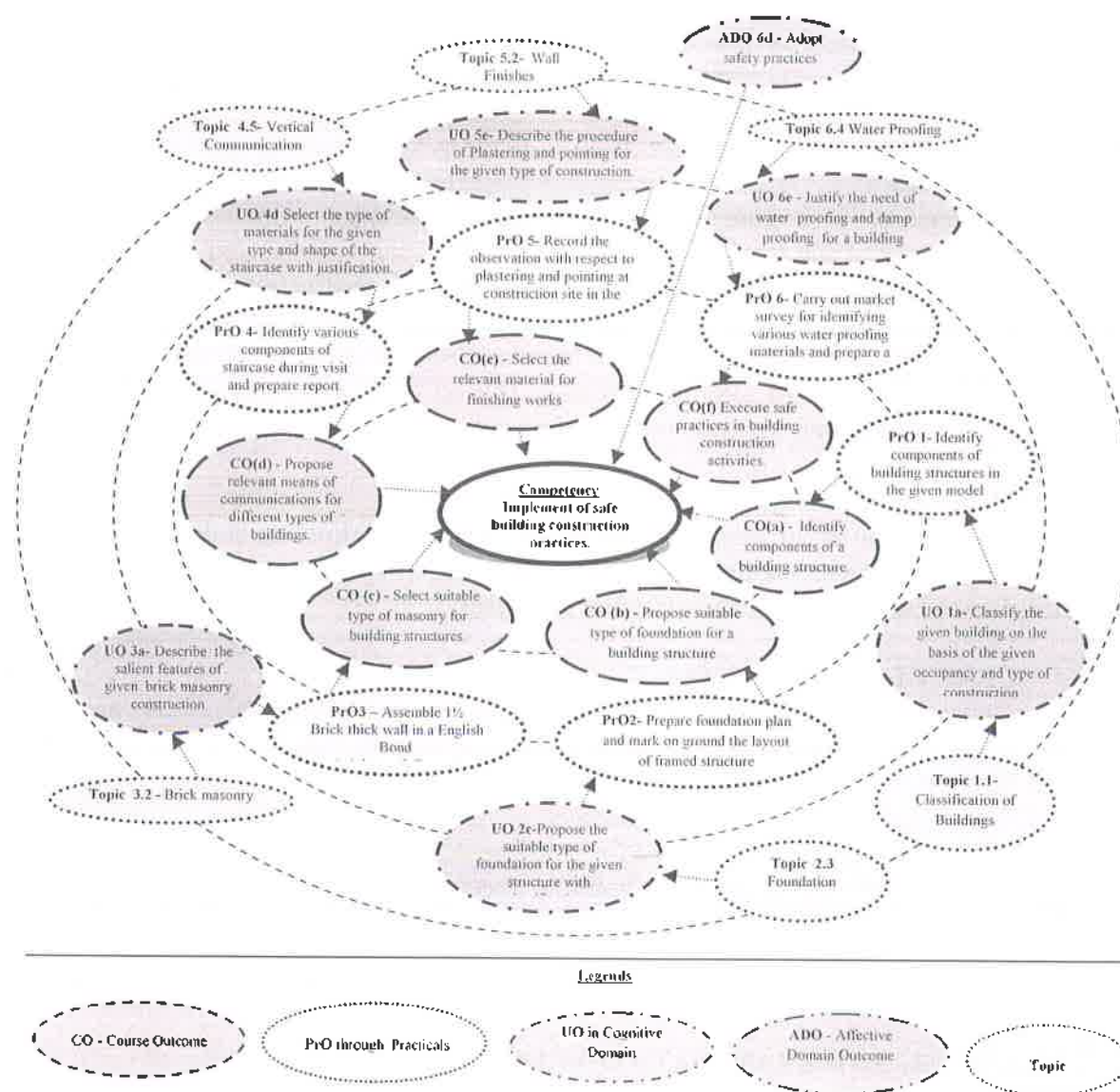


Figure 1 - Course Map

6. SUGGESTED PRACTICALS / EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Identify components of building structures in the given model.	I	02*
2	Prepare foundation plan to mark layout on the ground of the load bearing structure from the given building plan.(Part I)	II	02*
3	Prepare foundation plan to mark layout on the ground of the load bearing structure from the given building plan.(Part II)	II	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
4	Prepare foundation plan to mark layout <u>on the ground</u> of the framed structure from the given building plan.(Part I)	II	02*
5	Prepare foundation plan to mark layout <u>on the ground</u> of the framed structure from the given building plan.(Part II)	II	02*
6	Assemble $1\frac{1}{2}$ Brick thick wall in a English Bond, (minimum 3 Course)	III	02*
7	Assemble $1\frac{1}{2}$ brick thick wall in a Flemish Bond. (minimum 3 Course)	III	02
8	Prepare a simple stone masonry construction work.	III	02
9	Prepare a report on visit to construction site with respect to scaffolding, formwork and centering work.(Part I)	III	02*
10	Prepare a report on visit to construction site with respect to scaffolding, formwork and centering work.(Part II)	III	02*
11	Identify various components of staircase in the given model.	IV	02*
12	Identify various components of doors and windows in the lab in the model to prepare the report with sketches.	IV	02
13	Identify various types of flooring and roofing materials in the lab to prepare report.(Part I)	V	02*
14	Identify various types of flooring and roofing materials in the lab to prepare report.(Part II)	V	02*
15	Record the observation of plastering and pointing work at construction site to prepare a report.	V	02*
16	Record the observation of painting in residential / public building work to prepare a report.	V	02
17	Carry out market survey for identifying various water proofing materials and prepare a report	VI	02
18	Prepare a sketch book consisting of all the sketches from experiment Number 1, 2, 4, 6, 7,11,12	I to IV	02*
Total			36

Note

- i. A suggestive list of **PrOs** is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical LOs/tutorials need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- ii. Hence, the 'Process' and 'Product' related skills associated with each PrO of the laboratory/workshop/field work are to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
a.	Preparation of experimental set up	20
b.	Setting and operation	20
c.	Safety measures	10



S. No.	Performance Indicators	Weightage in %
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- a. Follow safety practices.
- b. Practice good housekeeping.
- c. Demonstrate working as a leader/a team member.
- d. Maintain tools and equipment.
- e. Follow ethical Practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. S. No.
1	Optical Square, Ranging rod, Pegs. Arrows, Line dori, Lime powder, Measuring Tape, Hammer of standard size and specification as per civil engineering application.	2-5
2	Bricks, Plumbs, Mason Square, Level tube, Line dori.	6,7
3	Models: <ol style="list-style-type: none"> a. Model of a civil engineering structure depicting various components. b. Cut section of building showing different components c. Types of Bonds in Brick masonry d. Types of Door and Windows e. Types of Stairs f. Types of Roofs g. Formwork for different RCC elements 	9-12



8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Overview of Building components	1a. Classify the given building on the basis of the given occupancy and type of construction. 1b. Categorize the component parts of the given type of building. 1c. Explain the salient characteristics for the given building structure. 1d. Compare the given parameters of given load bearing and framed structure.	1.1 Classification of Buildings As per National Building Code- Part III (2005) Group A to I Latest code may be referred As per Types of Constructions- Load Bearing Structure, Framed Structure, Composite Structure. 1.2 Building Components a. Building Components and their function. b. Substructure – Foundation, Plinth and Plinth Filling. c. Superstructure – Walls, Partition wall, cavity wall, Sill, Lintel, Doors and Windows, Floor, Mezzanine floor, Roof, Columns, Beams, Parapet.
Unit – II Construction of Substructure	2a. Describe the procedure of line out of the given building for the given method 2b. Explain the precautions required in excavation for the given type of foundation. 2c. Propose the suitable type of foundation for the given structure with justification 2d. Suggest the relevant pumping method of dewatering from given excavation pit with justification.	2.1 Job Layout : Site Clearance, Preparing Job Layout, Layout For Load Bearing Structure and Framed Structure by Center Line And Face Line Method, Precautions 2.2 Earthwork: Excavation For Foundation, Timbering and Strutting, Earthwork for Embankment, Material For Plinth Filling. Tools and Plants Used for Earthwork 2.3 Foundation: Functions of Foundation, Types of Foundation –Shallow Foundation, Stepped Footing, Wall Footing, Column Footing, Isolated And Combined Column Footing, Raft Foundation, Grillage Foundation. Deep Foundation-Pile Foundation, classification based on materials and functions, Well foundation and Caissons. Pumping Methods of Dewatering. Deep wells, Well points, Cofferdams.
Unit- III Construction of Superstructure	3a. Describe the salient features of given type of brick masonry construction 3b. Describe the major features of the given type of stone masonry construction 3c. Describe the given type(s) of brick masonry bonds	3.1 Stone Masonry: Terms used in stone masonry- facing, backing, hearting, through stone, corner stone, cornice. Type of stone masonry: Rubble masonry, Ashlar Masonry and their types. Joints in stone masonry and their purpose and procedure. Selection of Stone Masonry, Precautions to be observed in Stone Masonry Construction.



	<p>with sketches.</p> <p>3d. Describe the given type(s) of joints in stone masonry with sketches.</p> <p>3e. Compare stone masonry with brick masonry on the basis of given criteria.</p>	<p>3.2 Brick masonry: Terms used in brick masonry- header, stretcher, closer, quoins, course, face, back, hearting, bat bond, joints, lap, frog line, level and plumb. Bonds in brick masonry- header bond, stretcher bond, English bond and Flemish bond. Requirements of good brick masonry, Junctions in brick masonry and their purpose and procedure. Precautions to be observed in Brick Masonry Construction. Comparison between stone masonry and Brick Masonry. Tools and plants required for construction of stone masonry and brick masonry. Hollow concrete block masonry and composite masonry.</p> <p>3.3 Scaffolding: Necessity, component parts and types of Scaffolding, platforms used for multi storeyed building.</p> <p>3.4 Scaffolding and Shoring: Purpose, Types of Scaffolding, Process of Erection and Dismantling. Purpose and Types of Shoring, Underpinning. Formwork: Definition of Formwork, Requirements of Formwork, Materials used in Formwork, Types of Formwork, Removal of formwork.</p>
Unit- IV Building Communication and Ventilation	<p>4a. Describe the type of opening for the given situation with sketches.</p> <p>4b. Select the relevant types of doors and windows for the given situation with justification.</p> <p>4c. Select the type of fixture and fastener for given type of door or window with justification.</p> <p>4d. Select the type of materials for the given type and shape of the staircase with justification.</p> <p>4e. Suggest the type of staircase for the given situation with justification.</p>	<p>4.1 Horizontal Communication: Doors – Components of Doors, Fully Panelled Doors, Partly Paneled and Glazed Doors, Flush Doors, Collapsible Doors, Rolling Shutters, Revolving Doors, Glazed Doors. Sizes of Door recommended by BIS.</p> <p>4.2 Windows: Component of windows, Types of Windows- Fully Panelled, Partly Panelled and Glazed, wooden, Steel, Aluminum windows. Sliding Windows, Louvered Window, Bay window, Corner window, clear-storey window. Gable and Dormer window, Skylight. Sizes of Windows recommended by BIS. Ventilators, Cement Grills.</p> <p>4.3 Fixtures and fastenings for doors and windows.</p> <p>4.4 Material used and Functions of Window Sill and Lintels. Weather. Shed/Chajja.</p> <p>4.5 Vertical Communication: Means of Vertical Communication- Stair Case, Ramps, Lift, Elevators and Escalators.</p>



		Terms used in staircase-steps, tread, riser, nosing, soffit, waist slab, baluster, balustrade, going, scotia, hand rails, newel post, landing, headroom, winder. Types of staircase-on the basis of shape: Straight, dog-legged, open well, Spiral, Quarter turn, Bifurcated, Three quarter turn, and Half turn, On the basis of Material: Stone, Brick, R.C.C., wooden and Metal.
Unit-V Building Finishes	<p>5a. Choose the flooring material for the given type of building with justification.</p> <p>5b. Explain the procedure for laying and construction of given type of floor.</p> <p>5c. Describe the procedure of Plastering and pointing for the given type of construction.</p> <p>5d. Select the relevant type of paint material(s) to be used for the given type of building surface.</p>	<p>5.1 Floors and Roofs: Types of Floor Finishes and its suitability- Shahabad, Kota, Marble, Granite, Kadappa, Ceramic Tiles, Vitrified, Chequerred Tiles, Pavement Blocks, Concrete Floors, wooden Flooring, Skirting And Dado. Process of Laying- Process of laying And Construction, Finishing and Polishing of Floors, Roofing Materials- RCC, Mangalore Tiles, AC Sheets, G.I. and Painted Corrugated G.I. Sheets, Plastic and Fibre Sheets. Types of Roof: Flat roof, Pitched Roof-King Post truss, Queen Post Truss and Lean to Roof, terms used in roofs.</p> <p>5.2 Wall Finishes: Plastering – Necessity of Plastering, Procedure of Plastering, Single Coat Plaster, Double Coat Plaster, rough finish, Neeru Finishing and POP. Special Plasters- Stucco Plaster, sponge finish, pebble finish. Plaster Board And Wall Claddings. Precaution to be Taken While Plastering. Defects in Plaster. Pointing – Necessity, Types of pointing and Procedure of Pointing, Painting –Necessity, Surface Preparation for painting, Methods of Application, Selecting Suitable Painting Material.</p>
Unit- VI Building Maintenance	<p>6a. Suggest the techniques for repair of given type of cracks with justification.</p> <p>6b. Describe the causes and remedial measure for settlement of foundation of the given type of building structure.</p> <p>6c. Describe the safe procedure for demolition of the given structure.</p> <p>6d. Justify the need of water</p>	<p>6.1 Cracks : Causes and Types of Cracks, Identification and Repair of Cracks. Grouting and Guniting.</p> <p>6.2 Settlement of Foundation: Types, Causes and Remedial measures.</p> <p>6.3 Demolition: Necessity, Method of Demolition- Hand Demolition, Machine Demolition, Controlled Blasting. Demolition Implosion, Precautions During Demolition.</p> <p>6.4 Water Proofing: Necessity and importance, Material used for Water Proofing, Non</p>



	proofing and damp proofing for the given type of building construction. 6e. Describe safe practices to be used during the construction of the given type of building.	conventional method of waterproofing- Introduction of crystalline waterproofing, cement base polymer coatings. conventional waterproofing methods-brick bat coba waterproofing, Box type water proofing, Injection/grouting, Plinth Protection necessity and material used, Damp Proof Course.
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Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

9.SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Overview of building components	6	2	2	4	08
II	Construction of Substructure	10	4	4	6	14
III	Construction of Superstructure	12	4	6	10	20
IV	Building Communication and Ventilation	8	2	4	6	12
V	Building Finishes	6	2	2	4	08
VI	Building Maintenance	6	2	2	4	08
Total		48	18	20	34	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Classify minimum three buildings near by your institute with reference to National Building Code- Part III (2005) and prepare a report.
- Identify the components of a building by inspecting the available model and prepare a report.
- Visit to construction site to observe brickwork, Sill, Lintel, Chajja, Slab, Parapet wall and prepare a report.
- Identify types of foundation by inspecting available models and prepare a report.
- Search software/freeware for the course content and write the report stating their applications.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:



- a. Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- b. '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c. About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- e. Guide student(s) in undertaking micro-projects.
- f. Procure various materials required for practical exercises.
- g. Arrange visit to nearby industries and workshops for understanding various construction materials.
- h. Use video/animation films to explain various processes like Manufacturing of construction materials, concrete mixing, and base preparation for painting, mortar laying, carpentry work, false ceiling.
- i. Use different instructional strategies in classroom teaching.
- j. Demonstrate different samples of various construction materials like Stone, aggregate of different sizes, timber, lime, bitumen, Bricks, tiles, precast concrete products, Water proofing material, Termite proofing material, Thermal insulating material, plaster of Paris, paints, distemper, and varnishes.
- k. Display various technical brochures of recent building materials.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

- a. Prepare a sketchbook consisting of components of building (for Sketches which are not included in Practical sketch book).
- b. Collect the relevant information of recent technologies in building construction and prepare a report on it.
- c. Identify the different types of cracks and remedial measures and submit a report on case study.
- d. Collect the relevant information of different techniques of demolition of existing structure and submit a report on it.
- e. Prepare a summary report with reference to content in any one part of National Building Code.



- f. Carryout market survey for identifying various water proofing materials and prepare a report.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	Building Construction	S. P. Arora and Bindra	Dhanpat Rai Publication, Delhi Edition 2013, ISBN: 9788189928803
2.	Building construction illustrated	Francis D.K. Ching	Wiley India, USA, 2014, ISBN: 978-1-118-45834-1
3.	Building Construction	S. C. Rangawala	Charotar Publication, Dist-Anand ISBN-13: 978-8185594859
4.	Building Construction	B. C. Punmia and A.K. Jain	Firewall Media, 2005 ISBN 9788170080534
5.	Building Construction	S.K. Sharma	S. Chand and Co. Pvt. Ltd., New Delhi (ISBN:978-81-219-0479-7)
6.	Building Construction	Dr. Janardan Zha	Khanna Publication, New Delhi 2007, ISBN -8174091106
7.	Building Construction	S. S. Bhavikatti	Vikas Publication House Pvt. Ltd., New Delhi (ISBN: 978-93259-6079-4)
8.	A to Z Building Construction	Sandip Mantri	Satya Prakashan; New Delhi (2015) ISBN-13: 978-8176849692

HandBooks

S. No.	Title of Book	Author	Publication
1.	PWD Handbooks for Materials, Masonry, Building, Plastering and Pointing - Foundation	All India Council for Technical Education	All India Council for Technical Education (AICTE)
2.	Practical Civil Engineering Handbook	Khanna	Khanna Publication

BIS/ International Codes of Practice

S. No.	Title of Book	Author	Publication
1	National Building Code	BIS	Bureau of Indian Standard, New Delhi
2	BIS 962-1989 Code of Architectural and Building Drawing	BIS	
3	BIS 1038- 1983 Steel Doors, Windows and Ventilators	BIS	

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

- <http://www.learningconstruction.com/>
- <http://www.understandconstruction.com/>
- <http://www.constructionknowledge.net/>



Program Name : Civil Engineering Program Group
Program Code : CE/CR/CS
Semester : Third
Course Title : Concrete Technology
Course Code : 22305

1. RATIONALE

Concrete is the most widely used construction material today for different kinds of infrastructural development works. The versatility and mouldability of the concrete and its high compressive strength have contributed largely to its wide spread use in development and construction works. The contents of course will focus on learning about quality of concrete with regards to mix design, preparation, transporting and placing in position for various structures. It will also provide guidelines for effective supervision and quality control of concreting work. With good knowledge of concrete materials namely cement, aggregates, water and admixtures and concreting operation namely selection of materials, mixed design, mixing, placing, compacting and finishing, curing, one can obtain concrete of desired workability and required strength. The content of this course will also enable students to acquire knowledge and skills for carrying out various tests on different materials of concrete for quality construction works. Effective learning on above aspects will assist students to become a useful professional civil engineer contributing to the profession of construction and development works.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through active engagement in various teaching learning experiences:

- Use relevant types of concrete in different site conditions.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

- Use relevant types of cement in different site conditions.
- Use relevant aggregates for required concrete works.
- Prepare concrete of desired compressive strengths.
- Prepare concrete of required specifications.
- Maintain the quality of concrete.
- Use relevant admixtures for concreting for different weather conditions.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme													
L	T	P		Theory								Practical					
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
3	-	2	7	3	70	28	30*	00	100	40	25#	10	25	10	50	20	



(*): Under the theory PA; Out of 30 marks, 10 marks of theory PA is for micro-project assessment to facilitate attainment of UOs and the remaining 20 marks is for tests and assignments given by the teacher.

Legends: **L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** - Practical; **C** – Credit, **ESE** - End Semester Examination; **PA** - Progressive Assessment

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

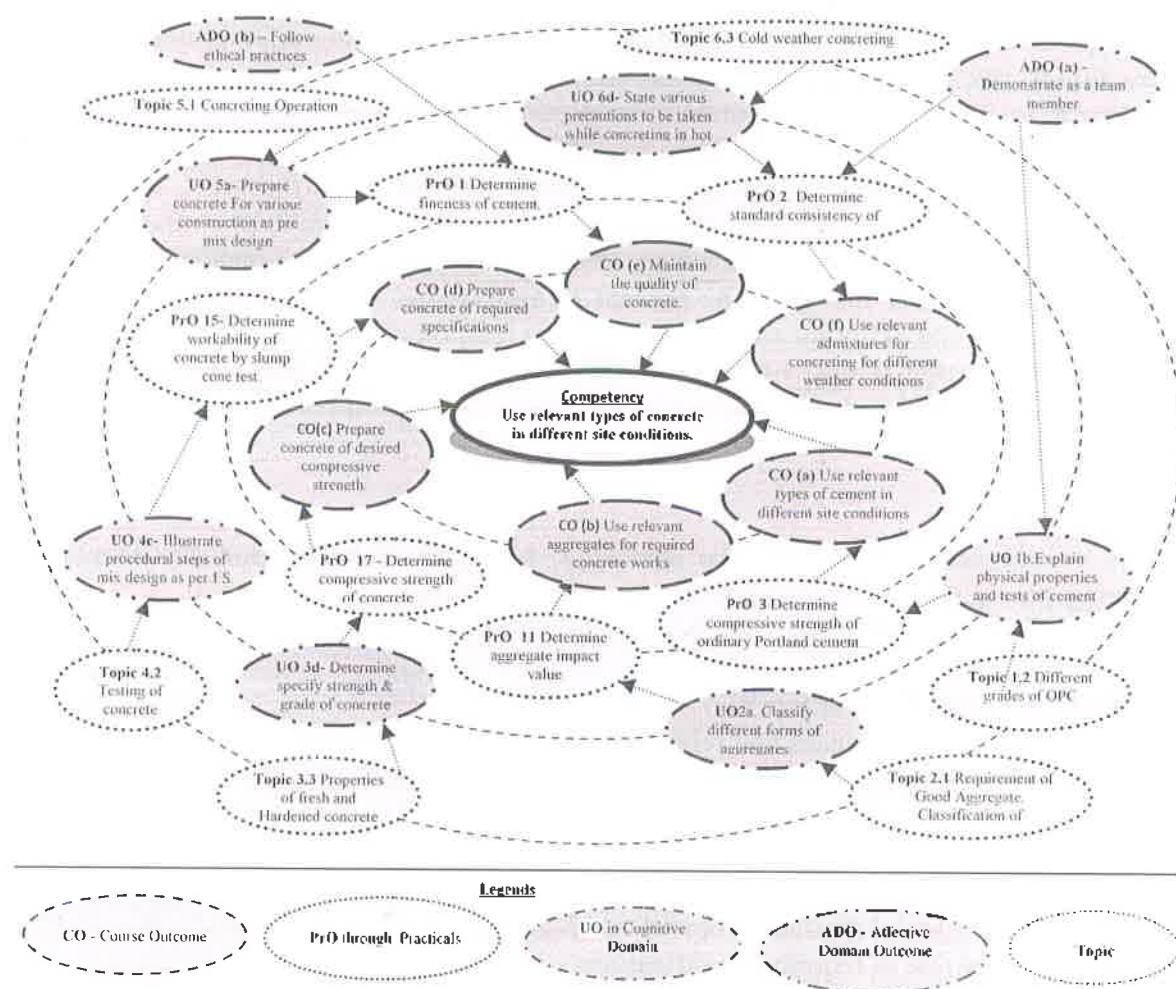


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Determine fineness of cement by Blaine's air permeability apparatus Or by sieving.	I	02*
2	Determine standard consistency, initial and final setting times of	I	02*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	OPC.		
3	Determine compressive strength of ordinary Portland cement.	I	02
4	Determine specific gravity of ordinary Portland cement.	I	02
5	Determine silt content in sand by volume.	II	02
6	Determine bulking of sand.	II	02
7	Determine bulk density of fine and coarse aggregates.	II	02*
8	Determine water absorption of fine and coarse aggregates.	II	02
9	Determine Fineness modulus of fine aggregate by sieve analysis.	II	02*
10	Determine Fineness modulus of coarse aggregate by sieve analysis.	II	02
11	Determine aggregate impact value.	II	02*
12	Determine aggregate crushing value.	II	02
13	Determine abrasion value of aggregate.	II	02
14	Determine aggregate elongation index and flakiness index.	I	02
15	Determine workability of concrete by slump cone test.	IV	02*
16	Determine workability of concrete by compaction factor test.	IV	02
17	Determine compressive strength of concrete for 7 days	IV	02*
18	Determine compressive strength of concrete by any one method of NDT .	IV	02
	Total		36

Note

- A suggestive list of **PrOs** is given in the above table. More such **PrOs** can be added to attain the **COs** and competency. A judicious mix of minimum 12 or more practical **LOs/tutorials** need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- Hence, the 'Process' and 'Product' related skills associated with each **PrO** of the laboratory/workshop/field work are to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
a.	Preparation of experimental setup	20
b.	Setting and operation	20
c.	Observation and recording	10
d.	Safety measures	10
e.	Interpretation of results and conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
	Total	100

The above **PrOs** also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences.

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.



- e. Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. S. No.
1	Blaine's air permeability apparatus as per IS: 4031 (part 1)-1999, and sieve no. IS 90 micron - IS Brass Sieve (200 mm dia), 90 Micron size.	1
2	Vicats apparatus- VICAT mould of dia. 80 mm & 40 mm high glass base plate, initial needle, final needle. Consistency plunger M.S. base plate (non porous) of weight 300 gm. Vicat mould split type with camping ring.	2
3	Compression testing machine-2000 kN capacity, Cement mortar cube vibrator-, moulds size 50 cm ² (7.07 cm x 7.07 cm)	3,17
4	Lce Chartlier flask and Kerosine	4
5	Measuring Cylinder of 100 ml capacity	2,3,5,6,
6	Measuring Cylinder 1000 ml capacity	2,3,5,6,
7	Density basket as per IS specification	7
8	IS sieve set (sizes- 80 mm, 40 mm, 20 mm, 10 mm, 4.75 mm, 2.36 mm, 1.18 mm, 600 μ , 300 μ , 150 μ and pan), sieve shaker with adaptors	1,9,10
9	Aggregate impact testing m/c with mould,	11
10	Aggregate crushing mould	12
11	Los Angeles abrasion testing m/c	13
12	Elongation gauge and thickness gauge.	14
13	Slump cone(top dia.100mm, bottom dia.200mm, Height 300mm)	15
14	Compaction factor test apparatus	16
15	Table vibrator, moulds(150mm x150mmx 150mm)	17
16	NDT apparatus – rebound concrete hammer, ultrasonic pulse velocity meter	18
17	Hot Air Oven	8
18	Weighing Balance	For All

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Cement	1a. Describe the given types of cement and their	1.1 Chemical Constituents of OPC and their effects properties of OPC, Bogue's



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	<p>relevant use with justification.</p> <p>1b. Justify the need for the given chemical constituents for given type OPC.</p> <p>1c. Describe the practical significance of the given types of cements for the given conditions.</p> <p>1d. Suggest the method to judge the quality of the given type of cement with justification.</p>	<p>compounds and their properties, hydration of cement. Physical properties of OPC: fineness, standard consistency, setting time, soundness, compressive strength.</p> <p>1.2 Different grades of OPC. 33, 43, and 53 with specifications of physical properties as per relevant IS codes.</p> <p>1.3 Testing of OPC: Field tests and laboratory tests-fineness test, standard consistency test, setting time test, soundness test, compressive strength test, Storage of cement and effect of storage on properties of cement.</p> <p>1.4 Physical properties, I.S. Specifications and field applications of different types of cements: Rapid hardening cement, Low heat cement, Portland pozzolana cement, sulphate resisting cement, blast furnace slag cement, White cement.</p>
Unit- II Aggregates	<p>2a. Identify the type of given aggregate samples based on and source shape and size.</p> <p>2b. Explain the methodology to suggest suitability of given fine aggregate.</p> <p>2c. Explain the methodology to suggest suitability of given coarse aggregate.</p> <p>2d. Describe the permissible limits of solids for using sea water in mixing concrete.</p>	<p>2.1 Aggregates: Requirement of good aggregates, Classification according to source, size and shape.</p> <p>2.2 Fine aggregates: Properties, size, specific gravity, bulk density, water absorption and bulking, fineness modulus and grading zone of sand by sieve analysis, silt content in sand and their specification as per IS 383, bulking of sand. Concept of crushed Sand.</p> <p>2.3 Coarse aggregates: Properties, size, shape, surface texture, water absorption, soundness, specific gravity and bulk density, fineness modulus of coarse aggregate by sieve analysis, grading of coarse aggregates, crushing value, impact value and abrasion value of coarse aggregates with specification.</p> <p>2.4 Water: Quality of water, impurities in mixing water, and permissible limits for solids as per IS: 456, use of sea water for mixing concrete.</p>
Unit- III Concrete	<p>3a. Justify use of different grades of concrete and their properties for given applications, with justification.</p> <p>3b. Select w/c for a given grade of concrete, with justification</p> <p>3c. Interpret the given data obtained from test on given type of concrete sample</p>	<p>3.1 Concrete: Necessity of supervision for concreting operation, different grades of concrete (ordinary Concrete, standard concrete and high strength concrete as per provisions of IS 456.</p> <p>3.2 Water cement ratio Duff Abraham w/c law, significance of w/c ratio, selection of w/c ratio for different grades of concrete prepared from different grades of OPC as per graphs specified in IS 10262, maximum w/c ratio for different grades of concrete for different</p>



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	3d. Describe the factors affecting overall durability of given type of concrete.	<p>exposure conditions.</p> <p>3.3 Properties of fresh concrete: Workability, Factors affecting workability of Concrete. Determination of workability of concrete by slump cone test, compaction factor test. Range values of workability requirement for different types of concrete works. Segregation, bleeding and preventive measures.</p> <p>3.4 Properties of Hardened concrete: compressive strength, durability, impermeability and dimensional changes of concrete.</p>
Unit-IV Concrete Mix Design and Testing of Concrete	<p>4a. Explain the given method of concrete mix design for the given situation.</p> <p>4b. Interpret the given data obtained from test on given type of concrete.</p> <p>4c. Describe the need of NDT for the given field situation.</p> <p>4d. Interpret the given data obtained from NDT on given structure.</p>	<p>4.1 Concrete mix design, objectives, methods of mix design, study of mix design procedure by I.S. method as per I.S. 10262-(Only procedural steps)</p> <p>4.2 Testing of concrete: Significance of testing, determination of compressive strength of concrete cubes at different ages, interpretation and co-relation of test results.</p> <p>4.3 Non- destructive testing of concrete: Importance of NDT, methods of NDT,</p> <p>4.4 Rebound hammer test, working principle of rebound hammer and factor affecting the rebound index, Ultrasonic pulse velocity test, specification for deciding the quality of concrete by Ultrasonic pulse velocity as per I.S.13311 (part 1 and 2).</p>
Unit –V Quality Control of Concrete	<p>5a. Explain the sequential operations of concreting in given situation.</p> <p>5b. Explain the given type of form works and stripping time.</p> <p>5c. Select given method of waterproofing for given situation with justification</p> <p>5d. Identify the type of construction joint to be used in given situations of concreting works, with justification.</p>	<p>5.1 Concreting Operations: Batching, Mixing, Transportation, Placing, Compaction, Curing and Finishing of concrete.</p> <p>5.2 Forms for concreting: Different types of form works for beams, slabs, columns, materials used for form work, requirement of good form work. Stripping time for removal of form works per IS 456-2000 provision for different structural members.</p> <p>5.3 Waterproofing: Importance and need of waterproofing, methods of waterproofing and materials used for waterproofing.</p> <p>5.4 Joints in concrete construction: Types of joints, joining old and new concrete, methods of joining, materials used for filling joints.</p>



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit-VI Chemical Admixture in concrete, Special Concrete and, Extreme weather concreting	6a. Justify the need of given admixtures in concrete mix. 6b. Describe the characteristics and uses of given type of concrete. 6c. Explain effects and preventive measures in the given type of weather concreting. 6d. Select the type of weather concreting in the given situation with justification. 6e. Select the type of industrial flooring in the given situation with justification.	6.1 Admixture in concrete: Purpose, properties and application for different types of admixture such as accelerating admixtures, retarding admixtures, water reducing admixture, air entraining admixture and super plasticizers. 6.2 Special Concrete: Properties, advantages and limitation of the following types of Special concrete: Ready mix Concrete, Fiber Reinforced Concrete, High performance Concrete and self compacting concrete, light weight concrete. 6.3 Cold and Hot weather concreting: Effect of cold and Hot weather on concrete, precautions to be taken while concreting in cold and hot weather condition. 6.4 Concrete as industrial flooring material and various techniques: Vacuum dewatering flooring, Free Movement flooring, Techniques of groove cutting and various materials used for groove filling in concrete flooring.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Cement	04	02	02	02	06
II	Aggregates	06	02	02	06	10
III	Concrete	10	02	02	10	14
IV	Concrete Mix Design and testing of Concrete	12	02	04	10	16
V	Quality Control of Concrete	10	02	06	06	14
VI	Chemical Admixture in concrete, Special Concrete and Extreme weather concreting	06	02	04	04	10
Total		48	12	20	38	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES



Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- i. Market survey to select type of cement for various types of construction works.
- ii. Visit to site under construction to collect detail information about the ingredients of concrete mix.
- iii. Visit to nearby RMC plant and draw flow chart.
- iv. Visit to site under construction to observe concreting operations.
- v. Visit to site under construction to observe the quality of fresh concrete.
- vi. Visit to site under construction to observe form work, scaffolding used and joints in concrete.
- vii. Visit to site under construction and make a check list of effect of each property of Cement and aggregate on quality of concrete.
- viii. Search the software/freeware for the course content and prepare report stating their applications.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- a. Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- b. '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c. About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- e. Guide student(s) in undertaking micro-projects.
- f. Assign unit wise tutorials to group of 4 to 5 students for solving problems unit wise.
- g. Assign micro projects to group of 4 to 5 students and let them prepare and present the project through PPT. Group shall submit a report which is limited to 5 pages.
- h. Use of video animation films to explain concept, Facts and applications related to Concrete Technology.
- i. In respect of item 10 above teacher needs to ensure to create opportunity and provisions for such co curricular activities.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and **ABOs**. Each student will have to maintain

dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

- a. Undertake any one micro-projects (Group of 4 to 6 students)
 - i. Prepare cast in situ concrete of given grade. It includes visit to site, observations, records, field tests of cement, sand and coarse aggregate. Follow the concrete chain operations.
 - ii. Using IS code method of mix design obtain ingredients of concrete and prepare concrete.

Note: Any other relevant micro project suggested by subject teacher.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Concrete Technology	Gambhir, M.L.	Tata McGraw Hill Publishing Co. Ltd., New Delhi, ISBN-13: 978-1-259-06255-1
2	Concrete Technology	Shetty, M.S.	S. Chand and Co. Pvt. Ltd., Ram Nagar, New Delhi-110055 ISBN, : 978-8-121-90003-4
3	Concrete Technology	Santhakumar, A. R.	Oxford University Press, New Delhi ISBN-13: 978-0-195-67153-7
4	Concrete Technology	Neville, A. M. and Brooks, J.J.	Pearson Education Pvt. Ltd., New Delhi ISBN 978-0-273-73219-8
5	Properties of Concrete	Neville A. M.	Pearson Education Pvt. Ltd., New Delhi ISBN 978-0-273-75580-7

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

- a. <http://nptel.ac.in>
- b. www.w3schools.com
- c. www.engineeringcivil.com/various-lab-test-on-cement.html
- d. www.engineeringcivil.com/various-lab-test-on-aggregates.html
- e. www.aboutcivil.org/tests-on-concrete.html
- f. <https://theconstructor.org/practical-guide/non-destructive-testing-of-concrete/5553/>
- g. nptel.ac.in/courses/105104030/34
- h. nptel.ac.in/courses/105104030/
- i. nptel.ac.in/courses/105102012/38
- j. <https://www.youtube.com/watch?v=cbL5q0HBlnE>
- k. [www.nbmcw.com/concrete/3834-steel-fibre-concrete-composites-for-special applicati](http://www.nbmcw.com/concrete/3834-steel-fibre-concrete-composites-for-special-applicati)



Program Name : Civil Engineering Program Group
Program Code : CE/CR/CS
Semester : Third
Course Title : Computer Aided Drawing
Course Code : 22022

1. RATIONALE

An essential skill of a civil engineering diploma holder is to use Computer aided drawing as a drafting tool to draw, read and interpret the civil engineering drawings. This will facilitate the more speed, accuracy and repetitive use of drawings as and when needed. Through this technique student will be able to edit the existing drawing and create new 2 and 3-dimensional drawings and isometrics as per requirements.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Draw civil engineering drawings using Computer aided drawing software.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

- Interpret the given 2-dimensional drawing.
- Use CAD software for drafting and editing 2-dimensional drawings.
- Locate the dimensions of the drafted drawing.
- Draw the isometric and 3- dimensional drawings.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
-	-	4	4	--	--	--	--	--	--	--	50@	20	50~	20	100	40

(~2): For the **practical only** courses, the PA has two components under practical marks i.e. the assessment of practicals (seen in section 6) has a weightage of 60% (i.e.30 marks) and micro-project assessment (seen in section 12) has a weightage of 40% (i.e.20 marks). This is designed to facilitate attainment of COs holistically, as there is no theory ESE.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.



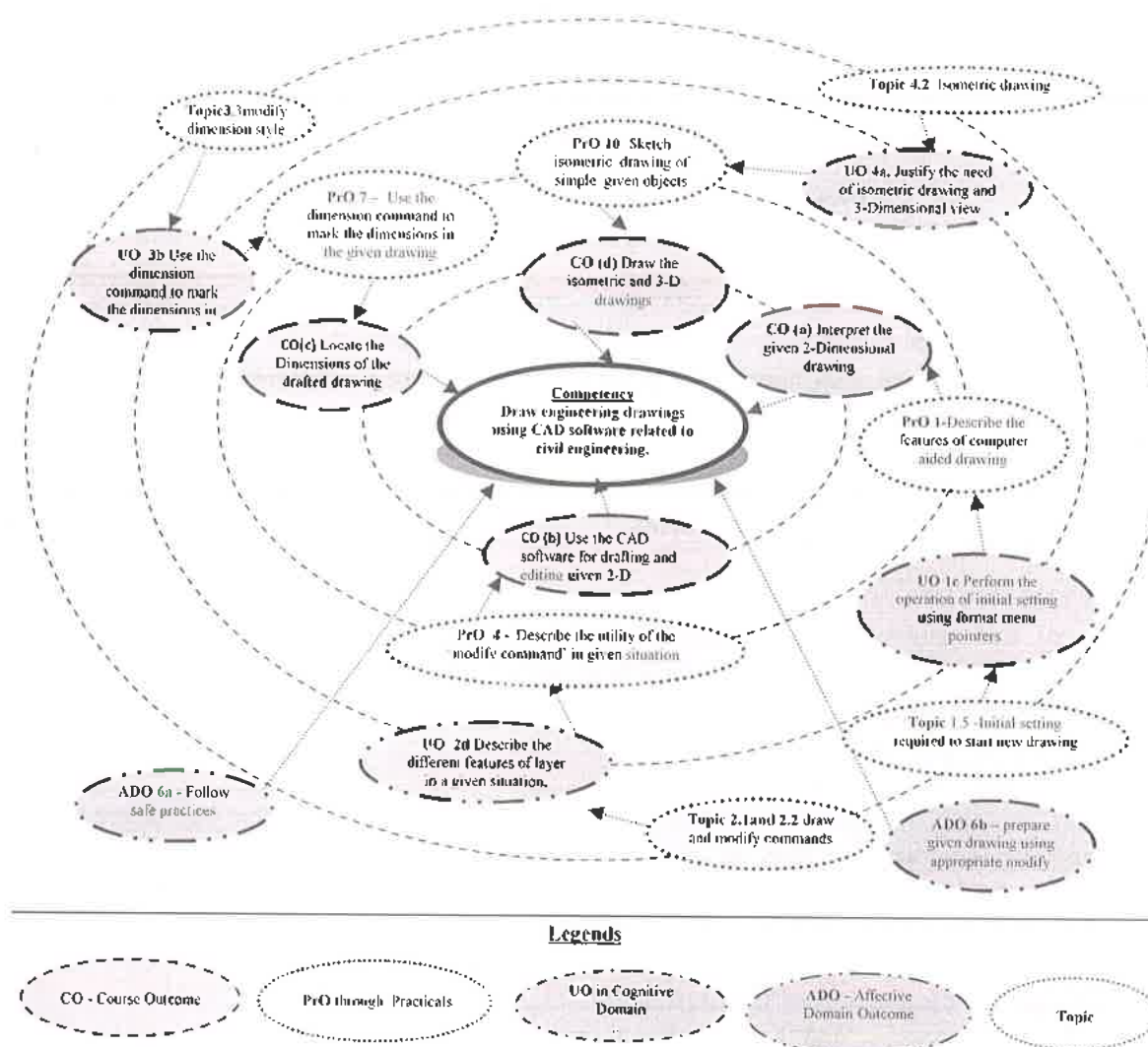


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Identify the components of CAD screen and apply the processes of Initial setting using format menu. Part I	I	02*
2	Identify the components of CAD screen and apply the processes of Initial setting using format menu. Part II	I	02*
3	Calculate -Cartesian coordinates (relative and absolute) Polar coordinates of given shapes.(any Two)	I	02*
4	Calculate -Cartesian coordinates (relative and absolute) Polar coordinates of given shapes.(any Two)	I	02*
5	Draw the given figures according to Cartesian coordinate system. (any Two)	I	02*
6	Draw the given figures according to Polar coordinate system. (any Two)	I	02*



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
7	Use “ Draw and modify command” to draw the given shapes - (minimum 2 shapes)	II	02*
8	Use “ Draw and modify command” to draw the given shapes - (minimum 2 shapes)	II	02*
9	Use “ Draw and modify command” to draw the given shapes - (minimum 2 shapes)	II	02*
10	Use “ Draw and modify command” to draw the given shapes - (minimum 2 shapes)	II	02
11	Use “ Draw and modify command” to draw given shapes - (minimum 2 shapes)	II	02
12	Use “ Draw and modify command” to draw given shapes - (minimum 2shapes)	II	02
13	Use “ Draw and modify command” to draw given shapes - (minimum 2shapes)	II	02
14	Use “ Draw and modify command” to draw given shapes - (minimum 2shapes)	II	02
15	Use “ Draw and modify command” to draw given shapes - (minimum 2shapes)	II	02
16	Use “Draw and modify command” to draw cross section of walls showing different building components symbols.	II	02
17	Use “Draw and modify command” to draw cross section of walls showing different building material symbols.	II	02*
18	Draw plan of any one stair case from the given drawing.(Dog legged stair case / spiral stair case)	II	02*
19	Draw sectional elevation of stair case drawn in exercise no 18.	II	02*
20	Mark the dimensions in the figures drawn in exercise number 5 to 15.and 18,19.	III	02 *
21	Use area command to compute the area of the given, figure, line plan (of residential and public building).	III	02*
22	Use “Draw and modify command” to prepare line plan of given residential building.	III	02*
22	Use “Draw and modify command” to prepare line plan of given public building.	II	02*
23	Use “Draw and modify command” to prepare typical floor developed plan of a given framed residential building in minimum four layers.	II	02*
24	Use “Draw and modify command” to prepare above typical floor developed plan of a given framed residential building in minimum four layers .Give labels , doors and window openings , schedule of openings , scale , north direction.	II	02*
25	Use “Draw and modify command” to prepare elevation of given framed residential building in exercise 22.	II	02*
26	Use “Draw and modify command” to prepare section of a given framed residential building in exercise 22.	II	02*
27	Use “Draw and modify command” to prepare section of a given framed residential building in exercise 22.	II	02*



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
28	Use “dimension command” to locate dimensions of typical floor plan, elevation and section dimensions of a given framed residential building in layer in exercise 22 to 26.	II	02*
29	Draw isometric drawing of simple objects.(minimum 02 objects)	IV	02*
30	Draw isometric drawing of simple objects.(minimum 02 objects)	IV	02
31	Draw 3-D view of simple object.(any one)	IV	02*
32	Draw 3-D view of simple object.(any one)	IV	02
Note: 1. The term work consists of a journal with the relevant write up and output of 2-11 experiment in the form of print out as an output and soft copy as well. 2. The figures used for practical numbers from 7 to 15 are different for each practical.			
Total			64

Note

- A suggestive list of **PrOs** is given in the above table. More such **PrOs** can be added to attain the **COs** and competency. A judicious mix of minimum 24 or more practical **LOs/tutorials** need to be performed, out of which, the practicals marked as ‘*’ are compulsory, so that the student reaches the ‘Precision Level’ of Dave’s ‘Psychomotor Domain Taxonomy’ as generally required by the industry.
- Hence, the ‘Process’ and ‘Product’ related skills associated with each **PrO** of the laboratory/workshop/field work are to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1.	Prepare Initial setting necessary for given drawing.	10
2.	Prepare given drawing using draw commands.	30
3.	Follow Safety measures	05
4.	Prepare given drawing using appropriate modify commands.	20
5.	Answer the questions related to drafted drawing.	10
6.	Submit journal report on time	15
7.	follow Housekeeping	05
8.	Attendance and punctuality	05
TOTAL		100

The above **PrOs** also comprise of the following social skills/attitudes which are Affective Domain Outcomes (**ADOs**) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical Practices.

The **ADOs** are not specific to any one **PrO**, but are embedded in many **PrOs**. Hence, the acquisition of the **ADOs** takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the **ADOs**



according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

Sr. No.	Equipment Name with Broad Specifications	PrO. S.No.
1.	Computer with specification as 2GB RAM ,HDD 500GB,LCD Monitor with relevant CAD software.(with latest configuration)	1 to 32
2.	Printer preferably for the output of A-3 size ,paper	5to 32
3.	LCD projector.	1 to 32

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit- I Fundamentals of computer aided drawing	1a. Explain the importance of computer aided drawing in civil engineering applications. 1b. Describe the features of computer aided drawing screen. 1c. Describe the operation of initial setting using Format menu. 1d. Calculate coordinates in given situation.	1.1 CAD software –meaning, various drafting software for civil engineering applications. 1.2 System requirement for drawing software 1.3 Advantages of computer aided drawing over traditional method of drawing. 1.4 Features of CAD screen. 1.5 Initial setting required to start new drawing from scratch 1.6 Coordinate systems used in CAD. 1.7 Save and plot/print command.
Unit-II CAD commands	2a. Draw the given figures using "draw commands" 2b. Describe the utility of the 'modify command' in given situation. 2c. Describe the utility of enquiry command to find the parameters like distance, area, perimeter of a given figure. 2d. Describe the different features of layer in a given situation.	2.1 Draw commands-line, poly line, construction line, rectangle, polygon, circle, ellipse, hatch, boundary, text, arc, point, make block 2.2 Modify commands- erase, copy, mirror, offset, trim, move, extend, rotate, array, lengthen, scale, chamfer, fillet, explode, stretch, join, brake, divide. 2.3 Enquiry –list, area ,distance, mass property 2.4.Changing properties of entity-line type, color, scale, font- size, color.



		style. 2.5 Layer command.
Unit– III Introducti on to Dimension command	3a. Explain the necessity of the dimensioning the given figure. 3b. Use the dimension command to mark the dimensions in the given drawing. 3c. Modify the existing dimension style.	3.1 Enter form of dimension style. 3.2 Type of dimensions-quick dimension, linear dimension, and continuous dimension; align dimension, angle dimension and radius, diameter. 3.3 Modify dimension style.
Unit– IV Introducti on to 3- Dimension al view	4a. Justify the need of isometric drawing and 3-Dimensional view. 4b. Sketch isometric drawing of simple given objects. 4c. Sketch 3- dimensional drawing of simple given object.	4.1 Necessity of 3 dimensional view 4.2 Isometric drawing- meaning and necessity, use of isometric snap, isometric axes, isocircle, isotext 4.3 3-Dimensional drawing –use of extrude ,pressfull command.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

- Not applicable -

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Collect the working drawings from builders, architect and engineers.
- Collect the 3-Dimensional drawings from various resources.
- Collect information of similar software other than Computer Aided drawing available in construction industry.
- Search for the websites related to course contents.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course. These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About *15-20% of the topics/sub-topics* which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.

- e. Guide student(s) in undertaking micro-projects
- f. Demonstrate students thoroughly before they start doing the practice.
- g. Encourage students to refer different websites to have deeper understanding of the subject.
- h. Observe continuously and monitor the performance of students in Lab.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be *individually* undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

- a. Draw plan, elevation, and section of a given framed structure as it is from the available drawings using software available in laboratory.
- b. Prepare construction notes, site plan, and schedule of openings from the drawings of a framed structure made available from builder/engineer/civil engineering service provider.
- c. Draw plan, elevation, and section and site plan of a given load bearing structure as it is from the available drawings using software available in laboratory.
- d. Prepare construction notes, site plan, and schedule of openings from the drawings of a load bearing structure made available from builder/engineer/civil engineering service provider.
- e. Learn latest software's of Civil Engg Drawing

13. SUGGESTED LEARNING RESOURCES

S.N.	Title of Book	Author	Publication
1	AUTOCAD-2000	Frey, David	BPB Publication, New Delhi, ISBN13: 9788176560801
2	Introduction to Auto CAD 2012 for Civil Engineering Applications	Yasmin, Nighat	SDC Publication, 2011 ISBN 978-1-58503-642-4
3	AutoCAD 2016: A Problem-Solving Approach, Basic and Intermediate	Tickoo, Shyam	CADCIM Technologies, 22nd Edition, August 2015 ISBN 13: 9781942689003
4	Auto CAD 2010 Instructor	Leach, James	Tata Mc Graw Hill, New Delhi 2007; ISBN:9780073375410
5	Auto CAD and its Applications-Basics	Shumaker, Terence M.; Madsen, David	Good heart- Willcox Publishers, 2010; ISBN:13: 9781590707600



S.N.	Title of Book	Author	Publication
	2010	A.; Madsen, David P.;	
6	Engineering drawing	Bhatt, N.D.	Charotar Publications, Anand, 2016 ISBN:978-93-80358-96-
7	Working with Auto CAD 2000	Singh, Ajit	Mc Graw Hill Publishing New Delhi, 2002; ISBN: 9780070435964

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

- <http://www.autodesk.com/education/freesoftware/autocad>
- <http://www.youtube.com/playlist?list=PLIpyIybv1CupI-9xve13CxzzwK0PLL>
- www.zwsoft.com/cad accessed on 15th October 2016,
- <https://www.scribd.com/doc/260678036/> accessed on 12th October 2016,
- medobutc.pixnet.net/blog/post/123908069 accessed on 10th October 2016
- www.ndl.iitkgp.ac.in





Maharashtra State Board of Technical Education, Mumbai
Teaching and Examination Scheme for Post S.S.C. Diploma Courses

Program Name : Computer Engineering Groups

Program Code : CO/CM/CW

Duration of Program : 6 Semesters

With Effect From Academic Year: 2017 - 18

Semester : Third

Duration : 16 Weeks

S. N.	Course Title	Course Abbreviation	Course Code	Teaching Scheme			Credit (L+T+P)	Examination Scheme														Grand Total		
				L	T	P		Theory								Practical								
								Exam Duration in Hrs.	ESE		PA		Total		ESE		PA		Total					
									Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
1	Object Oriented Programming Using C++	OOP	22316	3	2	2	7	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150			
2	Data Structure Using 'C'	DSU	22317	3	-	2	5	3	70	28	30*	00	100	40	25#	10	25	10	50	20	150			
3	Computer Graphics	CGR	22318	3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150			
4	Database Management System	DMS	22319	4	2	2	8	3	70	28	30*	00	100	40	25#	10	25	10	50	20	150			
5	Digital Techniques	DTE	22320	4	-	2	6	3	70	28	30*	00	100	40	25#	10	25	10	50	20	150			
Total				17	4	10	31	--	350	--	150	--	500	--	125	--	125	--	250	--	750			

Student Contact Hours Per Week: **31 Hrs.**

Medium of Instruction: **English**

Theory and practical periods of 60 minutes each.

Total Marks : 750

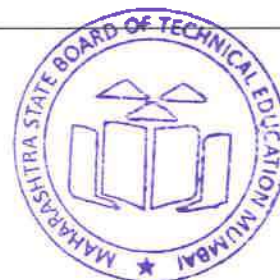
Abbreviations: ESE- End Semester Exam, PA- Progressive Assessment, L - Lectures, T - Tutorial, P - Practical

@ Internal Assessment, # External Assessment, *# On Line Examination, ^ Computer Based Assessment

* Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain LOs required for the attainment of the COs.

~ For the courses having ONLY Practical Examination, the PA marks Practical Part - with 60% weightage and Micro-Project Part with 40% weightage

- **If Candidate not securing minimum marks for passing in the "PA" part of practical of any course of any semester then the candidate shall be declared as "Detained" for that semester.**



Program Name : Computer Engineering Program Group
Program Code : CO/CM/IF/CW
Semester : Third
Course Title : Object Oriented Programming using C++
Course Code : 22316

1. RATIONALE

In the modern world of Information technology, the Object Oriented Programming has become the most preferred approach for software development. It offers a powerful way to cope up with complexity of real world problems. Among the OOP languages available, C++ is the primitive language which develops fundamental understanding of Object Oriented Concepts. This course enables students to develop programs in 'C++' using Object Oriented Programming approach.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Develop applications Using OOPs concepts in C++.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Develop C++ programs to solve problems using Procedure Oriented Approach.
- Develop C++ programs using classes and objects.
- Implement Inheritance in C++ program.
- Use Polymorphism in C++ program.
- Develop C++ programs to perform file operations.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme														
L	T	P		Theory								Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total			
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min		
3	2	2	7	3	70	28	30*	00	100	40	25@	10	25	10	50	20		

(*): Under the theory PA; Out of 30 marks, 10 marks of theory PA are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the



course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

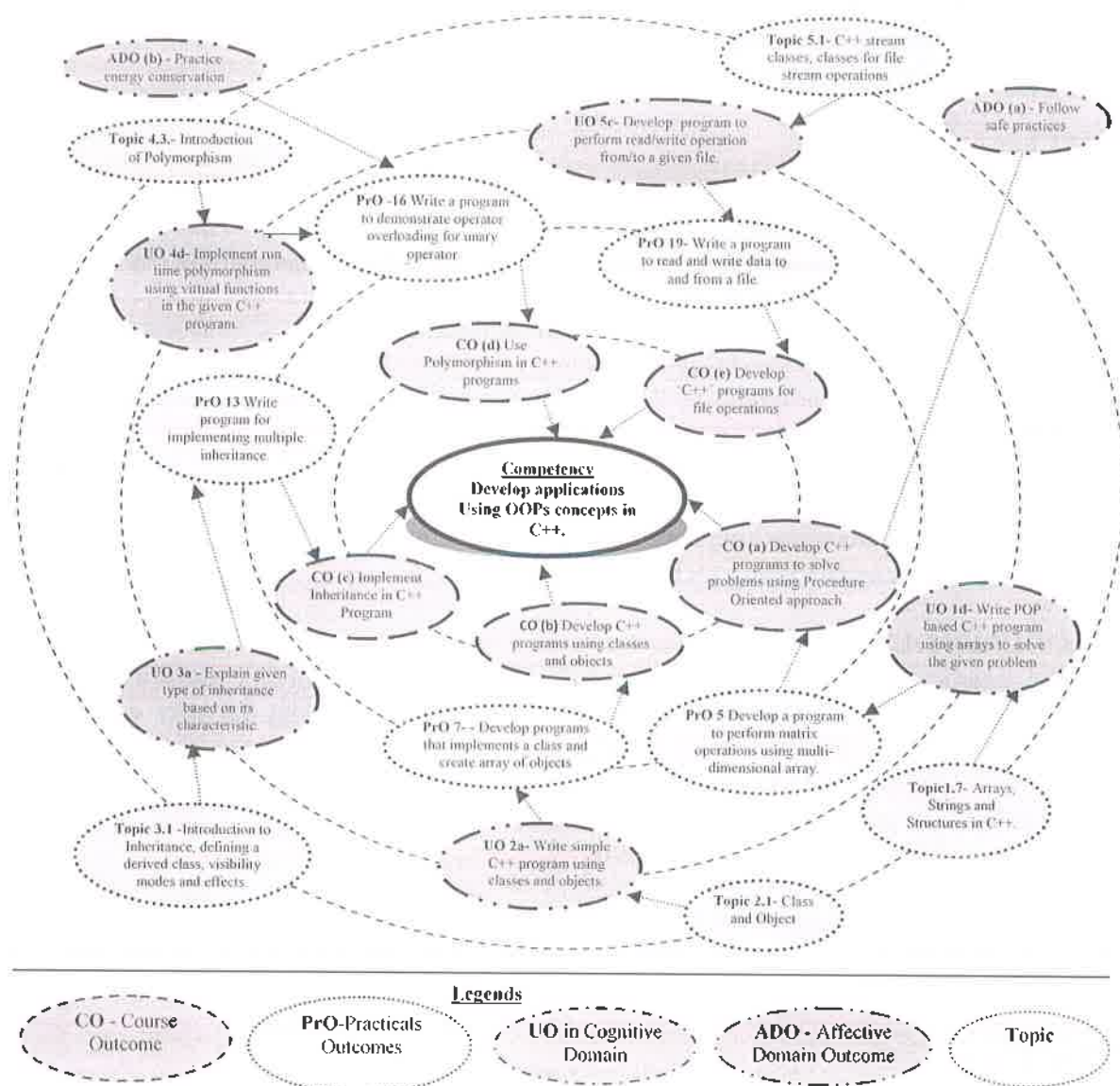


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency:

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Develop minimum 2 programs using constants, variables, arithmetic expression, operators, exhibiting data type conversion.	I	02*
2	Develop a program to implement decision making statements (If-else, switch).	I	02
3	Develop a program to demonstrate control structures (for, while, do-while).	I	02

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
4	Develop a program to implement 1-dimension array.	I	02 *
5	Develop a program to perform matrix operations using multi-dimensional array.	I	02
6	Develop programs that implements a class and use it with objects.	II	02*
7	Develop programs that implements a class and create array of objects.	II	02*
8	Write a program to implement friend function.	II	02*
9	Write a program to implement inline function.	II	02
10	Write a program to implement all types of constructors (constructor overloading) with destructor.	II	02*
11	Write a program for implementing single inheritance	III	02*
12	Write a program for implementing multi level inheritance.	III	02
13	Write a program for implementing multiple inheritance.	III	02*
14	Develop minimum 1 program to demonstrate Pointer to object.	IV	01 *
15	Develop minimum 1 program to demonstrate Pointer to derived class	IV	01 *
16	Write a program to demonstrate operator overloading for Unary operator.	IV	02
17	Write a program to demonstrate operator overloading for Binary operator	IV	02
18	Write a program to demonstrate function overloading	IV	02*
19	Write a program to read and write data to and from a file.	V	02
Total			38

Note

- A suggestive list of **PrOs** is given in the above table. More such **PrOs** can be added to attain the **COs** and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each **PrO** is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
a.	Correctness of algorithm	40
b.	Debugging ability	20
c.	Quality of input and output displayed (messaging and formatting)	10
d.	Answer to sample questions	20
e.	Submit report in time	10
Total		100

The above **PrOs** also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:



- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year and
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO S. No.
1	Computer system (Any computer system with basic configuration)	All
2	'C++' Compiler (Turbo C++ compiler/GCC compiler or any other C++ compiler)	

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added:

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Principles of Object Oriented Programm ing	1a. Write simple C++ program for solving the given expression using POP approach. 1b. Write POP based C++ program using decision making and loop structure for the given situation. 1c. Write POP based C++ program using arrays to solve the given problem. 1d. Use the structure in C++ program for solving the given problem.	1.1 Procedure Oriented Programming (POP) verses Object Oriented Programming (OOP), 1.2 Basic concepts of Object Oriented Programming, Object Oriented Languages, Applications of OOP. 1.3 C verses C++, Structure of C++ program, Simple C++ Program. 1.4 Tokens, keywords, variables, constants, basic data types, User defined data types, type casting, operators, expressions. 1.5 Control structures: Decision making statements and Loops 1.6 Scope resolution operator, memory management operators. 1.7 Arrays, Strings and Structures in C++.



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit- II Classes and Objects	2a. Develop relevant friend functions to solve the given problem. 2b. Write C++ program to use array of given objects. 2c. Write C++ program to create the given object using constructor. 2d. Write program to delete the given object using destructor in C++ program.	2.1 Class & Object: Introduction, specifying a class, access specifies, defining member functions, creating Objects, memory allocations for objects. 2.2 Static data members, static member function, friend Function 2.3 Array of Objects, Object as function arguments. 2.4 Concepts of Constructors, Types of constructors. 2.5 Multiple Constructors in a Class, Constructors with default arguments. 2.6 Destructors.
Unit-III Extending classes using Inheritance	3a. Explain given type of inheritance based on its characteristic. 3b. Implement given type of inheritance in C++ program. 3c. Write C++ program using virtual base class. 3d. Use constructor in the given derived class.	3.1 Introduction to Inheritance, defining a derived class, visibility modes and effects. 3.2 Types of Inheritance : Single, multilevel, multiple, hierarchical, hybrid 3.3 Virtual base class, abstract class, constructors in derived class.
Unit -IV Pointers and Polymorphism in C++	4a. Create C++ programs to perform the given arithmetic operations using pointers. 4b. Use function overloading to solve the given problem 4c. Use operator overloading to solve the given problem 4d. Implement run time polymorphism using virtual functions in the given C++ program.	4.1 Concepts of Pointer: Pointer declaration, Pointer operator, address operator, Pointer arithmetic. 4.2 Pointer to Object: Pointer to Object, this pointer, Pointer to derived class. 4.3 Introduction of Polymorphism, Types of Polymorphism. 4.4 Compile time Polymorphism: Function overloading, operator overloading, overloading of unary and binary operators, Rules for operator overloading. 4.5 Run time polymorphism: Virtual functions, rules for virtual functions, pure virtual function
Unit-V File operations	5a. Identify relevant class for performing the given file operation. 5b. Write statement to open and close the given file in C++. 5c. Develop C++ program to perform read/write operation from/to the given file.	5.1 C++ stream classes, Classes for file stream operations. 5.2 Opening files, closing files, reading from and writing to files. 5.3 Detection of end of file, file modes.



Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Principles of Object Oriented Programming	08	2	4	8	14
II	Classes and Objects	14	2	4	12	18
IV	Inheritance: Extending classes	10	2	4	10	16
V	Pointers and Polymorphism in C++	10	-	4	10	14
VI	Working with files	06	-	2	6	08
Total		48	6	18	46	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare journal of practicals.
- Undertake micro-projects using Object Oriented Concepts.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Guide student(s) in undertaking micro-projects.
- Demonstrate students thoroughly before they start doing the practice.
- Encourage students to refer different websites to have deeper understanding of the subject.
- Observe continuously and monitor the performance of students in Lab.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

- Develop library management application.
- Develop hotel management application.
- Develop bank management application.
- Develop store management application.
- Develop hospital management application.
- Any other micro-projects suggested by subject faculty on similar line.
(Use Object Oriented concepts and may also use file handling features of 'C++' to develop above listed applications)

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Object Oriented Programming with C++	Balgurusamy, E.	McGraw Hill Education, New Delhi 2015, ISBN: 9781259029936
2	The C++ Programming Language	Stroustrup, B.	Pearson Education, New Delhi 2015, ISBN: 9780201889543
3	Object Oriented Programming in C++	Lafore, R.	Sams Publication, New Delhi 2015, ISBN: 9780672323089
4	C++ The Complete Reference	Schildt, H.	McGraw Hill Professional, New Delhi 2015, ISBN: 9780072226805
5	Object Oriented Programming in C++	Subburaj, R.	Vikas Publication, New Delhi 2015, ISBN: 9789325969964
6	C++ Programming	Dr. Rajendra Kawale	Devraj Publications

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

- https://www.tutorialspoint.com/cplusplus/cpp_object_oriented.htm
- <http://www.studytonight.com/cpp/cpp-and-oops-concepts.php>
- https://www3.ntu.edu.sg/home/ehchua/programming/cpp/cp3_OOP.html
- <https://www.hscripts.com/tutorials/cpp/cpp-oops-concepts.php>
- <https://www.khanacademy.org/>
- <http://www.nptel.ac.in>



Program Name : Computer Engineering Program Group
Program Code : CO/CM/IF/CW
Semester : Third
Course Title : Data Structures Using 'C'
Course Code : 22317

1. RATIONALE

Data structure is an important aspect for Computer Engineering and Information Technology Diploma graduates. Data structure is a logical & mathematical model of storing & organizing data in a particular way in a computer. The methods and techniques of Data Structures are widely used in industries. After learning this subject student will be able to identify the problem, analyze different algorithms to solve the problem & choose most appropriate data structure to represent the data.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Implement relevant algorithms using Data Structures.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Perform basic operations on arrays.
- Apply different searching and sorting techniques.
- Implement basic operations on stack and queue using array representation.
- Implement basic operations on Linked List.
- Implement program to create and traverse tree to solve problems.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25#	10	25	10	50	20

(*): Under the theory PA; Out of 30 marks, 10 marks of theory PA are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the center of this map.

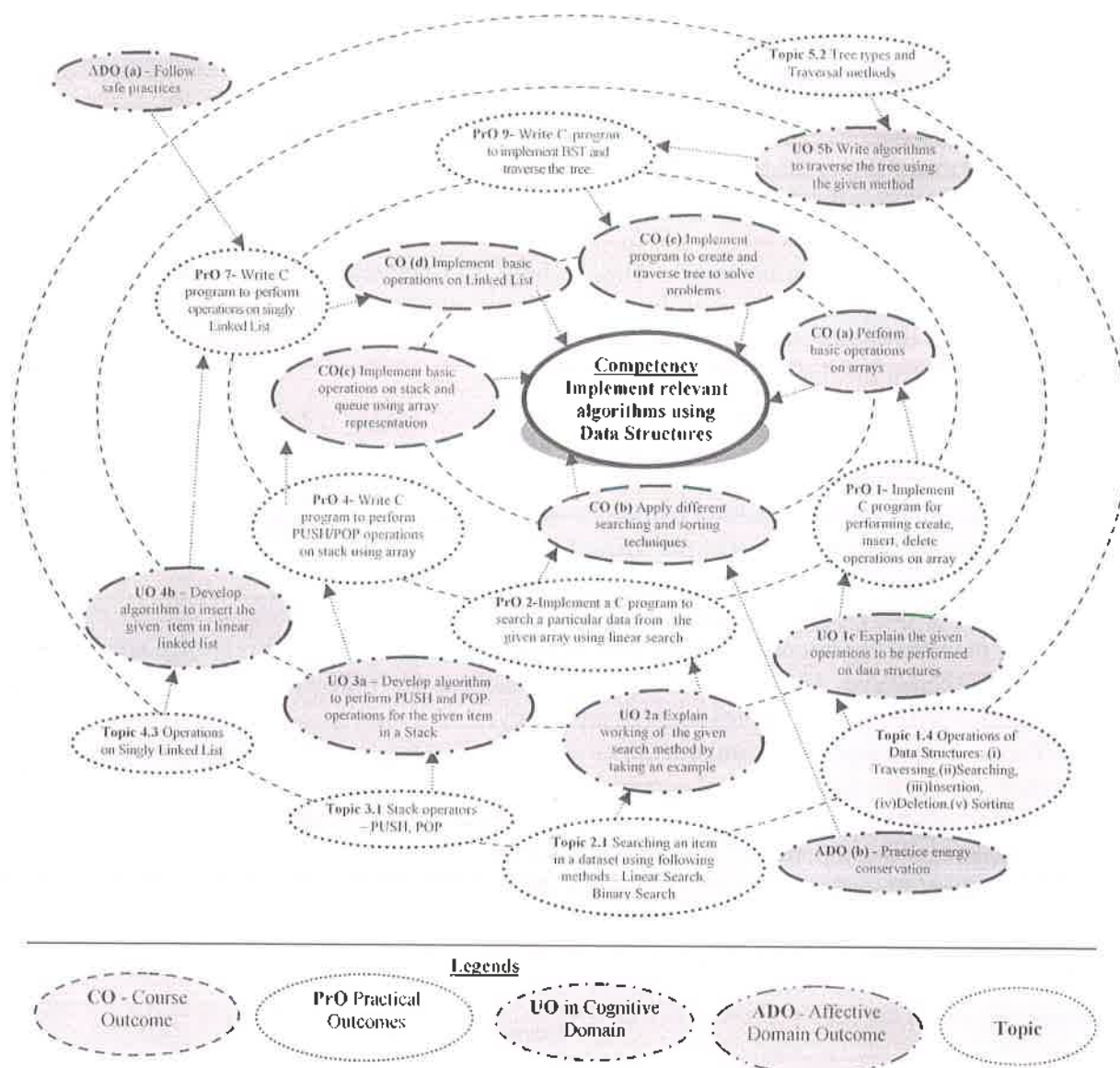


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency:

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Implement a 'C' program for performing following operations on Array: Creation, Insertion, Deletion, Display	I	02*
2	Implement a 'C' program to search a particular data from the given Array using: (i)Linear Search,	II	02*
3	Implement a 'C' program to search a particular data from the given	II	02*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	Array using Binary Search		
4	Implement a 'C' program to sort an array using following methods: (i)Bubble Sort, (ii) Selection Sort (iii) Insertion Sort	II	02*
5	Implement a 'C' program to sort an array using following methods: (ii) Selection	II	02
6	Implement a 'C' program to sort an array using following methods: (iii) Insertion Sort	II	02
7	Write C program to perform PUSH and POP operations on stack using array.	III	02*
8	Write C program to perform INSERT and DELETE operations on Linear Queue using array. Part - I	III	02
9	Write C program to perform INSERT and DELETE operations on Linear Queue using array. Part - II	III	02
10	Write C program to perform INSERT and DELETE operations on Circular Queue using array. Part - I	III	02
11	Write C program to perform INSERT and DELETE operations on Circular Queue using array. Part - II	III	02
12	Write C program to perform the operations (Insert, Delete, Traverse, and Search) on Singly Linked List. Part - I	IV	02*
13	Write C program to perform the operations (Insert, Delete, Traverse, and Search) on Singly Linked List. Part - II	IV	02
14	Write C program to perform the operations (Insert, Delete, Traverse, and Search) on Circular Singly Linked List. Part - I	IV	02*
15	Write C program to perform the operations (Insert, Delete, Traverse, and Search) on Circular Singly Linked List. Part - II	IV	02
16	Write C program to Implement BST (Binary Search Tree) and traverse the tree (Inorder, Preorder, Post order).	V	02*
	Total		32

Note

- A suggestive list of **PrOs** is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
a.	Correctness of data structure representation	20
b.	Correctness of algorithm	35
c.	Debugging ability	10
d.	Quality of input and output displayed	10
e.	Answer to sample questions	15
f.	Submit report in time	10
	Total	100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year and
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO S. No.
1	Computer system (Any computer system which is available in laboratory)	All
2	'C' Compiler / GCC Compiler	

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added:

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Introduction to Data Structures	1a. Classify the given type of Data Structures based on their characteristics. 1b. Explain complexity of the given algorithm in terms of time and space. 1c. Explain the given operations to be performed on the given type of data structures.	1.1 Concept and need of DS, Abstract Data Type 1.2 Types of Data Structures: (i) Linear Data Structures (ii) Non-Linear Data Structures 1.3 Algorithm Complexity: (i)Time (ii)Space 1.4 Operations on Data Structures: (i) Traversing,(ii)Searching, (iii)Insertion, (iv)Deletion,(v) Sorting
Unit– II Searching and Sorting	2a. Explain working of the given search method with an example. 2b. Write an algorithm to search the given key using binary Search method.	2.1 Searching: searching an item in a data set using following methods: (i) Linear Search (ii) Binary Search 2.2 Sorting: sorting of data set in an order using following methods:

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	2c. Write an Algorithm to sort data using a specified sorting method. 2d. Explain the working of given sorting method step-by-step with an example and small data set.	(i) Bubble Sort (ii) Selection Sort (iii) Insertion Sort (iv) Quick Sort (v) Radix Sort.
Unit- III Stacks and Queues	3a. Develop an algorithm to perform PUSH and POP operations for the given item in a Stack. 3b. Convert the given expression from Infix to Prefix/Postfix using Stack. 3c. Write steps to evaluate the given expression using the stack. 3d. Develop a program to perform the given operation on a linear Queue. 3e. Write Algorithm to perform the given operations on circular queue.	3.1 Introduction to Stack - Stack representation in memory using array - Stack as an ADT - Stack Operations – PUSH, POP - Stack Operations Conditions – Stack Full / Stack Overflow, Stack Empty / Stack Underflow. - Applications of Stack <ul style="list-style-type: none"> Reversing a list Polish notations 3.2 Conversion of infix to postfix expression, Evaluation of postfix expression, Converting an infix into prefix expression, Evaluation of prefix expression, Recursion, Tower of Hanoi 3.3 Introduction to Queue: - Queue representation in memory using array - Queue as an ADT - Types of Queues :- Linear Queue, Circular Queue, Concept of Priority Queue - Queue Operations – INSERT, DELETE - Queue Operations Conditions – Queue Full, Queue Empty - Applications of Queue
Unit-IV Linked List	4a. Create relevant structure to represent the given node using linked list. 4b. Develop algorithm to insert the given item in linear linked list. 4c. Develop algorithm to delete the given item from linear linked list 4d. Develop algorithm to traverse a circular linked list.	4.1 Introduction to Linked List Terminologies: node, Address, Pointer, Information field / Data field, Next pointer, Null Pointer, Empty list. 4.2 Type of lists: Linear list, Circular list 4.3 Operations on a singly linked list: Traversing a singly linked list, Searching a key in linked list, Inserting a new node in a linked list, Deleting a node from a linked list
Unit -V Trees and Graphs	5a. Draw Binary Search Tree for the given data set. 5b. Write algorithms to traverse the tree using the	Introduction to Trees 5.1 Terminologies: tree, degree of a node, degree of a tree, level of a node, leaf node, Depth / Height of a tree, In-degree & Out-Degree,



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	given method. 5c. Construct Expression tree for the given data. 5d. Represent the given Graph using adjacency matrix and adjacency list.	Path, Ancestor & descendant nodes 5.2 Tree Types and Traversal methods Types of Trees: General tree, Binary tree, Binary search tree (BST). Binary tree traversal : In order traversal, Preorder traversal, Post order traversal 5.3 Expression tree. 5.4 Introduction to Graph terminologies: graph, node (Vertices), arcs (edge), directed graph, undirected graph, in-degree, out-degree, adjacent, successor, predecessor, relation, path, sink, articulation point. 5.5 Adjacency List, Adjacency Matrix of directed / undirected graph.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to Data Structures	04	02	02	02	06
II	Searching and Sorting	08	02	02	08	12
III	Stacks and Queues	16	02	04	14	20
IV	Linked Lists	10	02	04	10	16
V	Trees and Graphs	10	02	04	10	16
Total		48	10	16	44	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare journal of practical.
- Undertake micro-projects.
- Prepare a chart to classify Data Structures.
- Prepare charts for logical representation of Data Structures.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)



These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Guide student(s) in undertaking micro-projects.
- Demonstrate students thoroughly before they start doing the practice.
- Encourage students to refer different websites to have deeper understanding of the subject.
- Observe continuously and monitor the performance of students in Lab.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

- Develop a program in 'C' to evaluate an arithmetic expression using Stack with linked list representation.
- Develop a program in 'C' that creates Queue of given persons. Shift the original position of person to a new position based on its changed priority or remove a person from the Queue using Linked List implementation.
- Develop a program in 'C' that creates tree to store given data set using linked list representation. Locate and display a specific data from the data set.
- Develop a 'C' program for performing following banking operations: Deposit, Withdraw and Balance enquiry. Select appropriate data structure for the same.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Data Structures using 'C'	Balgurusamy, E	McGraw Hill Education, New Delhi 2013, ISBN: 978-1259029547

S. No.	Title of Book	Author	Publication
2	Data Structures using 'C'	ISRD Group	McGraw Hill Education, New Delhi 2013, ISBN: 978-12590006401
3	Data Structures with 'C' (SIE) (Schaum's Outline Series)	Lipschutz	McGraw Hill Education, New Delhi 2013, ISBN: 978-0070701984
4	Practical 'C' programming	Steve Oualline	O'Reilly Media
5	Data Structures	Dr. Rajendra Kawale	Devraj Publications

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

- a. <http://nptel.ac.in/courses/106102064/1>
- b. www.oopweb.com/algorithms
- c. www.studytonight.com/data-structures/
- d. www.cs.utexas.edu/users
- e. liscs.wssu.edu
- f. <http://www.academictutorials.com/data-structures>
- g. <http://www.sitebay.com/data-structure/c-data-structure>
- h. <http://www.indiabix.com>
- i. <https://www.khanacademy.org/>



Program Name : Computer Engineering Program Group
Program Code : CO/CM/CW
Semester : Third
Course Title : Computer Graphics
Course Code : 22318

1. RATIONALE

This course provides an introduction to the principles of computer graphics. In particular, the course will consider methods for object design, transformation, scan conversion, visualization and modeling of real world. The emphasis of the course will be placed on understanding how the various elements that underlie computer graphics (algebra, geometry, algorithms) interact in the design of graphics software systems and also enables student to create impressive graphics easily and efficiently.

2. COMPETENCY

The aim of this course is to help the student to attain the following *industry identified* competency through various teaching learning experiences:

- **Develop programs using core graphical concepts.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

- Manipulate visual and geometric information of images.
- Implement standard algorithms to draw various graphics objects using C program.
- Develop programs for 2-D and 3-D Transformations.
- Use projections to visualize objects on view plane.
- Implement various clipping algorithms.
- Develop programs to create curves using algorithms.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20

(*): Under the theory PA; Out of 30 marks, 10 marks of theory PA are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the



course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

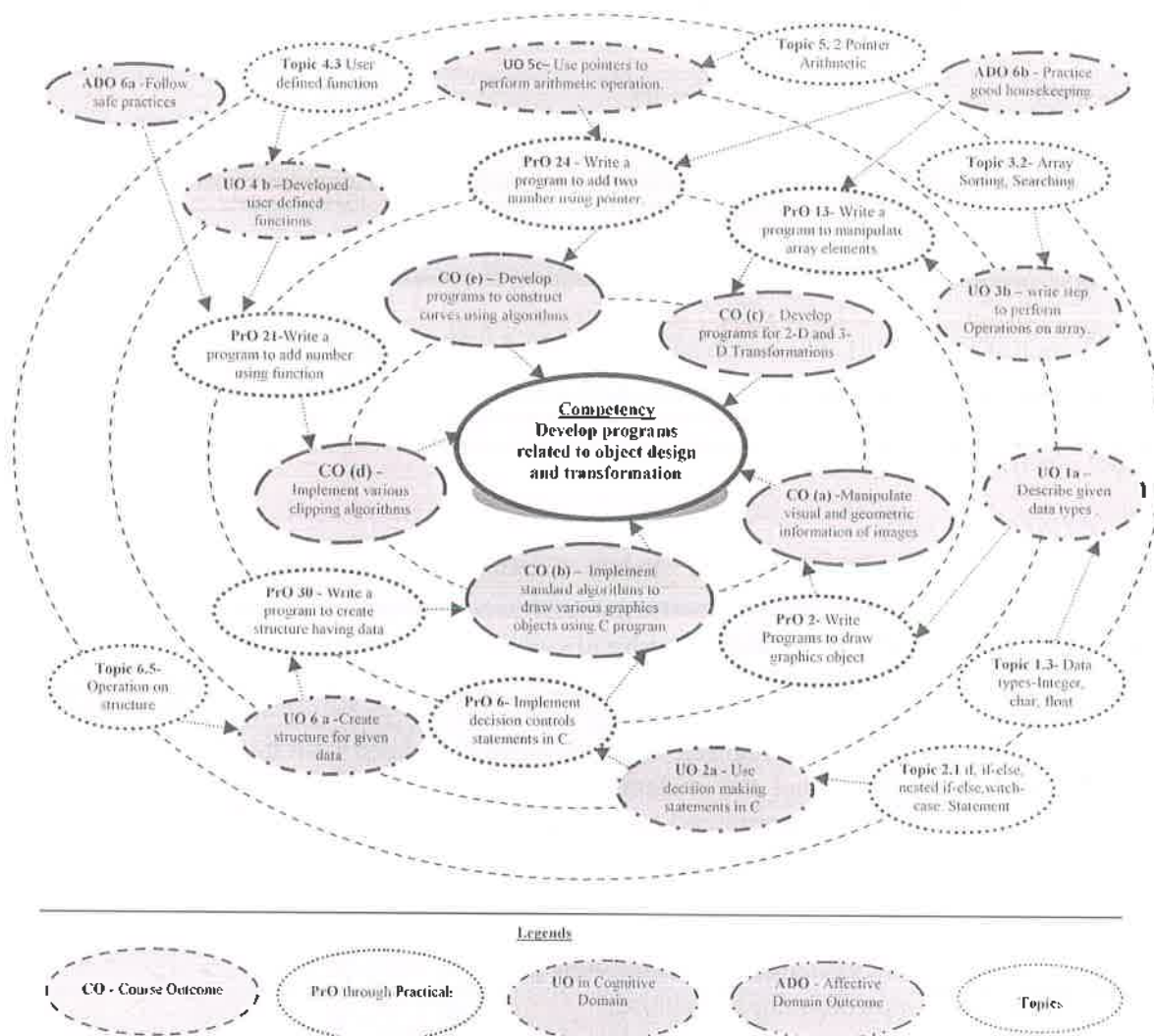


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency:

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Write Programs to draw following graphics object using built-in "C" functions. i) Pixel ii) Lines iii) Circles iv) Rectangle v) Ellipse	I	02*
2	Implement following algorithms to draw line i) DDA algorithm	II	02*
3	ii) Bresennham's algorithm	II	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
4	Implement Bresennham's algorithm to draw a circle.	II	02
5	Write a program to fill Polygon using following methods: i) Flood fill	II	02
6	ii) Boundary fill	II	02
7	Write a program for two-dimensional transformation i) Translation ii) Scaling	III	02*
8	iii) Rotation	III	02
9	iv) Reflection v) Shearing	III	02
10	Write a program for three-dimensional transformation i) Translation ii) Scaling	III	02
11	iii) Rotation	III	02
12	Write a program to clip line using following algorithms. Cohen- Sutherland algorithm	IV	02*
13	Write a program to clip line using following algorithms. Cohen Midpoint subdivision algorithm	IV	02
14	Write a program to clip polygon using Sutherland -Hodgeman, Algorithm.	IV	02
15	Write a program to draw (any one) following type of curves. i) Hilbert's Curve	V	02*
16	Write a program to draw (any one) following type of curves. i) Koch curve ii) Bezier curves	V	02*
Total			32

Note

- A suggestive list of **PrOs** is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S.No.	Performance Indicators	Weightage in %
1	Write program to draw graphics objects.	20
2	Use graphics software tool for programming to create, edit, compile the programs/applications	40
3	Debug, test and execute the programs/applications	20
4	Able to answer oral questions.	10
5	Submission of report in time.	10
Total		100



The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Handle command prompt environment.
- Experiment with graphics environment.
- Plan, construct, compile, debug and test programs.
- Maintain tools and equipment.
- Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year and
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. S.No.
1	Hardware: Personal computer, (i3-i5 preferable), RAM minimum 2 GB onwards.	For all Experiments
2	Operating system: Windows XP/Windows 7/LINUX onwards.	
3	Software: turbo C with dosbox or Emulated C.	

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added:

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Basics of Computer Graphics	1a. Differentiate attributes of the given mode. 1b. Compare features of the given Scan Display. 1c. Write a program to draw the given type of primitives using "C". 1d. Describe application of the given display device. 1e. Convert the given 2D co-ordinates to physical device co-ordinates.	1.1 Image and Objects, pixel and resolution, Text mode, Graphics mode, Basic Graphics Pipeline, Bitmap and Vector Based Graphics, Applications of Computer Graphics. 1.2 Display Devices: Raster-Scan Display, Random-Scan Display, Flat Panel Display, LED, LCD display, Plasma, Touch screen. 1.3 Output primitives: line, polygon, marker, text. 1.4 Graphics functions and standards. 1.5 Latest trends in Computer Graphics: Virtual reality, Augmented reality.
Unit– II	2a. Write a program to draw a	2.1 Basic concepts in line drawing: Line

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Raster Scan Graphics	line using the given algorithm. 2b. Use the given algorithm to rasterize the given line. 2c. Apply the given algorithm to generate the circle. 2d. Draw the Polygon using the given algorithm. 2e. Apply character generation method to display the given character.	drawing algorithms: Digital Differential Analyzer (DDA) algorithm, Bresenham's algorithm. 2.2 Circle generating algorithms: Symmetry of circle, Bresenham's circle drawing algorithm. 2.4 Polygons – Types of polygons, inside –outside test, Polygon Filling : Seed fill algorithms: Flood fill, Boundary fill, scan line algorithms 2.5 Scan conversion, Frame Buffers. 2.6 Character generation methods: stroke, starburst, bitmap.
Unit- III Overview of Transformations	3a. Perform the given operation in 2D transformation. 3b. Perform the given operation in 3D transformation. 3c. Solve the given problem based on Composite Transformations. 3d. Apply the given type of projection on object.	3.1 Two Dimensional Transformations: Translation, Scaling, Rotation, Reflection, Shearing. 3.2 Matrix representations and homogeneous coordinates: Translation Scaling, Rotation, Reflection, Shearing. 3.3 Composite Transformations- rotation about an arbitrary point. 3.4 Three dimensional transformations: Translation, Scaling, Rotation. 3.5 Types of Projections: Perspective and Parallel projection.
Unit-IV Windowing and clipping	4a. Apply Window to-viewport transformation on the given object, 4b. Write a program using the given line clipping algorithms. 4c. Apply the given line clipping algorithms to clip the line. 4d. Apply text clipping on the given text. 4e. Write a program using the given polygon clipping algorithm.	4.1 Windowing and clipping concepts: Window to-viewport transformation. 4.2 Line clipping: Cohen Sutherland clipping algorithm, Cyrusbeck. Liang Barsky, Midpoint subdivision. 4.3 Polygon clipping: Sutherland -Hodgeman. 4.4 Text clipping.
Unit –V Introduction to Curves	5a. Describe the given curve generation methods. 5b. Draw curve using the given curve algorithms. 5c. State properties of the given curve. 5d. Generate arc using the given algorithm.	5.1 Curve generation: Arc generation using DDA algorithm, Interpolation 5.2 Types of curves: Hilbert's Curve, Koch curve, B-Spline, Bezier curves.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.



9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Basics of Computer Graphics	06	04	04	-	08
II	Raster Scan Graphics	12	02	06	10	18
III	Overview of Transformations	12	02	06	10	18
IV	Windowing and clipping	10	-	06	08	14
V	Introduction to Curves	08	-	04	08	12
Total		48	8	26	36	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

This specification table also provides a general guideline for teachers to frame internal end semester practical theory exam paper which students have to undertake.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare journals based on practical performed in laboratory.
- Draw perspective and parallel projection for any object on view plane.
- Give seminar on relevant topic.
- Prepare power point presentation or animation for showing different types of graphics Applications.
- Undertake a market survey of different graphics application and compare with the following points.
 - Available Applications.
 - Application Profile.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).



- d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
- e. Guide student(s) in undertaking micro-projects.
- f. No. of practical's selection to be performed should cover all units.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be *individually* undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

- a) Program to Design Flying Balloons - Each group will design balloons using pieslice (), ellipse () functions and apply delay operation of process.h header file.
- b) Program to Display a moving car.
- c) Develop a miniature tic-tac-toe game.
- d) Design an analog clock.
- e) Design a rotating fan.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Computer Graphics	Donald Hearn , Baker M.Pauline	Pearson Education , New Delhi June 2012, , ISBN:817758765X.
2	Computer Graphics	Maurya Rajesh K.	Wiley-India 2011, Delhi ISBN: 978-81-265-3100-4.
3	Computer Graphics	Dr. Chopra Rajiv	S.Chand 2016, New Delhi. ISBN: 978-93-856-7633-8.
4	Computer Graphics principles and practices	Foley James	Pearson Education. New Delhi 2014, ISBN:978-0-321-39952-6.

14. SOFTWARE/LEARNING WEBSITES

- a. https://www.tutorialspoint.com/computer_graphics
- b. http://www.dailyfreecode.com/tutorial_simple_cpp-16/computer-graphics-215.aspx
- c. <http://www.newtechnologysite.com/graphics.html>
- d. <http://www.nptelvideos.in/2012/11/computer-graphics.html>
- e. <https://www.khanacademy.org/>



Program Name : Computer Engineering Program Group
Program Code : CO/CM/CW
Semester : Third
Course Title : Database Management System
Course Code : 22319

1. RATIONALE

Each and every organization like shopping mall, hospital, banking, institutes, industry needs to share huge amount of data in effective manner. This course aims to develop skills in students to create, store, modify, manage and extract information from a database. Database system can be used as a backend for developing database applications.

2. COMPETENCY

The aim of this course is to help the student to attain the following *industry identified* competency through various teaching learning experiences:

- Apply Database management concept using SQL.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

- Design Normalized database on given data.
- Create and Manage Database using SQL command.
- Write PL/SQL code for given database.
- Apply triggers on database also create procedure and function according to condition.
- Apply security and confidentiality on given Database.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
4	2	2	8	3	70	28	30*	00	100	40	25#	10	25	10	50	20

(*): Under the theory PA; Out of 30 marks, 10 marks of theory PA are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.



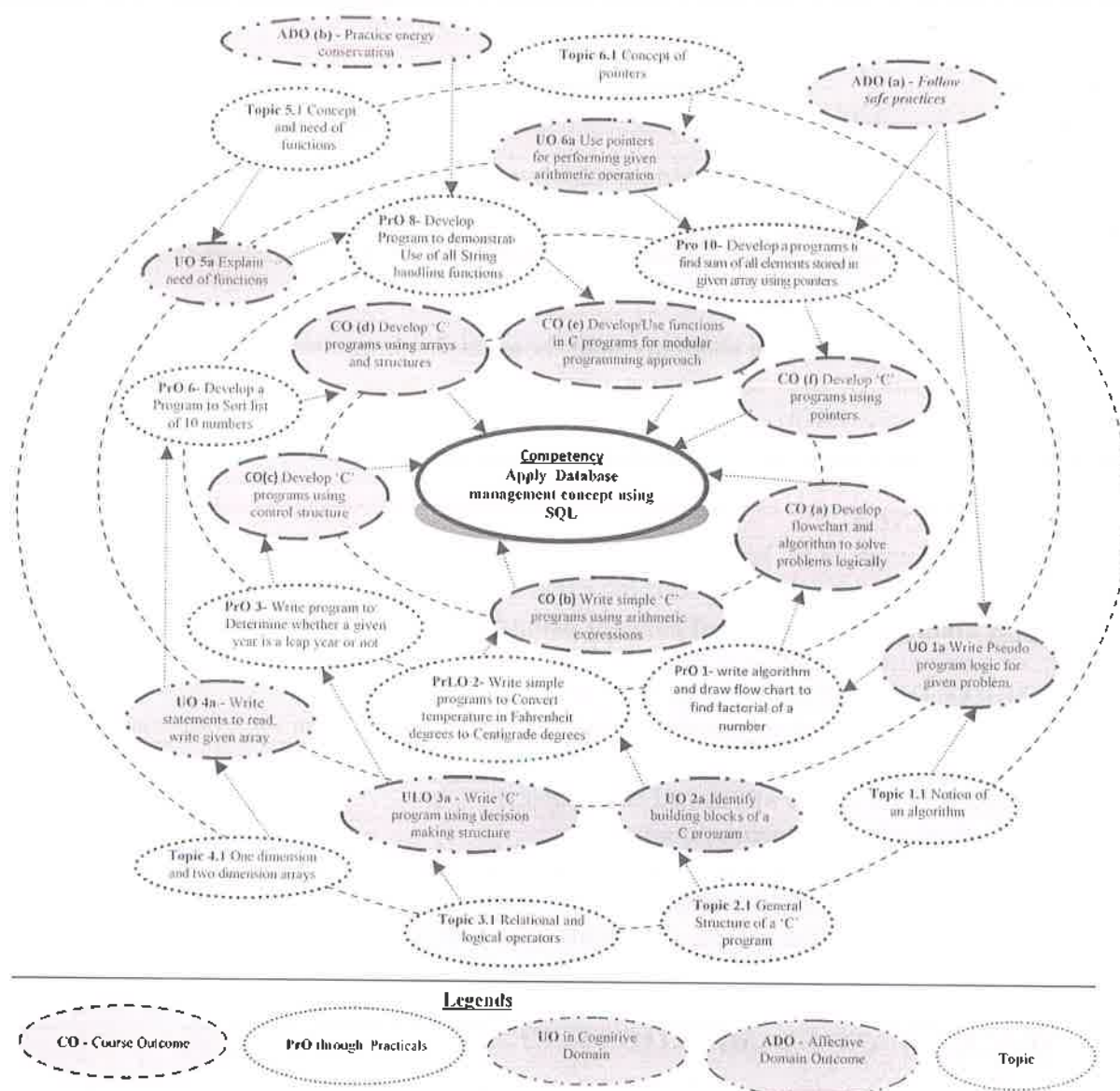


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency:

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Perform following in GUI based database software using GUI only i) Create Database ii) Create tables and assign primary key . iii) Modify the table structure-add column ,change the data type of column, delete the column from table. iv) Insert, update and delete the record from table. v) Retrieve data from the table according to condition given.	II	02*
2	Perform following in GUI based database using GUI only	II	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	i) Apply given validation on table and set error messages. ii) Set default value for column. iii) Set and remove database password.		
3	Design E-R diagram and Create Normalized Database on given data.	II	02
4	i) Create and Execute DDL commands using SQL. ii) Apply following Integrity constraints on table: iii) Primary key, Foreign key, Unique key constraint, Null, Not Null and Check constraint.	II	02*
5	Create and Execute DML commands using SQL.	II	02*
6	Write Queries using following operators: Arithmetic Operators, Comparison Operators, Logical Operators, Set Operators, Range Searching operators-Between, Pattern matching operators-Like.	II	02*
7	Write Queries using following Functions: String, Arithmetic, Date and time, Aggregate Functions.	III	02*
8	Execute Queries using the Select command with Where, Having, Group by and order by clauses.	III	02*
9	Execute the queries for implementation of Inner and Outer Join.	III	02
10	Implement Views i) Create different views ii) Insert, modify and delete records through views. iii) Delete the views.	III	02
11	Create and Execute Indexes, Sequences, and synonyms in SQL.	III	02*
12	Write a PL/SQL programs using if then else, for, while and nested loop.	IV	02*
13	Write a PL/SQL code to implement implicit and explicit cursors.	IV	02
14	Write PL/SQL Programs based on Exceptions handling.(Predefined and user-defined exceptions)	IV	02
15	Write PL/SQL code to create Procedures and functions.	IV	02
16	Write PL/SQL code to create triggers on given database.	IV	02
17	Executing DCL commands using SQL i) Create users ii) Grant privileges to users iii) Revoke privileges from users.	V	02*
	Total		34

Note

- A suggestive list of **PrOs** is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
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S. No.	Performance Indicators	Weightage in %
a.	SQL queries and PL/SQL programming	60
b.	Database Integrity	10
c.	Quality result displayed by SQL queries.	10
d.	Answer to sample questions	10
e.	Submit report in time	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical Practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Pro. S. No.
1	Computer system (Any computer system with basic configuration)	All
2	Any GUI based database software (MS-Access/Visual Foxpro/MySQL)	1-2
3	Any RDBMS software (MySQL/SQL server)	3-16

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added:

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – 1 Database System Concept	1a State the importance of DBMS over file processing in the given situation. 1b Describe the overall structure of the given	1.1 Concept of Data, database, DBMS, advantages of DBMS over file processing system, Application of database. 1.2 Three level Architecture for Database System. 1.3 Data abstraction: Different levels of Data

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	DBMS 1c Identify the relevant database model in the given situation. 1d Draw the E-R diagram of the given database and identify relationship between the entities.	abstraction, Instance and schema, Data independence - Logical and Physical Independence. 1.4 Overall Structure of DBMS. 1.5 Data Modeling: Record based logical model- Relational, Network, Hierarchical 1.6 Data Modeling Using the E-R Model: Entity Relationship Model, Strong Entity set, Weak Entity set, Types of Attributes, E-R Diagrams.
Unit- II Relational Data Model	2a Explain the concept of RDBMS also appropriateness for the given problem. 2b Design Normalized database structure in the given problem. 2c Design SQL queries to create Relational database and apply in the given data constraints. 2d Identify the operators for queries implementation of the given problem.	2.1 Fundamentals of RDBMS – Record, fields, data types, tables and database 2.2 Concept of RDBMS, E.F.Codd's Rule for RDBMS, Key concepts- Candidate key, Primary key, Foreign key. 2.3 Normalization: Normalization Concepts, Need of Normalization, Types of Normalization- 1NF,2NF,3NF 2.4 Introduction to Structured Query Language, Data Types in SQL, components of SQL- DDL,DML,DCL,DQL 2.5 DDL Commands: CREATE, ALTER, DROP, TRUNCATE, DESC, RENAME 2.6 Data Integrity Constraint: Types of Data Integrity Constraint: I/O constraint- Primary key, Foreign key, Unique key constraint, Business Rule Constraint-Null, Not Null and Check constraint. 2.7 DML Commands: INSERT, UPDATE, DELETE 2.8 DCL Commands: COMMIT, SAVEPOINT, ROLLBACK, GRANT, and REVOKE. 2.9 DQL Commands: SELECT. 2.10 SQL Operators: Arithmetic Operators, Comparison Operators, Logical Operators, Set Operators, Range Searching operators- Between, Pattern matching operators-Like.
Unit III- Interactive SQL and Advance SQL: SQL Performanc e Tuning	3a. Write the given queries using relevant functions. 3b. Write query to combine the given multiple table using Join. 3c. Design SQL queries to implement VIEWS	3.1 In-built Functions: String, Arithmetic, 3.2 Date and time, Aggregate functions. 3.3 Queries using Group by, having, and Order by clause, Joins-Inner and Outer Join, Sub queries. 3.4 Views: Concept of View, The Create View Command, Updating Views, Views and Joins, Views and Sub queries, Dropping Views. 3.5 Sequences: Creating Sequences, Altering

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	on the given tables. 3d. Apply and drop INDEXES and SYNONYM on the given table.	Sequences, Dropping Sequences. 3.6 Indexes: Index Types, Creating of an Index: Simple Unique, and 3.7 Composite Index, Dropping Indexes 3.8 Synonyms: Creating Synonyms, Dropping Synonyms.
Unit IV- PL/SQL Programmi ng	4a. Write simple PL/SQL Code using control structure and handle various exceptions in the given situation. 4c. Create cursor for retrieving multiple records in the given situation. 4d. Create and Execute stored procedures and functions in the given situation. 4e. Create and apply database trigger using PL/SQL in the given situation.	4.1 Introduction of PL/SQL, Advantages of PL/SQL, The PL/SQL Block Structure, PL/SQL execution environment, PL/SQL data Types, Variables, Constants. 4.2 Control Structure: Conditional Control, Iterative Control, Sequential Control. 4.3 Exception handling: Predefined Exception, User defined Exception. 4.4 Cursors: Implicit and Explicit Cursors, Declaring, Opening and Closing a Cursor, Fetching a Record from Cursor, Cursor for loops, Parameterized Cursors. 4.5 Procedures: Advantages, Creating, Executing and Deleting a Stored Procedure. 4.6 Functions: Advantages, Creating, Executing and Deleting a Function. 4.7 Database Triggers: Use of Database Triggers, How to apply database Triggers, Types of Triggers, Syntax for Creating Trigger, Deleting Trigger.
Unit V- Database security and Transaction Processing	5a. Provide security to the given database by assigning various privileges to the user. 5b. Create and manage the given database Users. 5c. Explain the importance of Transaction in the given situation. 5d. Explain advantages of Database Backup and Recovery in the given situation.	5.1 Database security: Introduction to database security, Data security Requirements, Types of Database Users-Creating, altering and Deleting Users. 5.2 Protecting the data within database-Database Privileges: Systems privileges and object Privileges, Granting and Revoking Privileges: Grant and Revoke command. 5.3 Transaction: Concept, Properties and States of Transaction. 5.4 Database Backup -Types of Failures, Causes of failures. Database Backup Introduction, Types of Database Backups-Physical and Logical. 5.5 Database Recovery-Recovery concept, Recovery Techniques-Roll forward, Rollback,

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN



Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Database System Concepts	10	04	04	04	12
II	Relational Data Model	16	02	04	12	18
III	Interactive SQL and Advance SQL: SQL Performance Tuning	14	02	04	08	14
IV	PL/SQL Programming	14	02	04	10	16
V	Database security and Transaction Processing	10	02	04	04	10
Total		64	12	20	38	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare journal of practical.
- Undertake micro-projects.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Guide student(s) in undertaking micro-projects.
- Demonstrate students thoroughly before they start doing the practice.
- Encourage students to refer different websites to have deeper understanding of the subject.
- Observe continuously and monitor the performance of students in Lab..

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually**



undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

- Survey on various database System Software and compare it.
- Design E-R Diagram for Hospital/college/medical/Jewellery Shop/Library/Blood Bank.
- Design Normalized Database for Hospital/college/medical/Jewellery Shop / Library / Blood Bank.
- Apply trigger on given database.
- Create procedure and function according to given condition.
- Any other micro-projects suggested by subject faculty on similar line.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Introduction to Database Management Systems	ISRD Group	McGraw Hill Education, New Delhi, 2015
2	Introduction to Relational databases & SQL programming	Allen	McGraw Hill Education, New Delhi, 2015
3	Database System Concepts McGraw Hillin ANSI C	Korth	McGraw Hill Education, New Delhi, 2015
4	Complete Reference:Mysql	Vikram Vaswani	McGraw Hill Education, New Delhi, 2015

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

- www.tutorialpoint.com (Important website)
- wielyIndia.com or DreamtechPress.com
- <http://phindia.com/gupta/chapter/chapter1.pdf>
- www.williamstannings.com
- www.nptel.ac.in
- <https://www.khanacademy.org/>



Program Name : Computer and Electronics Engineering Program Group
Program Code : CO/CM/CW/DE/EJ/ET/EN/EX/EQ/IE/IS/IC/MU
Semester : Third
Course Title : Digital Techniques
Course Code : 22320

1. RATIONALE

In the present scenario most of the electronic equipment like computers, mobiles, music systems, ATM, automation and control circuits and systems are based on digital circuits which the diploma electronic engineering passouts (also called technologists) have to test them. The knowledge of basic logic gates, combinational and sequential logic circuits using discrete gates as well as digital ICs will enable the students to interpret the working of equipment and maintain them. After completion of the course, students will be able to develop digital circuits based applications.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Build/ test digital logic circuits consist of digital ICs.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

- Use number system and codes for interpreting working of digital system.
- Use Boolean expressions to realize logic circuits.
- Build simple combinational circuits.
- Build simple sequential circuits.
- Test data converters and PLDs in digital electronics systems.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
4	-	2	6	3	70	28	30*	00	100	40	25#	10	25	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the

course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

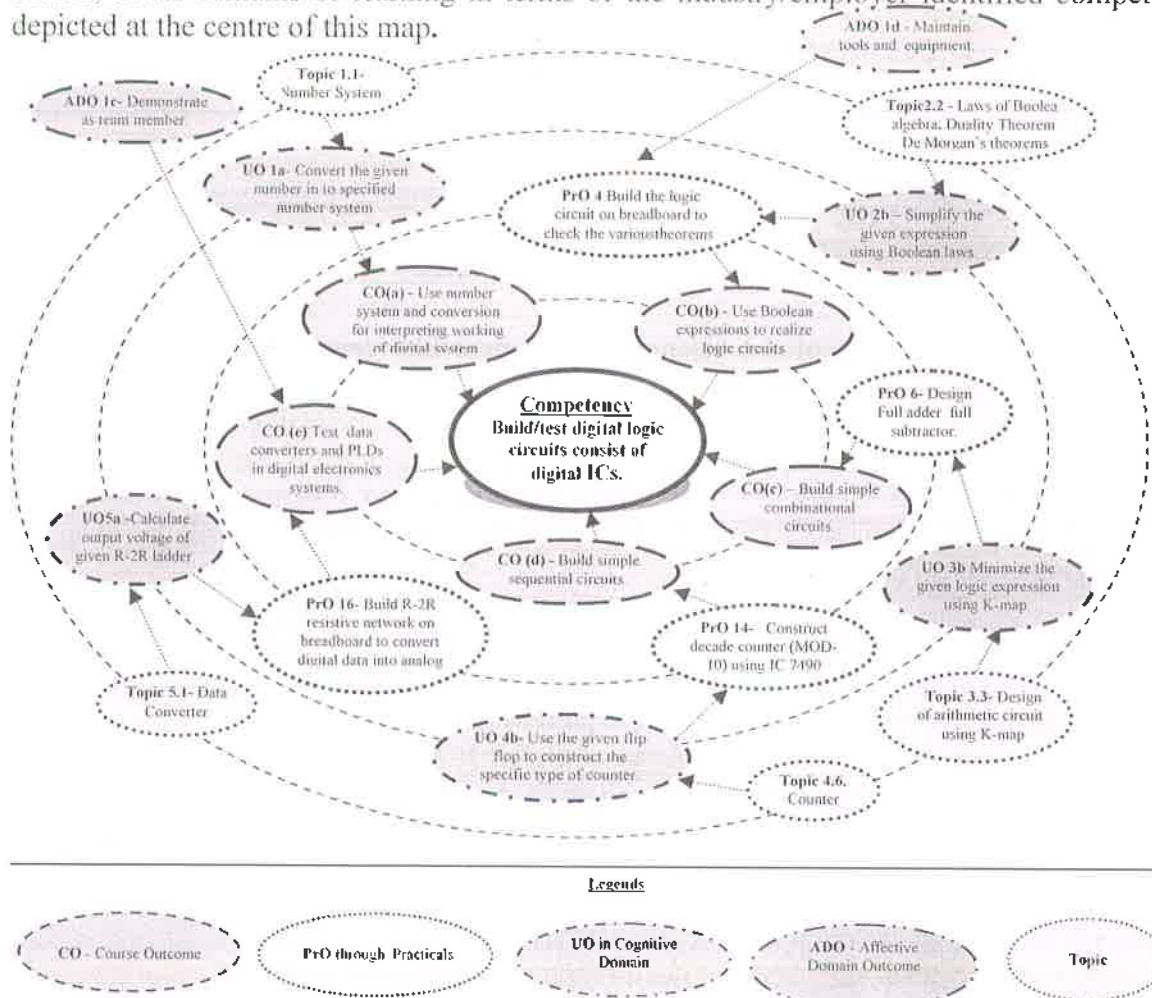


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Test the functionality of specified logic gates using breadboard. (IC 7404, 7408, 7432, 7486)	II	02*
2	Test the functionality of NAND and NOR gate of using breadboard (IC 7400 and 7402)	II	02
3	Construct AND, OR, NOT gates using universal gates.	II	02
4	Build the logic circuit on breadboard to check the De Morgan's theorems.	II	02
5	Design Half adder and Half subtractor using Boolean expressions.	III	02*
6	Design Full adder and full subtractor.	III	02
7	Construct and test BCD to 7 segment decoder using IC 7447/ 7448.	III	02
8	Build / test function of MUX 74151/74150/any other equivalent.	III	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
9	Build / test function of DEMUX 74155/74154/any other equivalent.	III	02
10	Build / test function of RS flip flop using NAND Gate.	IV	02*
11	Build / test function of MS JK flip flop using 7476.	IV	02
12	Use IC 7476 to construct and test the functionality of D and T flip flop.	IV	02
13	Implement 4 bit ripple counter using 7476.	IV	02
14	Use IC 7490 to construct decade counter (MOD-10).	IV	02
15	Implement 4 bit universal shift register.	IV	02
16	Build R-2R resistive network on breadboard to convert given digital data into analog.	V	02*
Total			32

Note

- A suggestive list of **PrOs** is given in the above table. More such **PrOs** can be added to attain the **COs** and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each **PrO** is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
a.	Preparation of experimental set up	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		100

The above **PrOs** also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical practices.

The ADOs are not specific to any one **PrO**, but are embedded in many **PrOs**. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year



- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. S. No.
1	Digital Multimeter: 3 and ½ digit with R, V, I measurements, diode and BJT testing.	All
2	CRO : Dual Channel, 4 Trace CRT / TFT based Bandwidth 20 MHz/30 MHz X10 magnification 20 ns max sweep rate, Alternate triggering Component tester and with optional features such as Digital Read out.	16
3	Pulse Generator: TTL pulse generator	10-15
4	DIGITAL IC tester: Tests a wide range of Analog and Digital IC's such as 74 Series, 40/45 Series of CMOS IC's.	1-15
5	Bread Board Development System: Bread Board system with DC power output 5V, +/-12V and 0-5V variable , digital voltmeter , ammeter, LED indicators 8 no, logic input switches 8 no, 7 segment display 2 no, clock generator, Manual pulser, Breadboard with about 1,600 points, Potentiometer, relay etc	1-15
6	Trainer kits for digital ICs: Trainer kit shall consists of digital ICs for logic gates, flop-flop, shift registers, counter along with toggle switches for inputs and bi-colour LED at outputs, built in power supply.	1-15
7	Regulated power supply: Floating DC Supply Voltages Dual DC : 2 x 0 -30V; 0-2 A Automatic Overload (Current Protection) Constant Voltage and Constant Current Operation Digital Display for Voltage and Current Adjustable Current Limiter Excellent Line and Load Regulation	1-16
8	Trainer kit for 4 bit Counter using Flip Flops: 4 bit ripple counter, Synchronous Counter, IC 7476 based circuit. Input given by switches and output indicated on LED. Facility to select MOD 8 or MOD 16 mode. Built in DC power supply and manual pulser with indicator.	13

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Number System and Codes	1a. Convert the given number into the specified number system. 1b. Perform the binary arithmetic operation on the given binary numbers. 1c. Convert the given coded number into the other specified code.	1.1 Number System: base or radix of number system, binary, octal, decimal and hexadecimal number system. 1.2 Binary Arithmetic: Addition, subtraction, multiplication, division. 1.3 Subtraction using 1's complement and 2's complement. 1.4 Codes: BCD, Gray Code, Excess-3, and ASCII code.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	1d. Add the given two decimal numbers using BCD code.	1.5 BCD Arithmetic: BCD Addition
Unit – II Logic gates and logic families	2a. Develop the basic gates using the given NAND/NOR gate as universal gate. 2b. Simplify the given expression using Boolean laws. 2c. Develop logic circuits using the given Boolean expressions. 2d. Compare the salient characteristics of the given digital logic families.	2.1 Logic gates: Symbol, diode/ transistor switch circuit and logical expression, truth table of basic logic gates (AND, OR, NOT), Universal gates (NAND and NOR) and Special purpose gates (EX-OR, EX-NOR), Tristate logic 2.2 Boolean algebra: Laws of Boolean algebra, Duality Theorem, De-Morgan's theorems 2.3 Logic Families: Characteristics of logic families : Noise margin, Power dissipation, Figure of merit, Fan-in and fan-out, Speed of operation, Comparison of TTL, CMOS, types of TTL NAND gate
Unit– III Combinational Logic Circuits	3a. Develop logic circuits in standard SOP/ POS form for the given logical expression. 3b. Minimize the given logic expression using K-map. 3c. Use IC 7483 to design the given adder/ subtractor. 3d. Draw MUX/DEMUX tree for the given number of input and output lines. 3e. Write the specifications of the component for the given application. 3f. Develop the specified type of code converter.	3.1 Standard Boolean representation: Sum of Product (SOP) and Product of Sum (POS), Min-term and Max-term, conversion between SOP and POS forms, realization using NAND /NOR gates 3.2 K-map reduction technique for the Boolean expression: Minimization of Boolean functions up to 4 variables (SOP and POS form) 3.3 Design of arithmetic circuits and code converter using K-map: Half and full Adder, half and full Subtractor, gray to binary and binary to gray (up to 4 bits) 3.4 Arithmetic circuits: (IC 7483) Adder and Subtractor, BCD adder 3.5 Encoder/Decoder: Basics of encoder, decoder, comparison, (IC 7447) BCD to 7 segment decoder/driver 3.6 Multiplexer and Demultiplexer: working, truth table and applications of Multiplexers and Demultiplexures, MUX tree, IC 74151 as MUX; DEMUX tree, DEMUX as decoder, IC 74155 as DEMUX 3.7 Buffer: Tristate logic, unidirectional and bidirectional buffer (IC 74LS244, 74LS245)



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit- IV Sequential Logic Circuit	4a. Use relevant triggering technique for the given digital circuit. 4b. Use the given flip-flop to construct the specific type of counter. 4c. Use excitation table of the given flip-flop to design synchronous counter. 4d. Design the specified modulo-N counter using IC7490. 4e. Construct ring/ twisted ring counter using the given flip-flop.	4.1 Basic memory cell: RS-latch using NAND and NOR 4.2 Triggering Methods: Edge trigger and level trigger 4.3 SR Flip Flops: SR-flip flop, clocked SR flip flop with preset and clear, drawbacks of SR flip flop 4.4 JK Flip Flops: Clocked JK Flip flop with preset and clear, race around condition in JK flip flop, Master slave JK flip flop, D and T type flip flop Excitation table of flip flops, Block schematic and function table of IC-7474, 7475 4.5 Shift Register: Logic diagram of 4-bit Shift registers – Serial Input Serial Output, Serial Input Parallel Output, Parallel Input Serial Output, Parallel Input Parallel Output, 4 Bit Universal Shift register 4.6 Counters: Asynchronous counter: 4 bit Ripple counter, 4 bit up/down Counter, modulus of counter Synchronous counter: Design of 4 bit synchronous up/down counter Decade counter: Block schematic of IC 7490 Decade counter, IC 7490 as MOD-N Counter, Ring counter, Twisted ring counter
Unit- V Data Converters and PLDs	5a. Calculate the output voltage of the R-2R ladder for the given specified digital input. 5b. Calculate the output voltage of the weighted resistor DAC for the given specified digital input. 5c. Explain with sketches the working principle of the given type of ADC. 5d. Explain with sketches the working principle of the given types of memories. 5e. Explain with basic block diagram the working principle of the given type of programmable logic device.	5.1 Data Converter: DAC: Types, weighted resistor circuit and R-2R ladder circuit, DAC IC 0808 specifications ADC: Block Diagram, types, and working of Dual slope ADC, SAR ADC, ADC IC 0808/0809, specification 5.2 Memory: RAM and ROM basic building blocks, read and write operation, types of semiconductor memories 5.3 PLD: Basic building blocks and types of PLDs, PLA, PAL, GAL 5.4 CPLD: Basic Building blocks, functionality.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Number System	06	2	2	4	08
II	Logic gates and logic families	10	4	4	4	12
III	Combinational Logic Circuits	16	4	6	8	18
IV	Sequential Logic Circuit	16	4	6	8	18
V	Data Converters and PLDs	16	4	4	6	14
Total		64	18	22	30	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare the survey report on the applications of different types of number system and code converters used in the design of digital system.
- Compare technical specifications and applications of various types of memory, PLDs, CPLDs and Prepare report.
- Test digital IC's using various testing equipment like digital IC tester, Digital multi-meter etc.
- Give seminar on any course relevant topic.
- Conduct library / internet survey regarding different data sheet and manuals.
- Prepare power point presentation on digital circuits and their applications.
- Undertake a market survey of different digital IC's required for different applications.
- Search for video / animations / power point presentation on internet for complex topic related to the course and make a presentation.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.



- e. Guide student(s) in undertaking micro-projects.
- f. PPTs/Animations may be used to explain the construction and working of electronic circuits.
- g. Guide students for using data sheets / manuals.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs. Micro project report may be of four to five pages.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

- a. Build a Digital IC tester circuit.
- b. Build a 4bit parity generator and parity checker circuit.
- c. Build a circuit to implement 4 bit adder.
- d. Build a circuit to test 7 segment display.
- e. Build a circuit to implement debounce switch.
- f. Build a circuit for LED flasher.
- g. Build a circuit for LED BAR display
- h. Design and analyze digital arithmetic circuit

Note: Use general purpose PCB for making micro projects

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Modern Digital Electronics	Jain, R.P.	McGraw-Hill Publishing, New Delhi, 2009 ISBN: 9780070669116
2	Digital Circuits and Design	Salivahanan S.; Arivazhagan S.	Vikas Publishing House, New Delhi, 2013, ISBN: 9789325960411
3	Digital Electronics	Puri, V.K.	McGraw Hill, New Delhi, 2016, ISBN: 97800746331751
4	Digital Principles	Malvino, A.P.; Leach, D.P.; Saha G.	McGraw Hill Education, New Delhi, 2014, ISBN : 9789339203405
5	Digital Design	Mano, Morris; Ciletti, Michael D.	Pearson Education India, Delhi, 2007, ISBN: 9780131989245
6	Digital Electronics, Principles and Integrated Circuits	Maini, Anil K.	Wiley India, Delhi, 2007, ISBN: 9780470032145



S. No.	Title of Book	Author	Publication
7	Digital Fundamentals	Floyd, Thomas	Pearson Education India, Delhi, 2014, ISBN : 9780132737968

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

- a. www.cse.yorku.ca/~mack/1011/01.NumberSystems.ppt
- b. www.people.sju.edu/~ggrevera/arch/slides/binary-arithmetic.ppt
- c. www.mathsisfun.com/binary-number-system.html
- d. www.codesandtutorials.com/hardware/electronics/digital_codes-types.php
- e. www.ee.surrey.ac.uk/Projects/Labview/gatesfunc/
- f. www.ee.surrey.ac.uk/Projects/Labview/boolalgebra/
- g. www.eng.auburn.edu/~strouce/class/elec2200/elec2200-8.pdf
- h. www.maxwell.ict.griffith.edu.au/yg/teaching/dns/dns_module3_p3.pdf
- i. www.scs.ryerson.ca/~aabhari/cps213Chapter5.ppt
- j. www.eng.wayne.edu/~singhweb/seq1.ppt
- k. www.cs.sjsu.edu/faculty/lee/Ch2Problems2.ppt
- l. www.rogtronics.net/files/datasheets/dac/SedraSmith.pdf
- m. www-old.me.gatech.edu/mechatronics_course/ADC_F04.ppt
- n. www.allaboutcircuits.com/vol_4/chpt_13/3.html
- o. www.youtube.com/watch?v=5Wz5f3n5sjs
- p. www.eee.metu.edu.tr/~cb/e447/Chapter%209%20-%20v2.0.pdf
- q. www2.cs.siu.edu/~hexmoor/classes/CS315-S09/Chapter9-ROM.ppt
- r. www.cms.gcg11.org/attachments/article/95/Memory2.ppt
- s. www.cosc.brocku.ca/Offerings/3P92/seminars/Flash.ppt
- t. www.webopedia.com/TERM/R/RAM.html
- u. www.cs.sjsu.edu/~lee/cs147/Rahman.ppt





Maharashtra State Board Of Technical Education, Mumbai
Teaching And Examination Scheme For Post S.S.C. Diploma Courses

Program Name : Diploma in Electronics & Tele-Communication, Diploma in Electronics, Diploma in Communication Technology, Diploma in Communication Engineering, Diploma in Electronics Engineering

Program Code : EJ/EN/EQ/ET/EX With Effect From Academic Year: 2017 - 18

Duration of Program : 6 Semesters Duration : 16 Weeks

Semester : Third Scheme – I

S. N.	Course Title	Course Abbreviation	Course Code	Teaching Scheme			Credit (L+T+P)	Examination Scheme														Grand Total		
				L	T	P		Theory								Practical								
								Exam Duration in Hrs.	ESE		PA		Total		ESE		PA		Total					
									Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
1	Digital Techniques	DTE	22320	4	-	2	6	3	70	28	30*	00	100	40	25#	10	25	10	50	20	150			
2	Applied Electronics	AEL	22329	4	-	4	8	3	70	28	30*	00	100	40	50#	20	50	20	100	40	200			
3	Electric Circuits and Networks	ECN	22330	3	2	2	7	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150			
4	ElectronicMeasurements and Instrumentation	EMI	22333	4	-	4	8	3	70	28	30*	00	100	40	50@	20	50	20	100	40	200			
5	Principles of Electronic Communication	PEC	22334	4	-	2	6	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150			
Total				19	2	14	35	--	350	--	150	--	500	--	175	--	175	--	350	--	850			

Student Contact Hours Per Week: **35 Hrs.** Medium of Instruction: **English**

Theory and practical periods of 60 minutes each. Total Marks : 850

Abbreviations: ESE- End Semester Exam, PA- Progressive Assessment, L - Lectures, T - Tutorial, P - Practical

@ Internal Assessment, # External Assessment, *# On Line Examination, ^ Computer Based Assessment

* Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment (5marks each for Physics and Chemistry) to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain LOs required for the attainment of the COs.

~ For the courses having ONLY Practical Examination, the PA marks. Practical Part - with 60% weightage and Micro-Project Part with 40% weightage

➤ **If Candidate not securing minimum marks for passing in the "PA" part of practical of any course of any semester then the candidate shall be declared as "Detained" for that semester.**



Program Name : Computer and Electronics Engineering Program Group
Program Code : CO/CM/CW/DE/EJ/ET/EN/EX/EQ/IE/IS/IC/MU
Semester : Third
Course Title : Digital Techniques
Course Code : 22320

1. RATIONALE

In the present scenario most of the electronic equipment like computers, mobiles, music systems, ATM, automation and control circuits and systems are based on digital circuits which the diploma electronic engineering passouts (also called technologists) have to test them. The knowledge of basic logic gates, combinational and sequential logic circuits using discrete gates as well as digital ICs will enable the students to interpret the working of equipment and maintain them. After completion of the course, students will be able to develop digital circuits based applications.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Build/ test digital logic circuits consist of digital ICs.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

- Use number system and codes for interpreting working of digital system.
- Use Boolean expressions to realize logic circuits.
- Build simple combinational circuits.
- Build simple sequential circuits.
- Test data converters and PLDs in digital electronics systems.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
4	-	2	6	3	70	28	30*	00	100	40	25#	10	25	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the



course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

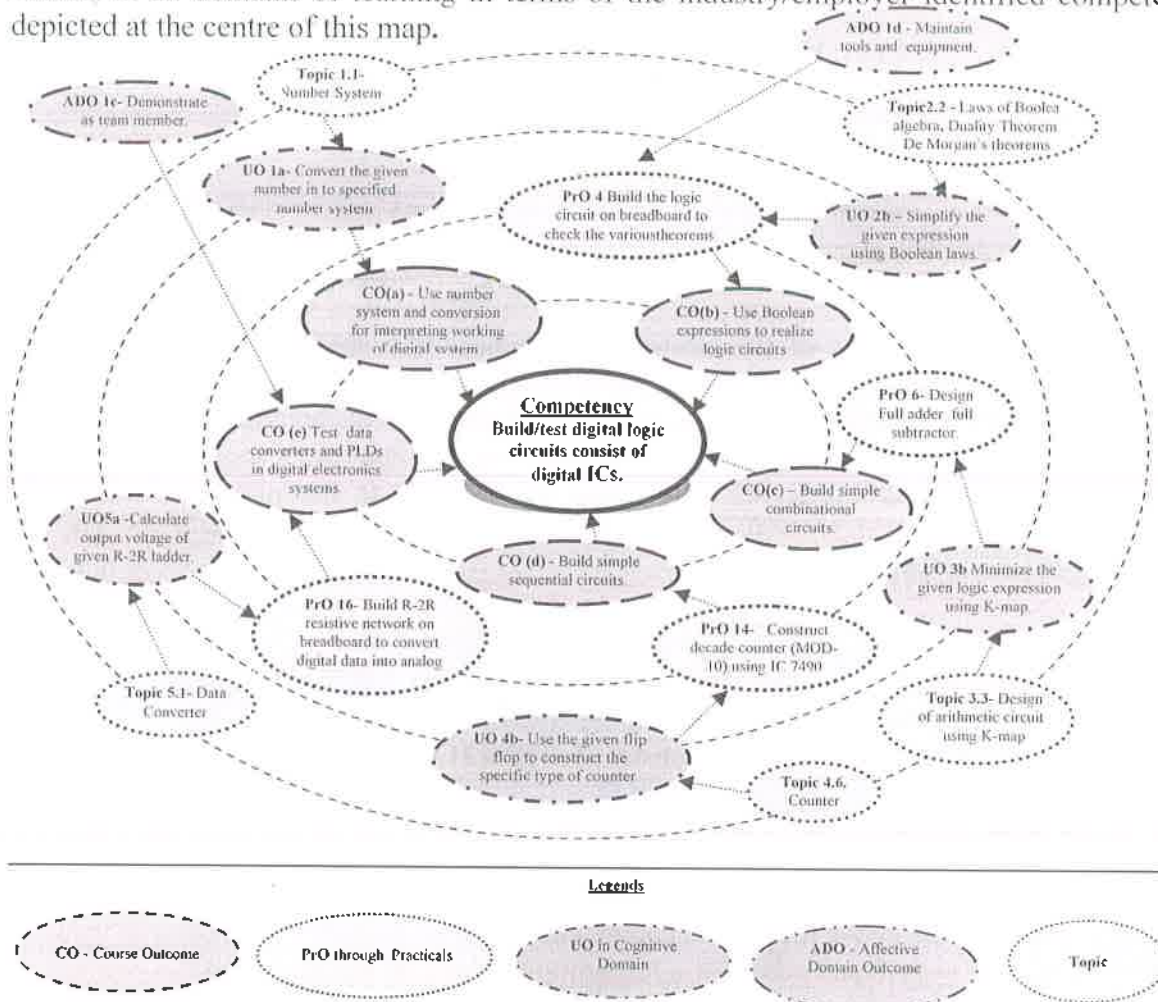


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Test the functionality of specified logic gates using breadboard. (IC 7404, 7408, 7432, 7486)	II	02*
2	Test the functionality of NAND and NOR gate of using breadboard (IC 7400 and 7402)	II	02
3	Construct AND, OR, NOT gates using universal gates.	II	02
4	Build the logic circuit on breadboard to check the De Morgan's theorems.	II	02
5	Design Half adder and Half subtractor using Boolean expressions.	III	02*
6	Design Full adder and full subtractor.	III	02
7	Construct and test BCD to 7 segment decoder using IC 7447/ 7448.	III	02
8	Build / test function of MUX 74151/ 74150/any other equivalent.	III	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
9	Build / test function of DEMUX 74155/74154/any other equivalent.	III	02
10	Build / test function of RS flip flop using NAND Gate.	IV	02*
11	Build / test function of MS JK flip flop using 7476.	IV	02
12	Use IC 7476 to construct and test the functionality of D and T flip flop.	IV	02
13	Implement 4 bit ripple counter using 7476.	IV	02
14	Use IC 7490 to construct decade counter (MOD-10).	IV	02
15	Implement 4 bit universal shift register.	IV	02
16	Build R-2R resistive network on breadboard to convert given digital data into analog.	V	02*
Total			32

Note

- A suggestive list of **PrOs** is given in the above table. More such **PrOs** can be added to attain the **COs** and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each **PrO** is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
a.	Preparation of experimental set up	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		100

The above **PrOs** also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical practices.

The ADOs are not specific to any one **PrO**, but are embedded in many **PrOs**. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year



- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. S. No.
1	Digital Multimeter: 3 and ½ digit with R, V, I measurements, diode and BJT testing.	All
2	CRO : Dual Channel, 4 Trace CRT / TFT based Bandwidth 20 MHz/30 MHz X10 magnification 20 ns max sweep rate, Alternate triggering Component tester and with optional features such as Digital Read out.	16
3	Pulse Generator: TTL pulse generator	10-15
4	DIGITAL IC tester: Tests a wide range of Analog and Digital IC's such as 74 Series, 40/45 Series of CMOS IC's.	1-15
5	Bread Board Development System: Bread Board system with DC power output 5V, +/-12V and 0-5V variable, digital voltmeter, ammeter. LED indicators 8 no, logic input switches 8 no, 7 segment display 2 no, clock generator, Manual pulser, Breadboard with about 1,600 points, Potentiometer, relay etc	1-15
6	Trainer kits for digital ICs: Trainer kit shall consists of digital ICs for logic gates, flop-flop, shift registers, counter along with toggle switches for inputs and bi-colour LED at outputs, built in power supply.	1-15
7	Regulated power supply: Floating DC Supply Voltages Dual DC : 2 x 0 -30V; 0-2 A Automatic Overload (Current Protection) Constant Voltage and Constant Current Operation Digital Display for Voltage and Current Adjustable Current Limiter Excellent Line and Load Regulation	1-16
8	Trainer kit for 4 bit Counter using Flip Flops: 4 bit ripple counter, Synchronous Counter, IC 7476 based circuit. Input given by switches and output indicated on LED. Facility to select MOD 8 or MOD 16 mode. Built in DC power supply and manual pulser with indicator.	13

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Number System and Codes	1a. Convert the given number into the specified number system. 1b. Perform the binary arithmetic operation on the given binary numbers. 1c. Convert the given coded number into the other specified code.	1.1 Number System: base or radix of number system, binary, octal, decimal and hexadecimal number system. 1.2 Binary Arithmetic: Addition, subtraction, multiplication, division. 1.3 Subtraction using 1's complement and 2's complement. 1.4 Codes: BCD, Gray Code, Excess-3, and ASCII code.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	1d. Add the given two decimal numbers using BCD code.	1.5 BCD Arithmetic: BCD Addition
Unit – II Logic gates and logic families	2a. Develop the basic gates using the given NAND/NOR gate as universal gate. 2b. Simplify the given expression using Boolean laws. 2c. Develop logic circuits using the given Boolean expressions. 2d. Compare the salient characteristics of the given digital logic families.	2.1 Logic gates: Symbol, diode/ transistor switch circuit and logical expression, truth table of basic logic gates (AND, OR, NOT), Universal gates (NAND and NOR) and Special purpose gates (EX-OR, EX-NOR), Tristate logic 2.2 Boolean algebra: Laws of Boolean algebra, Duality Theorem, De-Morgan's theorems 2.3 Logic Families: Characteristics of logic families : Noise margin, Power dissipation, Figure of merit, Fan-in and fan-out, Speed of operation, Comparison of TTL, CMOS, types of TTL NAND gate
Unit– III Combinational Logic Circuits	3a. Develop logic circuits in standard SOP/ POS form for the given logical expression. 3b. Minimize the given logic expression using K-map. 3c. Use IC 7483 to design the given adder/ subtractor. 3d. Draw MUX/DEMUX tree for the given number of input and output lines. 3e. Write the specifications of the component for the given application. 3f. Develop the specified type of code converter.	3.1 Standard Boolean representation: Sum of Product (SOP) and Product of Sum (POS), Min-term and Max-term, conversion between SOP and POS forms, realization using NAND /NOR gates 3.2 K-map reduction technique for the Boolean expression: Minimization of Boolean functions up to 4 variables (SOP and POS form) 3.3 Design of arithmetic circuits and code converter using K-map: Half and full Adder, half and full Subtractor, gray to binary and binary to gray (up to 4 bits) 3.4 Arithmetic circuits: (IC 7483) Adder and Subtractor, BCD adder 3.5 Encoder/Decoder: Basics of encoder, decoder, comparison, (IC 7447) BCD to 7 segment decoder/driver 3.6 Multiplexer and Demultiplexer: working, truth table and applications of Multiplexers and Demultiplexures, MUX tree, IC 74151 as MUX; DEMUX tree, DEMUX as decoder, IC 74155 as DEMUX 3.7 Buffer: Tristate logic, unidirectional and bidirectional buffer (IC 74LS244, 74LS245)



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit- IV Sequential Logic Circuit	4a. Use relevant triggering technique for the given digital circuit. 4b. Use the given flip-flop to construct the specific type of counter. 4c. Use excitation table of the given flip-flop to design synchronous counter. 4d. Design the specified modulo-N counter using IC7490. 4e. Construct ring/ twisted ring counter using the given flip-flop.	4.1 Basic memory cell: RS-latch using NAND and NOR 4.2 Triggering Methods: Edge trigger and level trigger 4.3 SR Flip Flops: SR-flip flop, clocked SR flip flop with preset and clear, drawbacks of SR flip flop 4.4 JK Flip Flops: Clocked JK Flip flop with preset and clear, race around condition in JK flip flop, Master slave JK flip flop, D and T type flip flop Excitation table of flip flops, Block schematic and function table of IC-7474, 7475 4.5 Shift Register: Logic diagram of 4-bit Shift registers – Serial Input Serial Output, Serial Input Parallel Output, Parallel Input Serial Output, Parallel Input Parallel Output, 4 Bit Universal Shift register 4.6 Counters: Asynchronous counter: 4 bit Ripple counter, 4 bit up/down Counter, modulus of counter Synchronous counter: Design of 4 bit synchronous up/down counter Decade counter: Block schematic of IC 7490 Decade counter, IC 7490 as MOD-N Counter, Ring counter, Twisted ring counter
Unit- V Data Converter s and PLDs	5a. Calculate the output voltage of the R-2R ladder for the given specified digital input. 5b. Calculate the output voltage of the weighted resistor DAC for the given specified digital input. 5c. Explain with sketches the working principle of the given type of ADC. 5d. Explain with sketches the working principle of the given types of memories. 5e. Explain with basic block diagram the working principle of the given type of programmable logic device.	5.1 Data Converter: DAC: Types, weighted resistor circuit and R-2R ladder circuit, DAC IC 0808 specifications ADC: Block Diagram, types, and working of Dual slope ADC, SAR ADC, ADC IC 0808/0809, specification 5.2 Memory: RAM and ROM basic building blocks, read and write operation, types of semiconductor memories 5.3 PLD: Basic building blocks and types of PLDs, PLA, PAL, GAL 5.4 CPLD: Basic Building blocks, functionality.

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- Prepare the survey report on the applications of different types of number system and code converters used in the design of digital system.
- Compare technical specifications and applications of various types of memory, PLDs, CPLDs and Prepare report.
- Test digital IC's using various testing equipment like digital IC tester, Digital multi-meter etc.
- Give seminar on any course relevant topic.
- Conduct library / internet survey regarding different data sheet and manuals.
- Prepare power point presentation on digital circuits and their applications.
- Undertake a market survey of different digital IC's required for different applications.
- Search for video / animations / power point presentation on internet for complex topic related to the course and make a presentation.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
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- With respect to item No.10, teachers should ensure to create opportunities and provisions for **co-curricular activities**.

- e. Guide student(s) in undertaking micro-projects.
- f. PPTs/Animations may be used to explain the construction and working of electronic circuits.
- g. Guide students for using data sheets / manuals.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be *individually* undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs. Micro project report may be of four to five pages.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

- a. Build a Digital IC tester circuit.
- b. Build a 4bit parity generator and parity checker circuit.
- c. Build a circuit to implement 4 bit adder.
- d. Build a circuit to test 7 segment display.
- e. Build a circuit to implement debounce switch.
- f. Build a circuit for LED flasher.
- g. Build a circuit for LED BAR display
- h. Design and analyze digital arithmetic circuit

Note: Use general purpose PCB for making micro projects

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Modern Digital Electronics	Jain, R.P.	McGraw-Hill Publishing, New Delhi. 2009 ISBN: 9780070669116
2	Digital Circuits and Design	Salivahanan S.; Arivazhagan S.	Vikas Publishing House, New Delhi, 2013. ISBN: 9789325960411
3	Digital Electronics	Puri, V.K.	McGraw Hill, New Delhi, 2016, ISBN: 97800746331751
4	Digital Principles	Malvino, A.P.; Leach, D.P.; Saha G.	McGraw Hill Education, New Delhi, 2014, ISBN : 9789339203405
5	Digital Design	Mano, Morris; Ciletti, Michael D.	Pearson Education India, Delhi, 2007. ISBN: 9780131989245
6	Digital Electronics, Principles and Integrated Circuits	Maini, Anil K.	Wiley India, Delhi, 2007, ISBN: 9780470032145



S. No.	Title of Book	Author	Publication
7	Digital Fundamentals	Floyd, Thomas	Pearson Education India, Delhi, 2014, ISBN : 9780132737968

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

- a. www.cse.yorku.ca/~mack/1011/01.NumberSystems.ppt
- b. www.people.sju.edu/~ggrevera/arch/slides/binary-arithmetic.ppt
- c. www.mathsisfun.com/binary-number-system.html
- d. www.codesandtutorials.com/hardware/electronics/digital_codes-types.php
- e. www.ee.surrey.ac.uk/Projects/Labview/gatesfunc/
- f. www.ee.surrey.ac.uk/Projects/Labview/boolalgebra/
- g. www.eng.auburn.edu/~strouce/class/elec2200/elec2200-8.pdf
- h. www.maxwell.ict.griffith.edu.au/yg/teaching/dns/dns_module3_p3.pdf
- i. www.scs.ryerson.ca/~aabhari/cps213Chapter5.ppt
- j. www.eng.wayne.edu/~singhweb/seq1.ppt
- k. www.cs.sjsu.edu/faculty/lee/Ch2Problems2.ppt
- l. www.rogtronics.net/files/datasheets/dac/SedraSmith.pdf
- m. www-old.me.gatech.edu/mechatronics_course/ADC_F04.ppt
- n. www.allaboutcircuits.com/vol_4/chpt_13/3.html
- o. www.youtube.com/watch?v=5Wz5f3n5sjs
- p. www.eee.metu.edu.tr/~cb/e447/Chapter%209%20-%20v2.0.pdf
- q. www2.cs.siu.edu/~hexmoor/classes/CS315-S09/Chapter9-ROM.ppt
- r. www.cms.gcg11.org/attachments/article/95/Memory2.ppt
- s. www.cosc.brocku.ca/Offerings/3P92/seminars/Flash.ppt
- t. www.webopedia.com/TERM/R/RAM.html
- u. www.cs.sjsu.edu/~lee/cs147/Rahman.ppt



Program Name : Electronics Engineering, Digital Electronics and Instrumentation Engineering Program Group

Program Code : DE/EJ/ET/EN/EX/EQ/IE/IS/IC

Semester : Third

Course Title : Applied Electronics

Course Code : 22329

1. RATIONALE

Enhanced use of electronic gadgets has made electronics engineers to deal with the various types of electronic circuits which generate the required analog/digital output. Transistor has remarkably expanded the utility of electronic equipment. Discrete components are widely used in amplifiers and other electronic systems which the engineering diploma holders (also called as technologist) have to use or maintain. The learning of basic operating principles of electronic circuits will help the students to use the basic electronic equipment. This course is developed in such a way that, students will be able to apply the knowledge of basic electronic circuit working to solve broad based electronic engineering application problems.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Use discrete electronic devices and voltage regulators.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

- Use transistor as low Power amplifier.
- Use BJT as high Power amplifier.
- Use BJT as feedback amplifier.
- Use BJT as waveform generator.
- Maintain IC voltage regulator and SMPS.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
4	-	4	8	3	70	28	30*	00	100	40	50#	20	50	20	100	40

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

Legends: L-Lecture; T- Tutorial/Teacher Guided Theory Practice; P- Practical; C- Credit, ESE - End Semester Examination; PA - Project Assessment.



5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

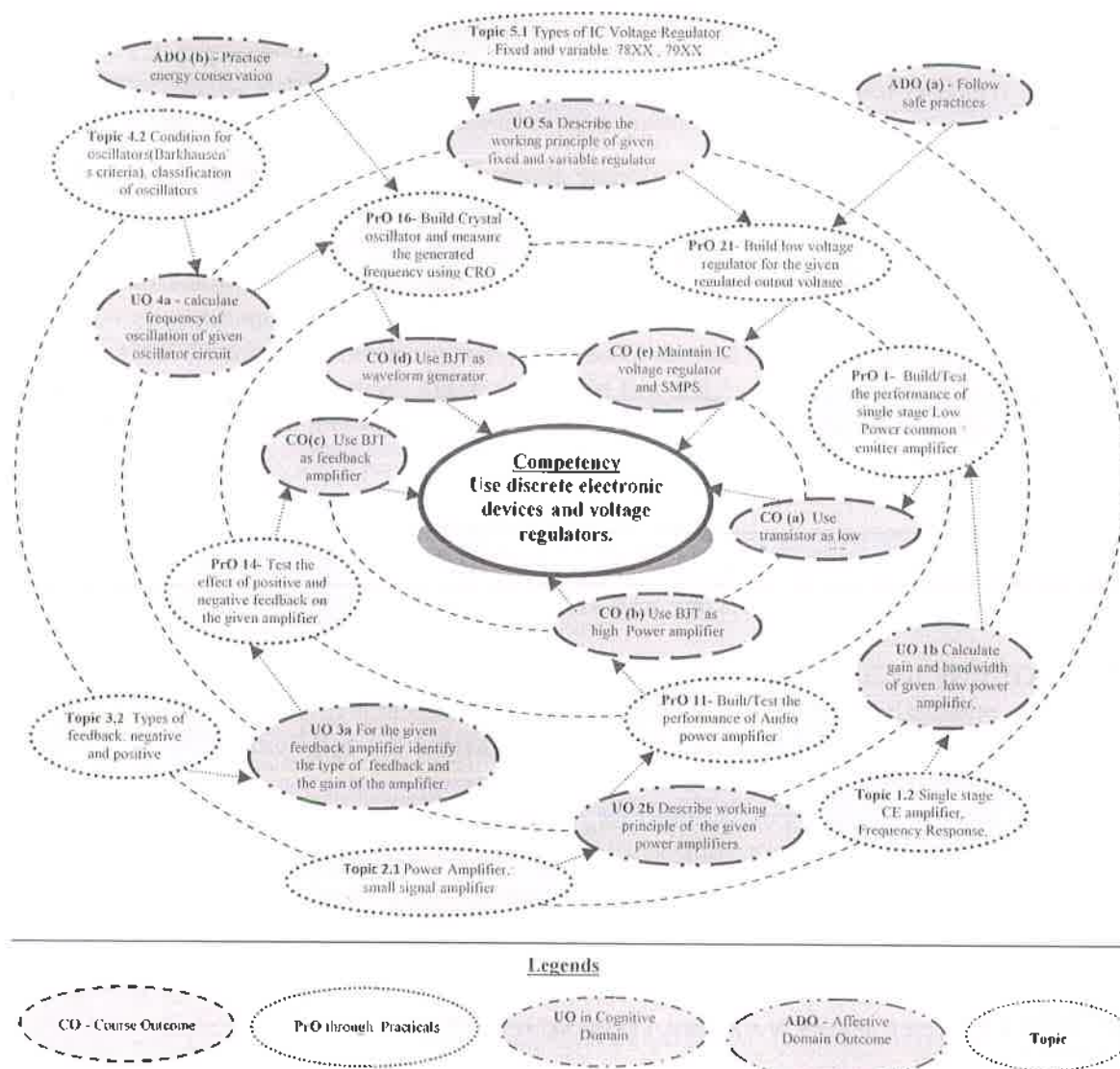


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

** Use bread board for the following Practials (wherever applicable).*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Build/test the performance of single stage Low Power common emitter amplifier.	I	2*
2	Simulate / test out put Wave form of single stage common	I	2

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	emitter (CE) amplifier using simulation software(like spice, multisim).		
3	Simulate/test the output Wave form of single Stage common source FET amplifier using simulation software	I	2
4	Build/test the performance of single stage Common source FET amplifier.	I	2
5	Build/test the performance of two stage RC Coupled common emitter amplifier using transistor.	I	2*
6	Build/test the performance of two stage direct Coupled amplifier using transistor.	I	2
7	Build/Test the performance of transformer Coupled amplifier.(Part-I)	I	2*
8	Build/Test the performance of transformer Coupled amplifier.(Part-II)	I	2*
9	Build/test the performance of single tuned amplifier using transistor.	I	2
10	Build/test performance of double tuned common Emitter amplifier. (Part-I)	I	2
11	Build/test performance of double tuned common Emitter amplifier. (Part-II)	I	2
12	Build/test performance parameters of single stage class A power amplifier.	II	2
13	Build/test performance parameters of class B Push pull amplifier using transistor.	II	2
14	Build/test the performance of Audio power amplifier.	II	2*
15	Use transistor to build/ test voltage series Feedback amplifier parameters with and without feedback.	III	2
16	Use transistor to built/ test voltage shunt Feedback amplifier parameters with and without feedback.	III	2
17	Test the effect of positive and negative feedback on the given amplifier.(Part-I)	III	2*
18	Test the effect of positive and negative feedback on the given amplifier.(Part-II)	III	2*
19	Build RC phase shift oscillator and measure the generated frequency using CRO.	IV	2
20	Build Crystal oscillator and measure the generated frequency using CRO.	IV	2
21	Simulate Hartley oscillator using any relevant simulation software. (Like spice, multisim. Lab view, LTspice, Octave).	IV	2*
22	Generate a waveform using Miller's sweep generator and measure sweep time and retrace time.	IV	2
23	Simulate dual voltage regulator using IC78XX and 79XX for the specified regulated output voltage	V	2*
24	Build dual voltage regulator for the specified Regulated output voltage.	V	2
25	Build low voltage regulator using IC723 for the given regulated output voltage. (2V to 7V)	V	2*
26	Build high voltage regulator using IC723 for the given regulated output voltage.(7 V to 37 V)	V	2



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
27	Test the performance parameters of voltage regulator using IC LM317.	V	2*
Total			54

Note

- A suggestive list of **PrOs** is given in the above table. More such **PrOs** can be added to attain the **COs** and competency. A judicious mix of minimum 24 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each **PrO** is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and Recording	10
5	Interpretation of result and conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
Total		100

The above **PrOs** also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical practices.

The ADOs are not specific to any one **PrO**, but are embedded in many **PrOs**. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. S. No.
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S. No.	Equipment Name with Broad Specifications	PrO. S. No.
1	Variable DC power supply 0- 30V, 2A, SC protection	All
2	Dual Power supply 0- 30V, 2A	All
3	Cathode Ray Oscilloscope, Dual Trace 30Mhz and above, 1Mega Ω Input Impedance	1-16
4	Digital storage Oscilloscope, Dual Trace 20Mhz and above, 1Mega Ω Input Impedance	1-16
5	Function Generator 0-2 MHz with Sine, square and triangular output with variable frequency and amplitude	1-12
6	Digital Multimeter: 3and1/2 digit display, 9999 counts digital multimeter measures: V_{ac} , V_{dc} (1000V max) , A_{dc} , A_{ac} (10 amp max) , Resistance (0 - 100 M Ω) , Capacitance and diode ,transistor tester	All
7	Electronic Work Bench : Bread Board 840 -1000 contact points, Positive and Negative power rails on opposite side of the board , 0-30 V , 2 Amp Variable DC power supply, Function Generator 0-2MHz, CRO 0-30MHz , Digital multimeter	All
8	LCR-Q meter, Test frequency standard 100 Hz / 1 kHz; Parameter L-Q, C-D, R-Q and Z-Q,Parameters L 100 Hz, 120 Hz 1 mH - 9999 H 1 KHz 0.1 mH - 999.9 Ht,C 100 Hz, 120Hz 1 pF - 9999 mF Range 1 KHz 0.1 pF - 999.9 mF,Terminals 4 terminals.	All

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Low Power Amplifiers	1a. Explain with sketches the working principle of the given type of amplifier. 1b. Calculate gain and bandwidth of the given low power amplifier. 1c. Compare performance parameters of the given types of amplifier coupling. 1d. Select relevant tuned amplifier for the given frequency band with justification. 1e. Describe the environment employed for the given simulation work with justification.	1.1 Classification of Amplifiers, BJT as an amplifier . 1.2 Single stage CE amplifier, frequency response, gain, bandwidth 1.3 Multistage amplifier: General Multistage amplifier BJT based. 1.4 Type of BJT amplifier coupling: Circuit diagram , operation, frequency response and applications of RC, transformer and direct coupling 1.5 FET Amplifier: Common Source amplifier, working principle and applications 1.6 Tuned Amplifier: Need of tuned amplifier, basic tuned circuit, circuit diagram, operating principle and frequency response of Single tuned, Double tuned and stagger tuned amplifiers



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit- II High Power Amplifiers	2a. Explain with sketches the working of the given type of power amplifier. 2b. Select the relevant power amplifier for the given application with justification. 2c. Calculate efficiency of the given power amplifier. 2d. Compare the performance parameters of the given types of power amplifiers. 2e. Prepare the specifications of the given type of amplifier.	2.1 Power Amplifier: Comparison between small signal amplifier and power amplifier, performance parameter of power amplifier like : bandwidth, gain, frequency band, efficiency 2.2 Classification: Class A, Class B, Class AB and Class C 2.3 Circuit, operation, input /output waveforms, efficiency and power equations of Single Stage Class A, Class B, Class AB and Class C Power amplifier.
Unit III Feedback Amplifiers	3a. Calculate the gain of the amplifier for the given type of feedback amplifier. 3b. Explain effect of negative feedback on the given type of amplifier performance. 3c. Calculate Gain, Bandwidth, Input and Output resistance of the given feedback amplifier. 3d. Compare the performance of given types of negative feedback amplifiers.	3.1 Principle of feedback Amplifier 3.2 Types of feedback: negative and positive feedback, advantages and disadvantages of negative feedback 3.3 Types of feedback connections, voltage shunt, voltage series, current series and current shunt: block diagram, circuit diagram, and operation
Unit IV Wave form Generators	4a. Calculate frequency of oscillation for the given type of oscillator circuit. 4b. Select the relevant oscillator to obtain the given range of frequency with justification. 4c. Choose the relevant sweep generator to obtain the specified saw tooth waveform with justification. 4d. Prepare the specifications of the given oscillator.	4.1 Oscillators: Need, oscillator and amplifier 4.2 Condition for oscillation (Barkhausen's criteria), classification of oscillators 4.3 Sine wave Oscillator : RC Phase shift oscillator and crystal oscillator , concept , working and applications 4.4 Sweep generator: Miller sweep, Bootstrap circuit, current time base generator
Unit- V IC Voltage Regulators and SMPS	5a. Explain with sketches the working principle of given type of voltage regulator IC. 5b. Compare the working of the given types of regulators. 5c. Design voltage regulator for the specified output voltage. 5d. Interpret the working of given block of the SMPS.	5.1 Types of IC Voltage Regulator: Fixed and variable: 78XX, 79XX, specification, series and LM723, LM317, line and load regulation. 5.2 SMPS : Block diagram, working principle, specifications, special features, advantages , disadvantages and applications. Use of heat sink for regulated power supply.



Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Low Power Amplifiers	14	4	6	6	16
II	High Power Amplifiers	18	4	6	8	18
III	Feedback Amplifiers	12	4	4	4	12
IV	Waveform Generators	12	4	4	6	14
V	IC voltage Regulators and SMPS	08	2	4	4	10
Total		64	18	24	28	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Undertake micro-projects.
- Give seminar on any relevant topic.
- Library survey regarding different electronics circuits and voltage regulators.
- Prepare power point presentation for electronic circuits.
- Undertake a market survey of different electronics circuits and voltage regulators

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Guide student(s) in undertaking micro-projects.
- Guide students for using data manuals.
- Use PPTs to explain the construction and working of rectifier.
- Use PPTs to explain the construction and working of wave shaping circuits.



12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs. Micro project report may be of four to five pages.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

- Construct a doorbell using transistor.
- Using transistor construct a clap switch.
- Construct audio amplifier using (IC810 or equivalent IC).
- Construct power amplifier for FM receiver output.
- Drive a 4Ω speaker using class A amplifier which is directly coupled and test its performance parameters.
- Using ClassAB push pull amplifier drive (4Ω/8Ω) speaker, test its performance parameters.
- IC regulators: Build a circuit of Dual regulated power supply on general purpose PCB to obtain +/- 15 V, 500mA using IC 78XX & 79XX series.
- IC regulators: Build a regulated power supply on general purpose PCB to obtain + 5V, 500mA using IC 78XX series. Drive suitable load with regulated output.
- IC regulators: Build a regulated power supply on general purpose PCB to obtain -20V, 500mA using IC 79XX series. Use suitable heat sink .Drive suitable load with regulated output.
- IC Regulators: Build a constant current regulator on general purpose PCB for output current of 125mA using IC 317.
- IC Regulators : Construct low voltage regulator on general purpose PCB for output voltage 5V using LM IC 723.Drive any 5v operated load.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Applied Electronics	Sedha, R.S.	S.Chand, New Delhi, 2015 ISBN:9788121927833
2	Principles of Electronics	Mehta, V.K. Mehta, Rohit	S.Chand, New Delhi, 2014 ISBN:8121924502
3	Electronic Devices and Circuit Theory	Boylestead, Robert, Neshelsky, Louis	Pearson Education, New Delhi, 2014, ISBN: 9780132622264
4	Fundamental of Electronic Devices and	Bell ,David	Oxford University Press, New Delhi, 2015, ISBN:9780195425239



S. No.	Title of Book	Author	Publication
	Circuits		
5	Electronic Devices and Circuits	Millman, Jacob Halkias, C. Christos Jit, Satyabrata	Mc Graw Hill Education, New Delhi 2015, ISBN:9789339219550
6	Modern Power Electronics	Sen, P.C.	S.Chand, New Delhi, 2015 ISBN:9788121924252

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

- a. www.eng.uokufa.edu.iq/staff/alikassim/lectures/CH-4.pdf
- b. www.electronics-tutorials.ws/amplifier/amp_1.html
- c. www.colorado.edu/physics/phys3330/PDF/Experiment7.pdf
- d. www.alldatasheet.com/view.jsp?Searchword=Bc147
- e. www.williamson-labs.com
- f. www.futurlec.com
- g. www.learnerstv.com/video/Free-video-Lecture-870-Engineering.htm
- h. www.electronicspost.com/discuss-the-essentials-of-a-transistor-oscillator-explain-the-action-of-tuned-collector-oscillator-colpitts-oscillator-and-hartley-oscillator/
- i. www.radio-electronics.com/info/power-management/switching-mode-power-supply/basics-tutorial.php
- j. www.circuitstoday.com/ic-723-voltage-regulators
- k. www.onsemi.com/pub_link/Collateral/LM317-D.PDF



Program Name : Electronics Engineering, Digital Electronics and Instrumentation Engineering Program Group

Program Code : DE/EJ/ET/EN/EX/EQ/IE/IS/IC

Semester : Third

Course Title : Electric Circuits and Networks

Course Code : 22330

1. RATIONALE

In industry, to build and test electronic/electrical circuits in different situations knowledge of electric circuits and networks is very important. This course is intended to develop the skills to diagnose and rectify the electric network and circuit related problems in the industry. The concept and principles of circuit analysis lays the foundation to understand courses of higher level.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Diagnose the electrical and electronic circuits problems.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Check the working of single phase a.c. circuits.
- Check the resonance condition of electric/electronic circuits.
- Check the functionality using the principles of circuit analysis.
- Use network theorems to determine the various parameters in circuits.
- Use two port networks to determine the circuit parameters.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	2	2	7	3	70	28	30*	00	100	40	25@	10	25	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment.



5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

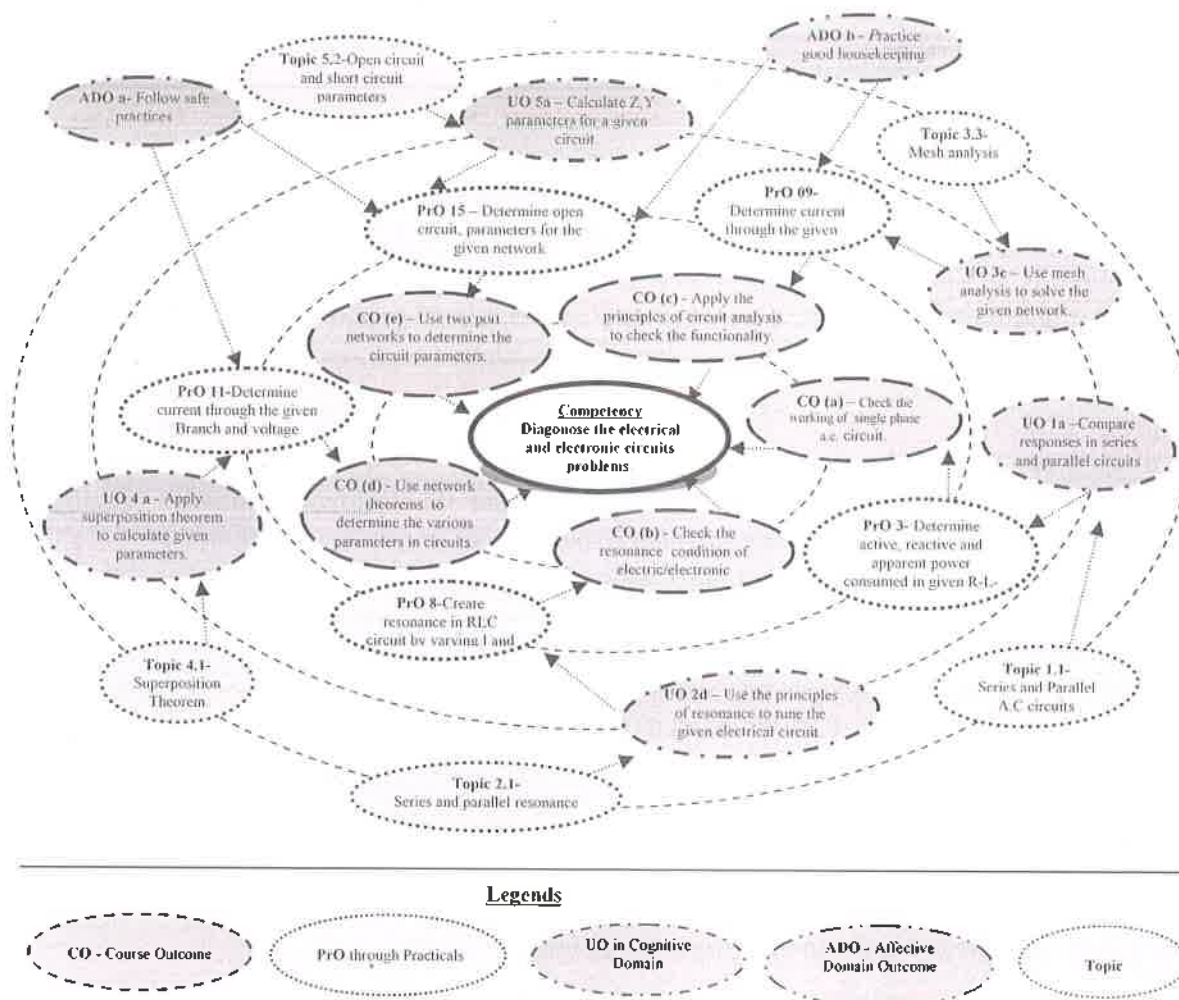


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Determine active, reactive and apparent power consumed in given R-L series circuit and draw phasor diagram.	I	02*
2	Determine active, reactive and apparent power consumed in given R-C series circuit and draw phasor diagram.	I	02
3	Determine active, reactive and apparent power consumed in given R-L-C series circuit and draw phasor diagram.	I	02*
4	a. Measure currents in R-C parallel A. C. circuit. b. Determine p.f., active, reactive and apparent power in R-C parallel a.c. circuit.	I	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
5	a. Measure currents in each branch of given R-L-C parallel a. c. circuit. b. Determine p.f., active, reactive and apparent power for given R-L-C Parallel circuit with series connection of resistor and inductor in parallel with capacitor.	I	02
6	Determine initial and final voltage across the capacitor at $t=0^-$ and $t=0^+$.	I	02
7	Determine initial and final current through the inductive coil at $t=0^-$ and $t=0^+$.	I	02
8	Create resonance in given R-L-C circuit by varying L and C or by using variable frequency supply.	II	02*
9	Determine current through the given branch of a electric network by applying mesh analysis.	III	02
10	Determine voltage at the particular node and current through any given branch of the network by applying nodal analysis.	III	02*
11	Determine current through the given branch and voltage across the given element of circuit by applying superposition theorem.	IV	02*
12	Determine equivalent circuit parameter in a given circuit by applying Thevenin's and Norton's theorem.	IV	02
13	Determine load resistance for maximum power transfer for a given circuit by applying maximum power transfer theorem.	IV	02
14	Test the response of the given circuit by applying reciprocity theorem.	IV	02
15	Determine open circuit (Z) parameters for the given network.	V	02*
16	Determine short circuit (Y) parameters for the given network.	V	02
17	Determine transmission (ABCD) parameters for the given network.	V	02
Total			34

Note

- A suggestive list of **PrOs** is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and recording	10
5	Interpretation of result and conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
Total		100



The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safe practices
- Practice good housekeeping
- Practice energy conservation
- Demonstrate working as a leader/a team member
- Maintain tools and equipment
- Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	Ammeters MI Type: AC/DC, 0-1Amp, 0-1.5 Amp, 0-2.5Amp, 0-5Amp.	1 to 17
2	Voltmeter MI Type: AC/DC, 0-150/300V, 0-250/500V, 0-75/150V.	1 to 17
3	Ammeters PMMC Type: DC, 0-1.5/3Amp, 0-2.5/5 Amp, 0-5/10Amp.	1 to 17
4	Voltmeter PMMC Type: DC, 0-150/300V, 0-250/500V, 0-75/150V.	1 to 17
5	Wattmeter: Single phase 2.5/5Amp, 200/400V. Single phase 5/10Amp, 250/500V	1 to 17
6	Low power factor wattmeter : Single phase. 5/10Amp, 250/500V.	1 to 5
7	Wattmeter: Dynamometer type, single phase. 5Amp, 250V.	1 to 5
8	Power factor meters: AC, 230V, 45-50-55 Hz, single phase, 5-10 Amp, 250V.	1 to 5
9	Digital storage oscilloscope 50MHz.	6, 7
10	Trainer kit for all theorems.	9 to 17

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Single Phase A.C. Circuits	1a. Compare the A.C. responses in the given type of series and parallel circuits. 1b. Explain with sketches the phasor diagram of the given AC circuit. 1c. Calculate active, reactive, apparent	1.1 Series A.C. circuits: R-L, R-C and R-L-C circuits, impedance, reactance, phasor diagram, impedance triangle, power factor, active(real) power, apparent power, reactive power, power triangle



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	<p>power and power factor for the specified circuit.</p> <p>1d. Suggest the power factor improve technique for the given situation with justification.</p> <p>1e. Calculate admittance, conductance and susceptance for the given circuit.</p> <p>1f. Determine the equivalent impedance and admittance for the given circuit.</p> <p>1g. Interpret the working of the given R, L, and C component using initial and final condition.</p>	<p>1.2 AC Series circuit by using complex algebra</p> <p>1.3 Parallel AC circuits: Resistance in parallel with pure inductance and capacitance, series combination of resistance and inductance in parallel with capacitance</p> <p>1.4 Concept of admittance, conductance and susceptance</p> <p>1.5 Concept of initial and final conditions in switching circuits, Meaning of $t = 0^-$, $t = 0^+$ and $t = \infty$. R, L and C at initial and final conditions</p>
Unit-II Resonance in Series and Parallel Circuits	<p>2a. Find the resonance condition for the specified series and parallel circuits.</p> <p>2b. Calculate current, voltage and frequency for the given resonant circuit.</p> <p>2c. Determine bandwidth and quality factor (Q) for the given series and parallel resonant circuit.</p> <p>2d. Describe the procedure to tune the given electrical circuit using the principles of resonance.</p>	<p>2.1 Series and parallel resonance</p> <p>2.2 Impedance and phase angle of a Series and parallel resonant circuits</p> <p>2.3 Voltage and current in a series and parallel resonant circuit</p> <p>2.4 Bandwidth of a RLC circuit (series and parallel resonance)</p> <p>2.5 Quality factor (Q) and its effect on bandwidth (series and parallel resonance)</p> <p>2.6 Magnification in series and parallel resonance circuits</p>
Unit-III Principles of Circuit Analysis	<p>3a. Use source transformation techniques for the given circuit.</p> <p>3b. Convert the given star connection to delta connection and vice versa.</p> <p>3c. Use mesh analysis to solve the given network.</p> <p>3d. Solve the given network using nodal analysis.</p> <p>3e. Diagnose the fault in the given circuit using the relevant technique(s).</p>	<p>3.1 Source transformation</p> <p>3.2 Star/delta and delta/star transformations</p> <p>3.3 Mesh analysis</p> <p>3.4 Node analysis</p>
Unit-IV Network Theorems	<p>4a. Use superposition theorem to calculate the given parameters in the given circuit.</p> <p>4b. Apply Thevenin's theorem to calculate the given parameters in the given circuit.</p> <p>4c. Use Norton's theorem to calculate the given parameters in the given circuit.</p>	<p>4.1 Superposition theorem for both AC voltage and DC source</p> <p>4.2 Thevenin's theorem</p> <p>4.3 Norton's theorem</p> <p>4.4 Maximum power transfer theorem</p> <p>4.5 Reciprocity theorem</p> <p>4.6 Superposition theorem</p>



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	4d. Calculate load impedance using maximum power transfer theorem for the given circuit. 4e. Use reciprocity theorem to analyse the given circuit.	
Unit –V Two Port Networks	5a. Calculate Z, Y, parameters for the given circuit. 5b. Find the ABCD parameters for the given circuit. 5c. Sketch the phasor diagram for the given T and π circuit with justification. 5d. Calculate Z and Y parameters to test whether the given circuit is reciprocal or symmetrical two port network .	5.1 Significance of two port network 5.2 Open circuit(Z) and short circuit(Y) Parameters 5.3 Transmission (ABCD) parameter 5.4 T and π representation of circuits 5.5 Reciprocal and symmetrical two port network(no derivation)

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Single Phase A.C. Circuits	10	04	04	06	14
II	Resonance in Series and Parallel Circuits	10	02	06	06	14
III	Principles of Circuit Analysis	10	04	04	06	14
IV	Network Theorems	12	04	06	08	18
V	Two port networks	06	02	04	04	10
Total		48	16	24	30	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare journals based on practical performed in laboratory.
- Follow the safety precautions.
- Use various meters to test electric/electronic equipment and component.
- Library /Internet survey of electrical circuits and network



- e. Prepare power point presentation or animation for understanding different circuits behaviour.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- a. Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- b. '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c. About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- e. Use Flash/Animations to explain various theorems in circuit analysis
- f. Guide student(s) in undertaking micro-projects

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs. Micro project report may be of four to five pages.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

- a. **Single Phase A.C. series and parallel Circuits:** Prepare series and parallel circuit using variable R, L and C combination on the bread board. Measure the response and draw vector diagram. Also calculate power factor for the circuit. Write report on the same.
- b. **Resonance in series and Parallel Circuits:** Prepare series RLC circuit using variable R, L and C combination on the bread board. Tune the circuit for resonance condition. Measure the responses and calculate band width and Q-factor for the circuit. Write report on the same.
- c. **Resonance in Series and parallel Circuits:** Prepare parallel RLC circuit using variable R, L and C combination on the bread board. Tune the circuit for resonance condition. Measure the response and calculate band width and Q-factor for the circuit. Write report on the same.



- d. **Principles of circuit analysis:** Prepare power point presentation on source transformation, star delta transformation, mesh and nodal analysis and give presentation in the class room.
- e. **Network Theorems:** Select suitable components for the given circuit and prepare the same on the bread board. Verify the following network theorem theoretically and practically.
 - i. Superposition Theorem
 - ii. Maximum power transfer theorem
 - iii. Thevenin's theorem
 - iv. Norton's theorem.
- f. **Two Port Networks:** Design and prepare two port network on bread board for given values of open circuit Z parameter.
- g. **Two Port Networks:** Design and prepare two port network on bread board for given values of short circuit Y parameter.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Basic Electrical Engineering	Mittle, V.N. ; Mittle, Arvind	McGraw Hill Education, Noida, 2005, ISBN: 9780070593572
2	A Text Book of Electrical Technology Vol-I	Theraja, B. L. ; Theraja, A. K.	S. Chand and Co., New Delhi, 2006 ISBN: 978-81-219-2440-5
3	Fundamentals of Electrical Engineering	Saxena, S.B.; Dasgupta, K.	Cambridge university press pvt. Ltd., New Delhi, 2016, ISBN : 9781107464353
4	Circuit and network	Sudhakar, A. ; Palli Shyammohan, S.	McGraw Hill, New Delhi, 2006 ISBN : 978-0-07-340458-5
5	Electric Circuits	Bell, David A.	Oxford University Press New Delhi, 2009 ISBN: 9780195425246
6	Electric Circuit Analysis	Paranjothi, S.R.	New Age Publisher, New Delhi, 2011, ISBN: 978-81-224-3154-4
7	Fundamentals of Electrical Networks	Gupta, B.R ; Singhal, Vandana	S.Chand and Co., New Delhi, 2005 ISBN: 978-81-219-2318-7
8	Schaum's Outline of Electric Circuits	Edminister, Joseph A. Nahvi, Mahmood	McGraw Hill, New Delhi, 2013 ISBN: 9780070189997
9	Introductory circuit Analysis.	Boylested, R.L.	Wheeler, New Delhi , 2013 ISBN: 978-0023131615

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

- a. www.cesim.com/simulations
- b. www.scilab.org/scilab
- c. www.ni.com/multisim
- d. www.youtube.com/electriccircuits
- e. www.dreamtechpress.com/ebooks
- f. www.nptelvideos.in/electricalengineering/circuittheory
- g. www.learnerstv.com/free-engineering
- h. electronicsforu.com/category/electronics-projects



Program Name : Electronics & Tele-Communication Engineering, Electronics,
Electronics & Communication Engineering, Electronics Engg.
and Electronics & Communication Technology

Program Code : EJ/ET/EN/EX/EQ

Semester : Third

Course Title : Electronics Measurements and Instrumentation

Course Code : 22333

1. RATIONALE

Modern automated instrumentation system is an emerging field, used for data sensing, acquisition, transmission, analysis and control in various practical applications. Analog and digital instruments are mainly used to measure different process control parameters. The physical quantities/parameters are converted into electrical signal with the help of various types of sensors and transducers and also used to maintain electronic control and automation system. Handling Test and Measuring Instrument is the essential activity of the diploma engineering passouts (also called technologists) when they work in any electronic automation industry.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Maintain electronic automated system in process and manufacturing industries.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

- Interpret the characteristics of measuring instrument.
- Calibrate different electronic instrument.
- Use the relevant instrument to measure specified parameters.
- Interpret working of various types of sensors and transducers.
- Use various types of transducers and sensors to measure quantities.
- Maintain signal conditioning and data acquisition system.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
4	-	4	8	3	70	28	30*	00	100	40	50@	20	50	20	100	40

(*): Under the theory PA, Out of 30 marks. 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.



Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C -- Credit, ESE - End Semester Examination; PA - Progressive Assessment

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

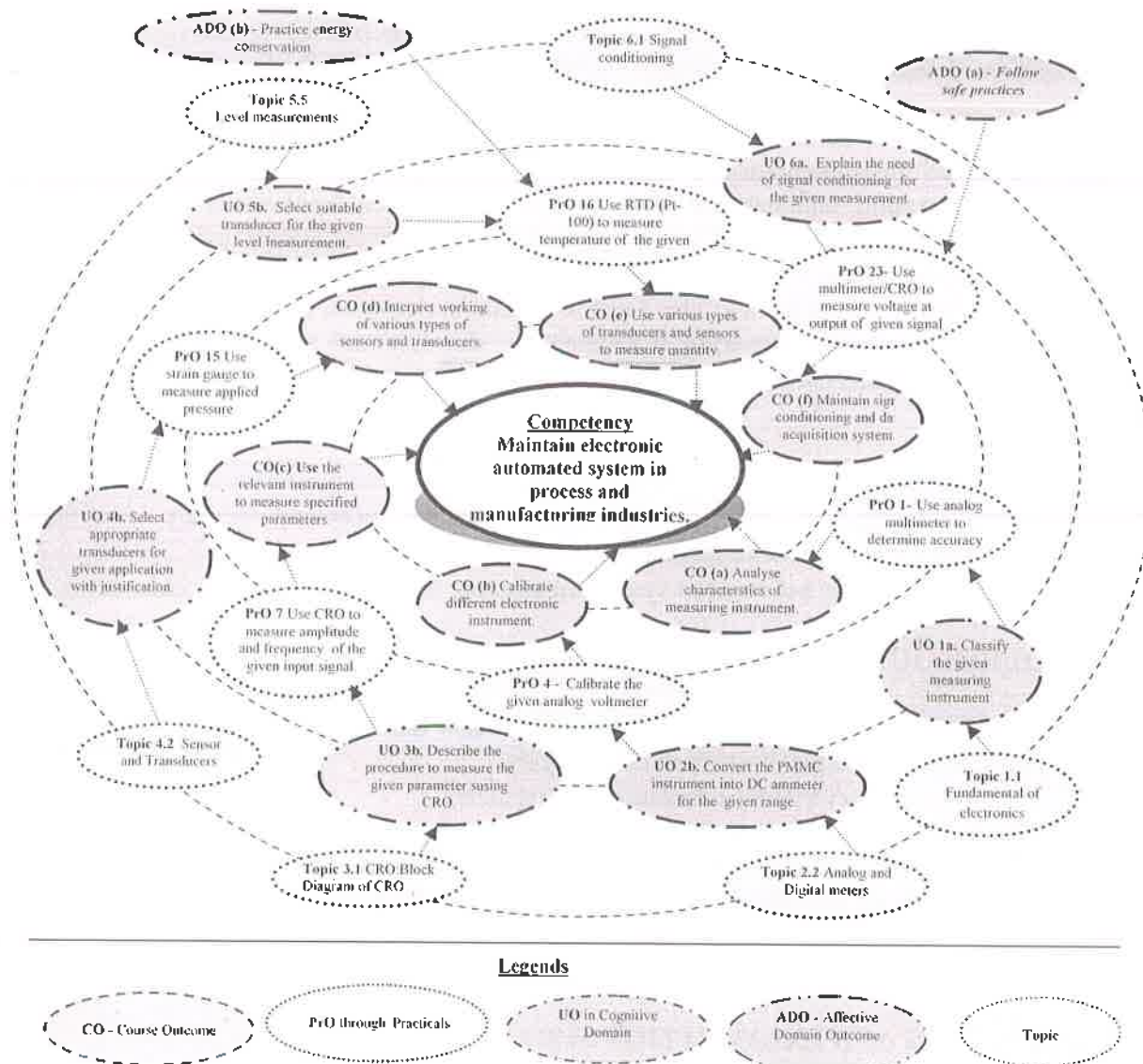


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Use analog multimeter to determine accuracy, resolution and hysteresis for specified measured quantity.	I	02*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
2	Use analog meters to measure voltage, current and resistance	I	02*
3	Use digital meters to measure voltage, current and resistance.	III	02*
4	Calibrate the given analog voltmeter.	II	02*
5	Calibrate the given analog ammeter.	II	02
6	Select the relevant range of CRO for various measurement by varying positions of front panel knobs.	III	02
7	Use CRO to measure amplitude and frequency of the given input signal.	III	02
8	Generate Lissajous pattern on CRO to measure frequency of the given input signal.	III	02*
9	Generate Lissajous pattern on CRO to measure phase of the given input signal	III	02
10	Use function generator to generate different types of waveforms and observe them on DSO.	III	02
11	Use DSO to measure amplitude and frequency of the given input signal.	III	02
12	Use spectrum analyzer to measure frequency band of the given input signal.	III	02
13	Test the characteristics of the potentiometer.	IV	02*
14	Test relation between Linear displacement and output voltage using LVDT.	IV	02
15	Use strain gauge to measure applied pressure.	V	02*
16	Use RTD (Pt-100) to measure temperature of the given liquid.	V	02*
17	Use thermocouple to measure temperature of liquid.	V	02
18	Use bourdon tube and LVDT to measure applied pressure.	V	02*
19	Use venturi tube to measure flow of fluid.	V	02
20	Use orifice plate to measure flow of fluid.	V	02
21	Use rotameter to measure flow of liquid.	V	02*
22	Use pH meter to measure pH value of given solution.	V	02*
23	Use multimeter/CRO to measure voltage at output of given signal conditioning circuit.	VI	02
24	Test the performance of Portable Data Acquisition System.	VI	02*
25	Troubleshoot of potentiometer.	VI	02
26	Troubleshoot of strain gauge.	VI	02
27	Troubleshoot of venturi tube.	VI	02*
28	Troubleshoot of rotameter	VI	02
	Total		56

Note

- A suggestive list of **PrOs** is given in the above table. More such **PrOs** can be added to attain the **COs** and competency. A judicious mix of minimum 24 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each **PrO** is to be assessed according to a suggested sample given below.



S. No.	Performance Indicators	Weightage in %
a.	Preparation of experimental set up	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical Practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/INSTRUMENTS REQUIRED

S. No.	Equipment Name with Broad Specifications	PrO. S. No.
1	Analog multi-meter: 0-10A, 0-600V, 0-10M Ω	1,2,4,5
2	Digital multi-meter: 0-10A, 0-600V, 0-10M Ω	All
3	Dual trace CRO with probe: Bandwidth AC 10Hz ~ 20MHz (-3dB). DC ~ 20MHz (-3dB), X10 Probe	6,7,8,9
4	Digital storage oscilloscope: Bandwidth 60MHz, Dual Channel	10,11
5	Function generator: Frequency Ranges: 0.1 Hz to 11 MHz, Pulse and Ramp Aspect Ratio: 95:5	8,9,10
6	Spectrum analyzer: 9 kHz - 26.5 GHz	12
7	LVDT: Stroke range ± 0.1 [± 2.54] or available range	14
8	Strain gauge: Universal general – purpose strain gages	15
9	RTD and Thermocouple (any one type): Pt 100, Type K, Chromel (+) Alumel (-), 0 to 1260°C	16,17
10	Venturi tube: process temperatures between -20 °F and +350 °F (-30 °C and +175 °C), accuracy of $\pm 0.50\%$ for standard meters and $\pm 0.25\%$ for flow calibrated meters. Orifice plate and rotameter: 30mm diameter	16,17
11	pH meter: Portable pH meter range from 0 to 14 resolution 0.1/0.01 pH.	22

S. No.	Equipment Name with Broad Specifications	PrO. S. No.
	RS.232C output and supply Data connector cable, digital display with 0.001 pH unit readability	
12	Portable Data Acquisition System Specification: 24-bit ADC/ch, 4 analog voltage inputs, Powered by USB	23,24

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Fundamental of electronics measurements	1a. Classify the given measuring instrument. 1b. Determine static and dynamic characteristics of the measuring instruments with the given data. 1c. Identify the standards for calibration of the given instrument with justification. 1d. Explain with sketches the generalized procedure for calibration of the given instrument.	1.1 Fundamentals of electronic measurement: 1.2 Characteristics of measurement: statics and dynamics characteristics, error in measurement, types of error. 1.3 Standards of measurement 1.4 Calibration: Need and meaning of calibration
Unit– II Analog and Digital meters	2a. Determine resolution, sensitivity and accuracy of the given digital display. 2b. Convert the PMMC instrument into DC ammeter for the given range. 2c. Convert the PMMC instrument into DC voltmeter for the given range. 2d. Explain with sketches the working of given type of ohm meter, AC voltmeter. 2e. Prepare specification of the given analog meter.	2.1 Indicating and display device: D Arsonval movement, PMMC , moving iron, LCD, LED 2.2 Analog and Digital meters: Type of analog and digital meters, voltmeter, ammeter, ohm meter, extension of measuring range of meters ,applications of meters, Calibration of meters
Unit– III Oscilloscope , Function generator, and Spectrum analyzer	3a. Explain with sketches the working of the given blocks and type of oscilloscope. 3b. Explain with sketches the procedure to measure the given parameters using CRO. 3c. Describe the function of the given blocks of signal/function generator. 3d. Explain with sketches the procedure to test the given types of signals using the relevant type test and measuring instrument. 3e. Select CRO/ DSO, Spectrum	3.1 CRO: Block diagram of CRO, CRT, vertical deflection system and horizontal deflection system, need of delay line, time base generator, amplitude and frequency measurement using CRO, lissajous patterns for phase and frequency measurement, component testing using CRO, dual trace and dual beam CRO 3.2 DSO: Block diagram of DSO, various function, and applications of DSO 3.3 Function generator: Block



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	analyzer and function generator for specified application with justification. 3f. Prepare specification for the given instrument.	diagram of function generator, application of function generator, 3.4 Spectrum analyzer : Block diagram of spectrum analyzer and its applications.
Unit-IV Sensors and Transducers	4a. Describe the function of the given block of instrumentation system with the help of suitable block diagram. 4b. Select relevant transducers for given application with justification. 4c. Differentiate the features transducers and sensors for the given quantity measurement. 4d. Explain with sketches the working principle of given type of thermal sensor. 4e. Select the relevant transducer for the given range of displacement measurement with justification.	4.1 Instrumentation System: Block diagram of instrumentation system, function of each block 4.2 Sensors and Transducers: basic definition, difference, classification of sensors 4.3 Thermal, optical, magnetic and electric sensors 4.4 Transducer : Need of transducer, types of transducer: Primary, secondary, active, passive, analog, digital, resistive, capacitive, inductive (LVDT, RVDT), piezoelectric transducer, selection criteria of transducer.
Unit –V Applications of sensors and transducers	5a. Explain with sketches the working principle of the given transducers. 5b. Select suitable transducer for the given level measurement with justification. 5c. Select the relevant sensor for the given range of temperature measurement with justification. 5d. Select the relevant transducer for the given range of pressure measurement with justification 5e. Select the relevant sensor/ transducer for the specified application with justification.	5.1 Level measurement: Need of level measurement, float type, capacitive type, ultrasonic type, radiation type, working principle, construction of each. 5.2 Temperature measurement: thermister, RTD (Pt-100), thermocouple: seebeck and peltier effects (J, K, R, S, T types), optical pyrometer 5.3 Pressure measurement: Types, Bourdon tube, Bellows, Diaphragm, pressure measurement using Bourdon tube and LVDT 5.4 Flow measurement: types, Variable head flow meter: Venturimeter, orifice plate meter, Variable area flow meter : Rotameter, electromagnetic flow meter, ultrasonic flow meter 5.5 Special transducers and measurement: Humidity measurement using hygrometer, pH measurement
Unit –VI Signal conditioning	6a. Explain the need of signal conditioning for the given measurement.	6.1 Signal conditioning: need of signal conditioning, Types of signal conditioning: Block



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
and Data acquisition system	6b. Differentiate between the given block of AC and DC signal conditioning circuits. 6c. Describe function of the given block of DAS . 6d. Explain with sketches the working of data acquisition system for the specified application .	diagram of AC and DC signal conditioning circuits 6.2 Data Acquisition System (DAS): type of DAS, Application of DAS with example

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Fundamental of electronics measurements	08	02	02	04	8
II	Analog and Digital meters	14	02	06	06	14
III	Oscilloscope, Function generator and Spectrum analyzer	14	02	04	08	14
IV	Sensors and transducers	10	02	04	06	12
V	Applications of sensor and transducers	12	02	04	06	12
VI	Signal conditioning and Data acquisition system	06	02	02	06	10
Total		64	12	22	36	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare journals based on practical performed in laboratory.
- Test different components using CRO.
- Give seminar on any latest Test and measuring Instruments used in the Industry.
- Library survey regarding different data books of different instruments and manuals.
- Prepare power point presentation to demonstrate operation of DSO.
- Undertake a market survey of different electronic instrument.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES



These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- a. Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- b. '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c. About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- e. Guide student(s) in undertaking micro-projects.
- f. Video programs/YouTube may be used to teach various topics and sub topics.
- g. Demonstrate working of measuring instrument to students before they start doing the practice.
- h. Encourage students to refer different websites to have deeper understanding of the Measurements.
- i. Observe performance of the student continuously and give them feedback about the progress periodically.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs. Micro project report may be of four to five pages.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

- a. **Analog and digital meters:** Build and test voltmeter (0-10V, 1mA, 500ohms) using PMMC.
- b. **Analog and digital meters:** Build and test ammeter (0-100 mA) using PMMC.
- c. **Signal conditioning:** Design D.C.signal conditioning circuit using Wheatstone bridge and implement that on PCB.
- d. **Function Generator:** Build and Test function generator using IC 8038(sine wave, square wave, triangular wave upto 100 kHz) on the PCB.
- e. **Oscilloscope Function generator, Spectrum analyzer:** Survey of different electronic instruments.
- f. (Use structure and other features of 'Electronic Measurement and Instrumentation' to develop above listed applications)



13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Electrical and Electronic Measurements and Instrumentation	Sawhney, A.K.	Dhanpat Rai & Sons, New Delhi, 2005, ISBN: 13-9788177000160
2	Electronic Instrumentation	Kalsi, H.S.	McGraw Hill, New Delhi, 2010 ISBN: 13-9780070702066
3	Electronic Instrumentation and Measurements	David, A. Bell	Oxford University Press, New Delhi, 2013, ISBN: 10:0-19-569614-X
4	Modern Electronic Instrumentation and Measurement Techniques	Helfrick, A.D. Cooper, W.D.	Pearson Education India, 1 st Edition, New Delhi, 2015, ISBN-13: 978-9332556065

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

- a. www.instrumentationcontrolbox.com
- b. www.circuitstoday.com
- c. [www.myclassroom.com/Engineering.../Electronics-&-Instrumentation-Engg.-\(EIE\)](http://www.myclassroom.com/Engineering.../Electronics-&-Instrumentation-Engg.-(EIE))
- d. www.en.wikipedia.org/wiki/List_of_electrical_and_electronic_measuring_equipment
- e. www.en.wikipedia.org/wiki/Electronic_test_equipment
- f. www.en.wikibooks.org/wiki/Electronics/Measuring_Instruments



Program Name : Electronics & Tele-Communication Engineering, Electronics,
Electronics & Communication Engineering, Electronics Engg.
and Electronics & Communication Technology

Program Code : EJ/ET/EN/EX/EQ

Semester : Third

Course Title : Principles of Electronics Communication

Course Code : 22334

1. RATIONALE

In the 21st century electronic communication plays vital role in every aspect of human life. Diploma Engineers (also called technologists) have to deal with the various electronic communication circuits while maintaining electronics communication systems. The study of basic operating principles and handling of various electronics communication system will help them to troubleshoot and maintain electronics communication systems used for various type of communication. This course is developed in such a way that, students will be able to apply the domain knowledge to solve broad communication engineering application problems in electronic communication engineering field.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Maintain basic Electronic Communication Systems.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

- Use relevant frequency range for different communication systems.
- Use relevant modulation technique for the specified application.
- Maintain transmitter and receiver circuits of AM and FM.
- Use relevant media for transmission and reception of signals.
- Use relevant type of antenna for various applications.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
4	-	2	6	3	70	28	30*	00	100	40	25@	10	25	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.



Legends: *L* - Lecture; *T* - Tutorial/Teacher Guided Theory Practice; *P* - Practical; *C* - Credit, *ESE* - End Semester Examination; *PA* - Progressive Assessment

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

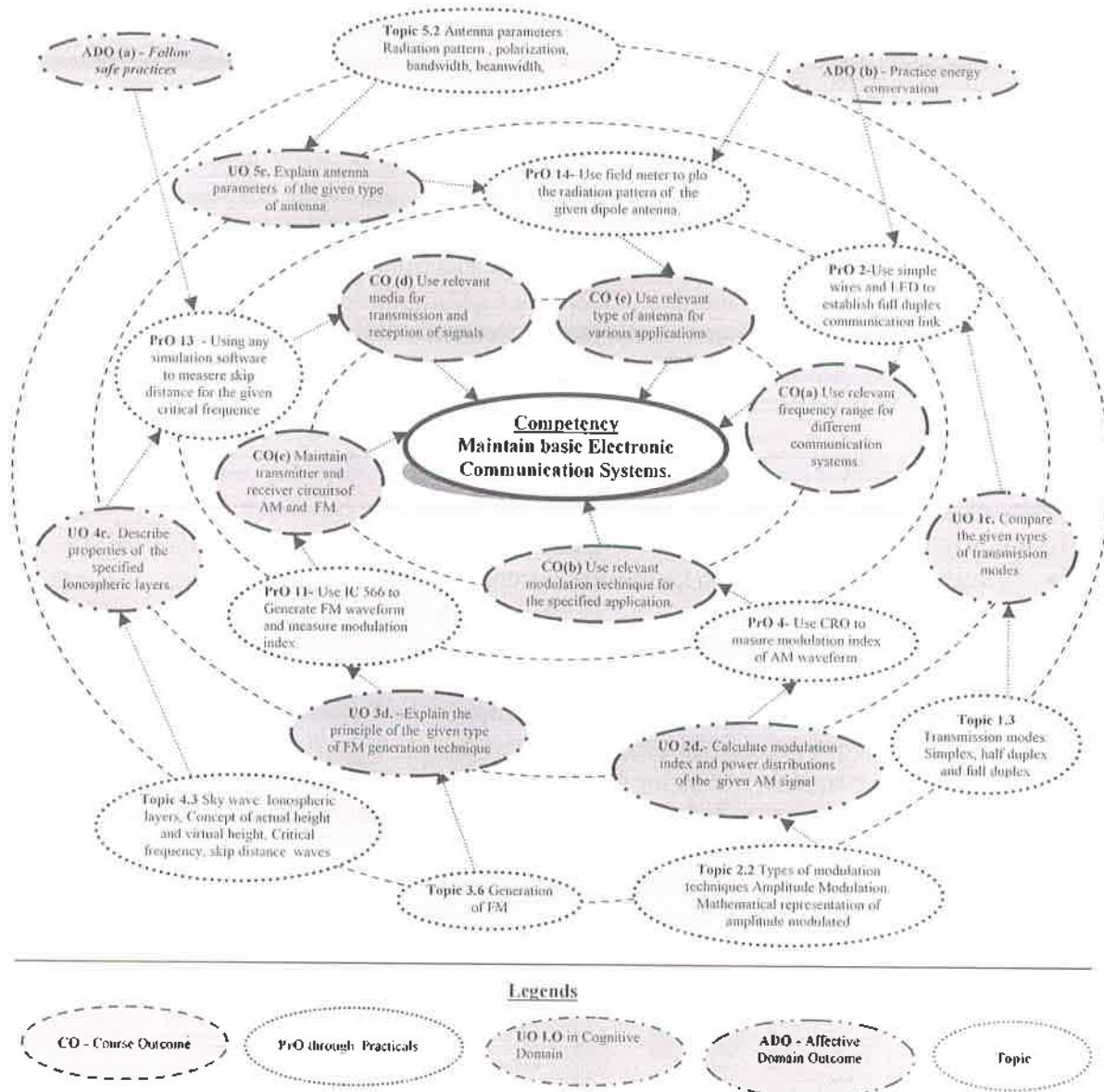


Figure 1 - Course Map



6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Use simple wires, switches and LEDs to establish simplex and half duplex communication link	I	02
2	Use simple wires, switches and LEDs to establish full duplex communication link	I	02
3	Observe the AM modulated waveforms generated for different carrier frequencies.	II	02
4	Generate AM wave and measure its modulation index .	II	02*
5	Use any simulation software to generate AM wave.	II	02
6	Use voltage controlled oscillator to generate FM wave and measure the frequency deviation.	II	02
7	Generate FM wave and measure its modulation index.	II	02
8	Use any simulation software to generate FM wave.	II	02*
9	Use AM demodulator circuit to detect the received AM signal.	III	02*
10	Use IC 566 to generate FM waveform and measure modulation index	III	02
11	Use IC 564 / IC 565 for FM demodulation and trace it's input and output waveforms.	III	02
12	Use any simulation software to measure 1. MUF for the given critical frequency and incident angle. 2. Radio horizon for given height of transmitting and receiving antenna	IV	02*
13	Use field meter to plot the radiation pattern of the given dipole antenna.	V	02*
14	Use field meter to plot the radiation pattern of given Yagi-Uda antenna.	V	02
15	Use any simulation software to plot radiation pattern of the given type of antenna.	V	02
Total			30

Note

- A suggestive list of **PrOs** is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20



S. No.	Performance Indicators	Weightage in %
3	Safety measures	10
4	Observations and Recording	10
5	Interpretation of result and Conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. S. No.
1	Cathode Ray Oscilloscope Dual Trace 20Mhz, 1Mega Ω Input Impedance	3 to12
2	RF signal generator with Wide frequency range 100 KHz to 150 MHz Fine frequency adjustment by calibrated dial built in audio frequency generator	3 to12
3	DSO with Bandwidth : 50/100MHz TFT Colour LCD Dual Channel Real Time Sampling: 1GSa/s Equivalent Sampling 25GSa/s Memory 1M pts 10 Waveforms & 10 Setups can be stored	3 to12
4	Regulated power supply: DC Supply Voltages Dual DC : 2 x 0 - 30V;0-2 A Automatic Overload (Current Protection) Constant Voltage & Constant Current Operation	1-12
5	AM trainer kit for DSB/SSB AM modulation and demodulation	3,4
6	Digital Multimeter : 3 1/2 digit display, 9999 counts digital multimeter measures: V_{ac} , V_{dc} (1000V max) , A_{dc} , A_{ac} (10 amp max) , Resistance (0 - 100 M Ω) , Capacitance and Temperature measurement	3 to12
7	FM trainer kit for FM modulation and demodulation	3
8	Trainer kit for FM modulator using IC566: AC Source: 600Hz to 2.5 KHz. FM Modulator : VCO Test Points , circuit diagram engraved on front panel with transparent rear panel	6,7,10, 11



S. No.	Equipment Name with Broad Specifications	PrO. S. No.
9	Trainer kit for FM demodulator using IC 564: AC Source: 600Hz to 2.5 KHz.FM Demodulator :PLL Test Points	12
10	Antenna trainer kit:for dipole and yagi-uda antenna, mobile antenna,omindirection antenna, horn antenna and other common type of antennas	14,15
11	Software for program : SCILAB,MATLAB ,TINA PRO.	5,8,13,16
12	Simulation software suitable for communication experiments .	5,8, 13,16

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs in cognitive domain for achieving the COs to attain the identified competency.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Basics of Electronic Communication	1a. Interpret the working of the given block of basic electronic communication system. 1b. Identify the relevant frequency band of electromagnetic spectrum for the specified application with justification. 1c. Compare features of the given types of transmission modes. 1d. Differentiate properties of the given types of noise.	1.1 The elements of basic electronic communication system 1.2 Electromagnetic spectrum 1.3 Transmission modes: Simplex, half duplex and full duplex, Synchronous and Asynchronous 1.4 Sources of Noise (internal and external), signal to noise ratio



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – II AM and FM Modulation	2a. Interpret necessity of the given type of modulation technique . 2b. Compare the working of the given type of AM generation technique. 2c. Describe with sketches the given parameters of AM signal. 2d. Calculate modulation index and power distributions of the given AM signal. 2e. Describe with sketches the specified parameters of FM and PM signal. 2f. Determine the modulation index of given FM signal.	2.1 Need for modulation 2.2 Types of modulation techniques Amplitude Modulation: Mathematical representation of amplitude modulated wave, modulation index, bandwidth requirement , representation of AM signal in time and frequency domain, types of AM with respect to frequency spectrum (DSB, SSB and VSB), Power relations in AM wave 2.3 Frequency Modulation: representation of FM signal in time domain and frequency domain , frequency deviation ratio, modulation index(β), mathematical representation of FM, bandwidth requirement, types of frequency modulation (NB and WBFM) 2.4 Phase Modulation
Unit– III Transmitters and Receivers	3a. Explain with sketches the working of the given type of AM generation technique. 3b. Explain the function of the given blocks of AM super heterodyne receiver. 3c. Explain with sketches the given types of AM demodulation technique. 3d. Explain with sketches principle of the given type of FM generation technique. 3e. Compare the working of the given types of FM detectors.	3.1 Generation of AM 3.2 Block diagram of AM super heterodyne receiver and its working with waveforms 3.3 Demodulation of AM signal: Diode detector and practical diode detector 3.4 Automatic gain control and its types. 3.5 Concept of pre-emphasis and De-emphasis 3.6 Generation of FM using direct (varactor diode and reactance modulator) and indirect method (Armstrong method) 3.7 Block diagram of FM receiver and its working with waveforms 3.8 FM detector circuits: Ratio detector and PLL as FM demodulator
Unit– IV Wave Propagation	4a. Describe the properties of the given types of electromagnetic waves. 4b. Describe with sketches propagation mode of the given type of radio wave.	4.1 Concept of propagation of radio waves 4.2 Ground Wave propagation 4.3 Sky wave: Ionospheric layers, Concept of actual height and virtual height, Critical frequency, skip



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	4c. Describe properties of the specified Ionospheric layer. 4d. Explain parameters and properties of the given types of wave propagation. 4e. For the given application, identify the type of wave propagation to be used with justification.	distance, skip zone, concept of fading, maximum usable frequency, multiple hop sky wave propagation 4.4 Space Wave propagation: line of sight, multipath space wave propagation, optical and radio horizon, shadow zones 4.5 Duct propagation (microwave space-wave propagation) 4.6 Troposphere scatter propagation.
Unit- V Antennas	5a. Explain with sketches the working principle of the given type of antenna. 5b. Compare with sketches working of the given type of antenna on the basis of radiation pattern. 5c. Explain antenna parameters of the given type of antenna. 5d. Choose type of antenna required with broad specification for the given applications.	5.1 Antenna fundamentals: Resonant antenna and Non-resonant antennas 5.2 Antenna parameters: Radiation pattern, polarization, bandwidth, beamwidth, antenna resistance, directivity and power gain, antenna gain 5.3 Dipole antenna: Half wave dipole antenna (Resonant Antenna) and its Radiation pattern. Folded dipole antenna and its radiation pattern, Radiation pattern for Dipole Antenna of different length 5.4 Loop antenna, Telescopic antenna, Yagi-Uda antenna, Micro wave antenna – Dish antenna, Horn antenna and Micro-strip patch antenna, rectangular, square and circular (Structure, radiation pattern and application of antennas)

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Basics of Electronic Communication	08	4	4	4	12
II	AM and FM Modulation	16	4	6	8	18
III	Transmitters and Receivers	16	2	6	6	14
IV	Wave propagation	10	4	4	6	14
V	Antennas	14	4	4	4	12
Total		64	18	24	28	70



Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare chart for electromagnetic spectrum.
- Give seminar on any relevant topic related to electronic communication medium.
- Library survey regarding different communication books and manuals.
- Prepare power point presentation for recent communication applications.
- Undertake a market survey of different communication devices.
- Visit radio transmitter station.
- Visit auditorium near your campus and make layout of PA system.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Guide student(s) in undertaking micro-projects.
- Demonstrate students thoroughly before they start doing the practice.
- Encourage students to refer different websites to have deeper understanding of the subject.
- Observe continuously and monitor the performance of students in Lab.
- Arrange visit for students to make clear certain communication concepts.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of POs, UOs and ADOs. Each student will have to



maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs. Micro project report may be of four to five pages.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

- a. **Modulation:** Build a circuit for modulation using IC MC1496/8038 on general purpose PCB and prepare the report.
- b. **FM transmitter:** Build a circuit on general purpose PCB for FM transmitter using IC 8038/ transistor BF549 and prepare a report.
- c. Find **different channels frequencies** associated with Am and FM stations.
- d. **Antenna:** Simulate a microstrip patch antenna for frequency 2.4GHz frequency using HFSS (high frequency structure simulator) software.
- e. **Tuning of IFT:** Build a circuit on general purpose PCB for tuning IFT at 455KHz.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Electronic Communication Systems	Kennedy George; Davis Bernard; Prasanna SRM	Mc-Graw Hill 5 th Edition, New Delhi, 2011, ISBN : 9780071077828
2	Principles of Electronics Communication system	Frenzel Louis E.	Mc-Graw Hill 5 th Edition, New Delhi, 2007, ISBN : 9780073222783
3	Electronic communication system: Fundamentals Through Advanced	Tomasi W.	Pearson Education India, New Delhi, 4 th Edition, 2001, ISBN: 9780130221254
4	Antenna Theory: Analysis and Design	Constantine A. Balanis	Wiley-Student edition India, New Delhi, 2015-16, ISBN: 9788126524228
5	Audio and video systems principals, maintenance and troubleshooting	Gupta R.G.	Tata McGraw Hill, New Delhi, 2010, ISBN : 9780070699762

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

- a. www.turbofuture.com/industrial/Elements-of-Electronic-Communications-System
- b. www.st-andrews.ac.uk/~www_pa/Scots_Guide/iandm/part3/page1.html
- c. www.antenna-theory.com/basics/main.php
- d. www.explainthatstuff.com/antennas.html
- e. www.circuitdiagram.org/am-radio-receiver-with-mk484.html
- f. www.circuitstoday.com/single-chip-fm-radio-circuit





Maharashtra State Board of Technical Education, Mumbai
Teaching and Examination Scheme for Post S.S.C. Diploma Courses

Program Name : Civil Engineering Groups

Program Code : CE/CR/ CS

With Effect From Academic Year: 2017 - 18

Duration of Program : 6 Semesters

Duration : 16 Weeks

Semester : Fourth

Scheme - I

S. N.	Course Title	Course Abbreviation	Course Code	Teaching Scheme			Credit (L+T+P)	Examination Scheme														Grand Total
				L	T	P		Theory							Practical							
								Exam Duration in Hrs.	ESE		PA		Total		ESE		PA		Total			
									Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks		
1	Hydraulics	HRY	22401	3	2	2	7	3	70	28	30*	00	100	40	25#	10	25	10	50	20	150	
2	Theory of Structures	TOS	22402	4	2	-	6	4	70	28	30*	00	100	40	--	--	--	--	--	--	100	
3	Railway and Bridge Engineering	RBE	22403	4	-	-	4	3	70	28	30*	00	100	40	--	--	--	--	--	--	100	
4	Geo-Technical Engineering	GTE	22404	3	-	2	5	3	70	28	30*	00	100	40	25#	10	25	10	50	20	150	
5	Building Planning and Drawing	BPD	22405	3	-	4	7	4	70	28	30*	00	100	40	50#	20	50	20	100	40	200	
6	Environmental Studies	EST	22447	3	-	-	3	90 Min	70*#	28	30*	00	100	40	--	--	--	--	--	--	100	
Total				20	4	08	32	--	420	--	180	--	600	--	100	--	100	--	200	--	800	

Student Contact Hours Per Week: **32 Hrs.**

Medium of Instruction: **English**

Theory and practical periods of 60 minutes each.

Total Marks : 800

Abbreviations: ESE- End Semester Exam, PA- Progressive Assessment, L - Lectures, T - Tutorial, P - Practical

@ Internal Assessment, # External Assessment, *# On Line Examination, @^ Computer Based Assessment

* Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain LOs required for the attainment of the COs.

~ For the courses having ONLY Practical Examination, the PA marks Practical Part - with 60% weightage and Micro-Project Part with 40% weightage

➤ **If Candidate not securing minimum marks for passing in the "PA" part of practical of any course of any semester then the candidate shall be declared as "Detained" for that semester.**

➤ **In-Plant Training during Summer vacation for minimum Six Weeks at the end of Fourth Semester (Second Year).**



Program Name : Civil Engineering Program Group
Program Code : CE/CR/CS
Semester : Fourth
Course Title : Hydraulics
Course Code : 22401

1. RATIONALE

It is necessary for Civil Engineering technologist to understand the behaviour of fluid flow in different water carriages. Basics of hydraulics and its application oriented content will help them to solve practical problems in the field of Water Resources, Irrigation, Environmental Engineering and Public health Engineering.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Apply hydraulics principles in water carriage systems and water retaining structures.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above-mentioned competency:

- Interpret the pressure parameters from pressure measuring devices in flowing liquids.
- Determine total hydrostatic pressure and centre of pressure for different conditions.
- Use relevant fluid flow parameters in different situations.
- Determine the loss of head of fluid flow through pipes.
- Find the fluid flow parameters in open channels.
- Select relevant hydraulic pumps for different applications.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	2	2	7	3	70	28	30*	00	100	40	25#	10	25	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the



course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

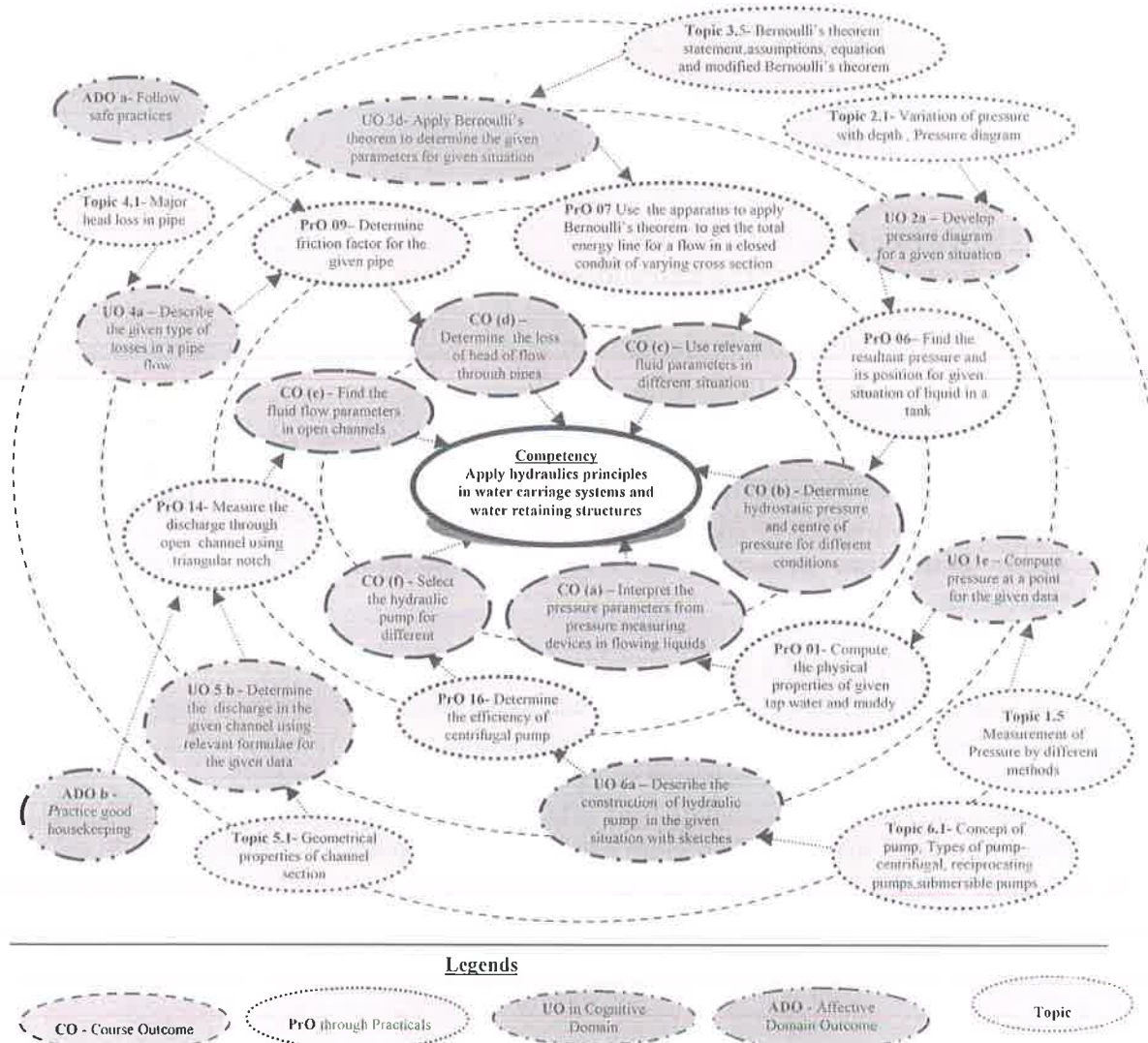


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Compute the physical properties of given tap water and muddy water	I	02*
2	Compute the physical properties of given oil and Mercury	I	02
3	Use the piezometer to measure the pressure at a given point.	I	02
4	Use the Bourdon Gauge to measure the pressure at a given point.	I	02
5	Use the U tube differential manometer to measure the pressure difference between two given points.	I	02*
6	Find the resultant pressure and its position for given situation of liquid in a tank.	II	02*
7	Use the Reynold's apparatus to interpret type of flow	III	02*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
8	Use the Bernoulli's apparatus to apply Bernoulli's theorem to get the total energy line for a flow in a closed conduit of varying cross sections.	III	02*
9	Use the Friction factor Apparatus to determine friction factor for the given pipe.	IV	02*
10	Determine the minor losses in pipe fittings due to sudden contraction and sudden enlargement.	IV	02*
11	Determine the minor losses in pipe fitting due to Bend and Elbow	IV	02
12	Calibrate the Venturimeter to find out the discharge in a pipe.	IV	02*
13	Calibrate the Orifice to find out the discharge through a tank	IV	02*
14	Use the current meter to measure the velocity of flow of water in open channel.	IV	02
15	Use the Pitot tube to measure the velocity of flow of water in open channel.	IV	02
16	Use the Triangular notch to measure the discharge through open channel.	V	02*
17	Use the Rectangular Notch to measure the discharge through open channel	V	02
18	Determine the efficiency of centrifugal pump.	VI	02*
	Total		36

Note

- A suggestive list of **PrOs** is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical LOs/tutorials need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- Hence, the 'Process' and 'Product' related skills associated with each PrO of the laboratory/workshop/field work are to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	10
2	Setting and operation	20
3	Safety measures	10
4	Observations and recording	20
5	Interpretation of result and conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
	Total	100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safe practices
- Practice good housekeeping
- Practice energy conservation



- d. Demonstrate working as a leader/a team member
- e. Maintain tools and equipment
- f. Follow ethical practices

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	Measuring cylinder, Weighing balance	01, 02
2	Piezometer	03
3	Bourdon tube pressure gauge	04
4	U tube differential manometer, Mercury	05
5	Reynold's apparatus, colour dye, Stop watch	06
6	Bernoulli's apparatus, Stop watch	07
7	Friction factor Apparatus, Stop watch	08
8	Apparatus for finding minor losses in the pipe, Stop watch	09
9	Pipe setup, bend, elbow fittings, stop watch	10
10	Pipe set up fitted with Venturimeter, U tube differential manometer, Stop watch	11
11	Current meter, stop watch	12
12	Pitot tube, stop watch	13
13	Channel set up with different notches, Stop watch	14
14	Centrifugal pump set up	15

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

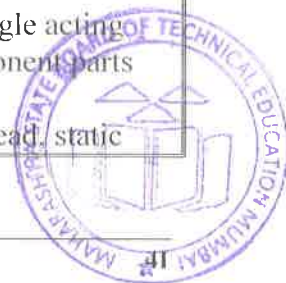
Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Pressure measurement	1a. Describe the role of hydraulics in the given civil engineering application. 1b. Compute different properties of liquid from given data. 1c. Convert gauge pressure into absolute pressure for the given data and viceversa.	1.1 Technical terms used in Hydraulics – fluid, fluid mechanics, hydraulics, hydrostatics, and hydrodynamics-ideal and real fluid, application of hydraulics in Civil Engineering field. 1.2 Physical properties of fluid – density-specific volume, specific gravity-surface tension-capillarity, viscosity-



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	1d. Convert pressure head of one liquid to that of another liquid for the given data. 1e. Compute pressure at a point for the given data. 1f. Compute pressure difference between two points for the given data.	Newton's law of viscosity 1.3 Various types of pressure – Atmospheric Pressure- Gauge Pressure-Absolute Pressure-Vacuum Pressure, Concept of Pressure Head and its unit, Pascal's law of fluid pressure and its uses. 1.4 Conversion of pressure head of one liquid in terms of other liquid. 1.5 Measurement of Pressure by different methods (By Piezometer, simple manometers and Borden pressure Gauge) 1.6 Measurement of difference of pressure by differential U tube manometers and inverted U tube manometers
Unit-II Hydrostatics	2a. Develop pressure diagram for a given situation. 2b. Determine total pressure and centre of pressure for given immersed surface with sketches. 2c. Find the resultant pressure and its position for given situation of liquid in a tank. 2d. Find the resultant pressure and its position for the given liquid on either side of the partition wall.	2.1 Variation of pressure with depth , Pressure diagram –concept and use 2.2 Total hydrostatic pressure and center of pressure on immersed surfaces and on tank walls 2.3 Determination of total pressure and center of pressure on vertical, inclined and horizontal immersed surfaces. 2.4 Determination of total pressure and center of pressure on sides and bottom of water tanks, sides and bottom of tanks containing two liquids, vertical surface in contact with liquid on either side
Unit- III Fluid Flow Parameters	3a. Differentiate the given types of flow. 3b. Interpret the type of flow using Reynold's number 3c. Calculate velocity and discharge in the given situation using continuity equation. 3d. Apply Bernoulli's theorem to determine the given parameters for given situation. 3e. Apply Modified Bernoulli's theorem to determine the given parameters for given situation	3.1 Types of flow – Gravity and pressure flow, Laminar -Turbulent -Uniform - Non-uniform –Steady-Unsteady flow 3.2 Reynold's number 3.3 Discharge and its unit, continuity equation of flow. 3.4 Energy of flowing liquid: potential, kinetic and pressure energy. 3.5 Bernoulli's theorem : statement, assumptions, equation and modified Bernoulli's theorem
Unit- IV Flow through	4a. Describe the given type of losses in a pipe flow. 4b. Use Darcy Weisbach equation to	4.1 Major head loss in pipe: Frictional loss and its computation by Darcy



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
pipes	<p>find out the head loss due to friction for the given data.</p> <p>4c. Compute the discharge in the given network (Parallel or series) of pipes.</p> <p>4d. Apply Dupit's equation to determine the equivalent pipe for given data.</p> <p>4e. Use Moody's diagram to find diameter of pipe from given data.</p> <p>4f. Use nomogram to find diameter of pipe from given data.</p> <p>4g. Calculate discharge in a pipe for the given data using Venturimeter.</p>	<p>Weisbach equation $h_f = \frac{f l v^2}{2gD}$</p> <p>4.2 Minor losses in pipe: loss at entrance, exit, sudden contraction, sudden enlargement and fittings.</p> <p>4.3 Flow through pipes in series, pipes in parallel and Dupit's equation for equivalent pipe</p> <p>4.4 Hydraulic gradient line and total energy line</p> <p>4.5 Water hammer in pipes : causes and Remedial measures</p> <p>4.6 Use of Moody's Diagram and Nomograms.</p> <p>4.7 Discharge measuring device for pipe flow: Venturimeter-construction and working</p> <p>4.8 Discharge measuring for a tank: using Orifice, Hydraulic Coefficients of Orifice.</p>
Unit –V Flow through Open Channel	<p>5a. Describe the geometrical properties of the given channel.</p> <p>5b. Determine discharge in the given channel using relevant formulae for the given data</p> <p>5c. Design the most economical channel section for the given conditions.</p> <p>5d. Describe the procedure of finding velocity and discharge using the given flow-measuring device.</p> <p>5e. Measure the velocity of flow through open channel for the given condition.</p>	<p>5.1 Geometrical properties of channel section: Wetted area, wetted perimeter, hydraulic radius for rectangular and trapezoidal channel section.</p> <p>5.2 Determination of discharge by Chezy's equation and Manning's equation</p> <p>5.3 Conditions for most economical rectangular and trapezoidal channel section</p> <p>5.4 Discharge measuring devices: Triangular and rectangular Notches</p> <p>5.5 Velocity measurement devices: current meter, floats and Pitot tube</p> <p>5.6 Specific energy diagram, Froude's Number, and Hydraulic.</p>
Unit –VI Hydraulic Pumps	<p>6a. Describe the construction of the hydraulic pump in the given situation with sketches.</p> <p>6b. Describe the working of the pump used for the given data with sketches.</p> <p>6c. Describe the different heads of pump in the given situation.</p> <p>6d. Compute the power of</p>	<p>6.1 Concept of pump, Types of pump- centrifugal, reciprocating pumps, submersible pumps</p> <p>6.2 Centrifugal pump: Component parts and working</p> <p>6.3 Reciprocating pump: single acting and double acting. component parts and working.</p> <p>6.4 Suction head, delivery head, static</p>



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	Centrifugal pump from the given data. 6e. Select relevant type of pump for the given situation.	head Manometric head 6.5 Compute power of centrifugal pump. 6.6 Selection and choice of pump

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Pressure and pressure measurement	08	4	4	4	12
II	Hydrostatics	08	2	4	4	10
III	Fundamentals of fluid flow	08	2	4	6	12
IV	Flow through pipes	10	2	6	6	14
V	Flow through open channel	10	4	4	6	14
VI	Pumps	04	-	4	4	08
Total		48	14	26	30	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare journals based on practical performed in laboratory.
- Follow the safety precautions.
- Library /Internet survey of hydraulic structures.
- Prepare power point presentation or animation for understanding different principles of hydraulics.
- Visit nearby natural channel/canal and Submit report consisting flow data, cross sections, hydraulic data for the same.
- Interpretation and relevance of Moody's chart.
- Collect the data from YouTube/videos showing various concepts and technologies related to the subject under consideration
- Interpretation and relevance of Nomogram.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)



These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- '**L**' in **item No. 4** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics**, which is relatively simpler or descriptive in nature, is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Guide student(s) in undertaking micro-projects.
- Use Flash/Animations to explain various theorems in circuit analysis
- Demonstrate various concepts used in hydraulics.
- Encourage the students to refer different websites to have deeper understanding of new concepts and new technologies related to hydraulics.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

- Collect the information of different types of pumps for selection of type of pump.
- Suggest the relevant type of Pump for typical bungalow/single storey building for the given data.
- Construct a channel for a given specific discharge.
- Determine the total head loss for a multistoried building.
- Measure the discharge of the channel by using triangular notches of different angle.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Hydraulics and Fluid Mechanics	Modi, P. N. and Seth, S.M.	Standard book house, Delhi ISBN:13: 978-8189401269;
2	Hydraulics, Fluid Mechanics and Fluid Machines	Ramamrutham, and Narayan, R.	Dhanpat Rai Publishing Company, New Delhi, ISBN:8187435841
3	Hydraulics, Fluid Mechanics,	Khurmi, R S	S Chand Publishers, New Delhi



S. No.	Title of Book	Author	Publication
	Hydraulic machines		ISBN: 9788121901628
4	Fluid Mechanics	Rajput, R K	S Chand, New Delhi ISBN: 9788121916677
5	Fluid Mechanics and Machinery	Ojha, C S P, and Berndtsson, R	Oxford University Press, New Delhi, ISBN: 9780195699630

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

- a. <https://www.youtube.com/watch?v=5RCeLYbiZCk>
- b. <https://www.youtube.com/watch?v=qGQ4fojjwvQ>
- c. <https://www.youtube.com/watch?v=YrFM51hBQXk>
- d. https://www.youtube.com/watch?v=JXQxdQt3Zac&list=PL1YauKdEeDpX5ycmkxY7WTLWfBLUV_Clp
- e. <https://www.youtube.com/watch?v=9DYyGYSUhlc>
- f. <https://www.youtube.com/watch?v=UJ3-Zm1wbIQ>
- g. <https://www.youtube.com/watch?v=H3TcLoapJBo>
- h. <https://www.youtube.com/watch?v=upHHx42r4E0>
- i. <https://www.youtube.com/watch?v=DnHZOFmlQqI>
- j. <https://www.youtube.com/watch?v=7dHmGYGt6Dg>
- k. https://www.youtube.com/watch?v=4Pyu_YBxYpE
- l. <https://www.youtube.com/watch?v=BaEHVpKc-1Q>
- m. <https://www.youtube.com/watch?v=s6RIx0SL3C8>
- n. <https://www.youtube.com/watch?v=aGlemvowbPs>
- o. https://www.youtube.com/watch?v=f_NChxpnc20



Program Name : Civil Engineering Program Group
Program Code : CE/CR/CS
Semester : Fourth
Course Title : Theory of Structures
Course Code : 22402

1. RATIONALE

Civil engineering structures are mainly made-up of column, Beam and Slabs and these structures are subjected to axial as well as eccentric loading along with different end conditions. The content on calculations of shear forces, bending moments, bending stresses, slope and deflections which are developed in various types of beams will be useful in design of these members. Analysis of members for axial forces, slope, deflection, combined direct and bending stresses will be useful in safe design of various structural members.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Analyze structural components using different methods.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

- Analyze stresses induced in vertical members subjected to direct and bending loads.
- Analyze slope and Deflection in beams under different loading conditions.
- Analyze end moments of fixed beams.
- Analyse continuous beam under different loading conditions using the principles of Three Moments.
- Analyze continuous beam using Moment Distribution Method under different loading conditions.
- Evaluate axial forces in the members of simple truss.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
4	2	-	6	4	70	28	30*	00	100	40	-	-	-	-	-	-

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

Legends: **L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** -Practical; **C** – Credit, **ESE** -End Semester Examination; **PA** - Progressive Assessment.



5. COURSE MAP(with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

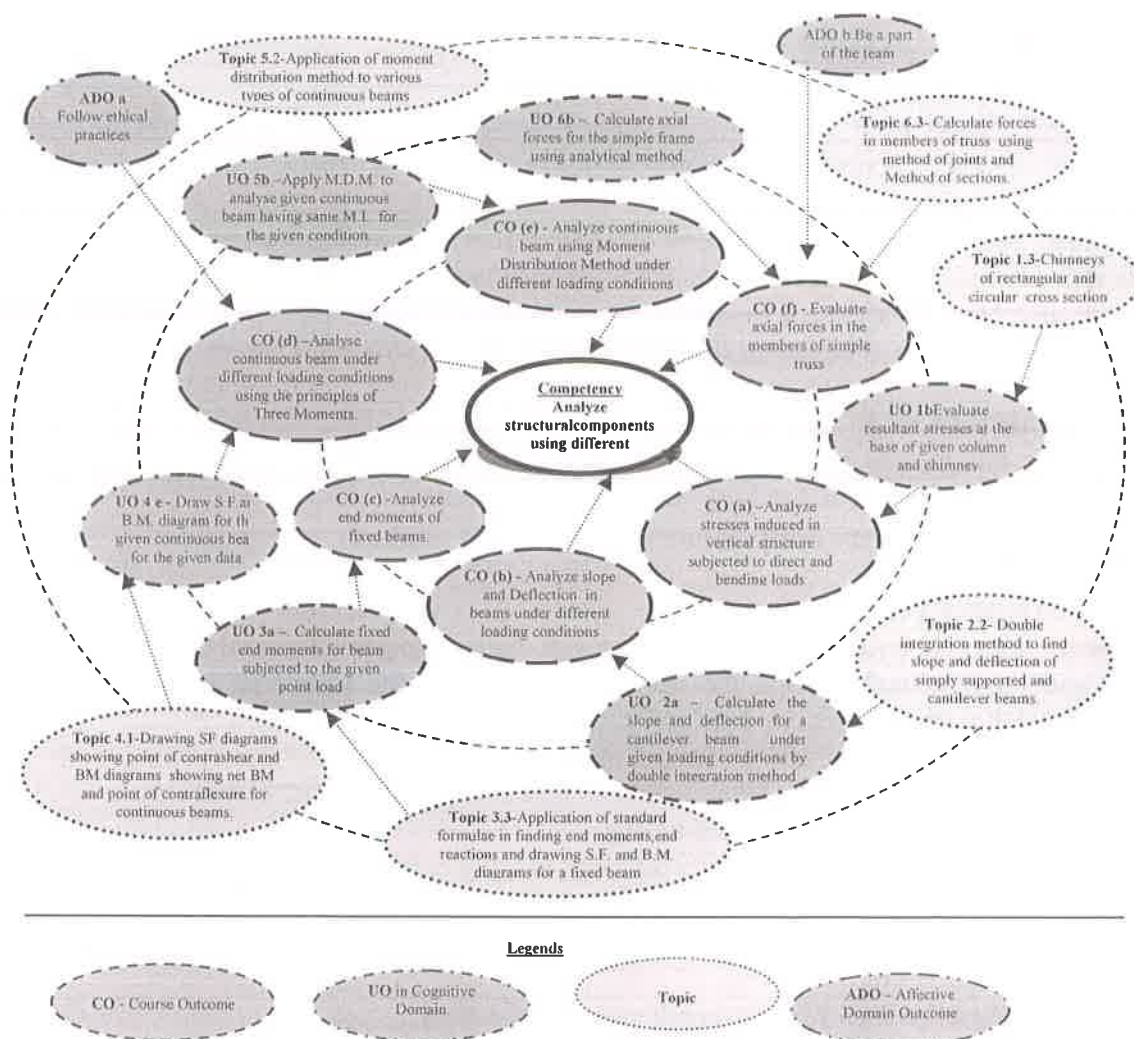


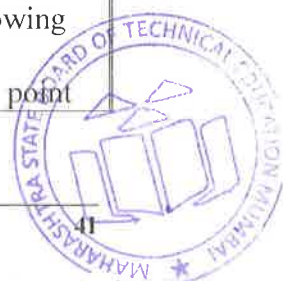
Figure 1 - Course Map

6. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Direct and Bending Stresses in vertical members.	1a. Compare stresses developed due to the axial load and eccentric load in the given situation. 1b. Evaluate resultant stresses at the base of given column and chimney under given loading conditions. 1c. Draw stress distribution diagram	1.1 Introduction to axial and eccentric loads, Eccentricity about one principal axis only, nature of stresses, Maximum and minimum stresses, resultant stresses and stress distribution diagram. 1.2 Condition for no tension or zero stress at extreme fiber, Limit of eccentricity.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	<p>for the given column and chimney under given loading conditions.</p> <p>1d. Calculate the limit of eccentricity and core of a given section.</p> <p>1e. Analyze stresses in a given dam section for given loading conditions.</p> <p>1f. Draw stress distribution diagram for the given dam section.</p>	<p>core of section for rectangular and circular cross sections, Middle third rule.</p> <p>1.3 Chimneys of rectangular and circular cross section subjected to wind pressure, coefficient of wind pressure, Maximum and minimum stresses, resultant stresses and stress distribution diagram at base.</p> <p>1.4 Analysis of dams subjected to horizontal water pressure, conditions of stability, Maximum and minimum stresses, resultant stresses and stress distribution diagram at base.</p>
Unit-II Slope and Deflection	<p>2a. Calculate the slope and deflection for a cantilever beam under given loading conditions by double integration method.</p> <p>2b. Determine the slope and deflection for a simply supported beam under given loading conditions by double integration method.</p> <p>2c. Find the slope and deflection for a cantilever beam under given loading conditions by Macaulay's method.</p> <p>2d. Calculate the slope and deflection for a simply supported beam under given loading conditions by Macaulay's method.</p>	<p>2.1 Concept of slope and deflection, stiffness of beams, Relation among bending moment, slope, deflection and radius of curvature, (no derivation).</p> <p>2.2 Double integration method to find slope and deflection of cantilever and simply supported beams subjected to concentrated load and uniformly distributed load on entire span.</p> <p>2.3 Macaulay's method for slope and deflection, application to cantilever and simply supported beam subjected to concentrated and uniformly distributed load on entire span.</p>
Unit- III Fixed Beam	<p>3a. Explain the effect of fixity in the given beam section.</p> <p>3b. Calculate fixed end moments for beam subjected to the given point load.</p> <p>3c. Determine fixed end moments for the given beam subjected to UDL over entire span by first principle.</p> <p>3d. Find end moments and reactions for fixed beam under given loading condition.</p> <p>3e. Draw S.F. and B.M. diagrams for the given fixed beam using</p>	<p>3.1 Concept of fixity, effect of fixity, advantages and disadvantages of fixed beam over simply supported beam.</p> <p>3.2 Principle of superposition, Fixed end moments from first principle for beam subjected to central point load, UDL over entire span, Point load other than mid span.</p> <p>3.3 Application of standard formulae in finding end moments, end reactions and drawing S.F. diagrams showing point of contraflexure and B.M. diagrams showing net BM and point</p>



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	given data.	of contraflexure for a fixed beam.
Unit– IV Continuous Beam	4a. Explain the effect of continuity in the given situation. 4b. Draw deflected shape of continuous beam subjected to given load and end conditions. 4c. Explain Clapeyron's theorem of three moments used for the analysis of given continuous beam. 4d. Analyse continuous beam under given loading conditions, using Clapeyron's theorem of three moment. 4e. Draw S.F. and B.M. diagram for the given continuous beam using given data.	4.1 Definition, effect of continuity, nature of moments induced due to continuity, concept of deflected shape, practical example. 4.2 Clapeyron's theorem of three moment (no derivation) Application of Clapeyron's theorem maximum up to three spans and two unknown support moment only. Supports at same level, spans having same and different moment of inertia subjected to concentrated loads and uniformly distributed loads over entire span. 4.3 Drawing SF diagrams showing point of contra-shear and BM diagrams showing net BM and point of contraflexure for continuous beams.
Unit –V Moment Distribution Method	5a. Explain Moment Distribution Method (M.D.M.) used for analyzing the given indeterminate beam. 5b. Apply M.D.M. to analyse given continuous beam having same M.I. for the given condition. 5c. Apply M.D.M. to analyse given continuous beam having different M.I. for the given condition. 5d. Plot S.F. and B.M. Diagrams for continuous beam using given data. 5e. Identify the type of given portal frame with justification. 5f. Plot S.F. and B.M. Diagrams for the portal frame using given data.	5.1 Introduction to moment distribution method, sign convention, Carry over factor, stiffness factor, distribution factor. 5.2 Application of moment distribution method to various types of continuous beams subjected to concentrated loads and uniformly distributed load over entire span having same or different moment of inertia, supports at same level, up to three spans and two unknown support moments only. 5.3 Drawing SF diagrams showing point of contra-shear and BM diagrams showing net BM and point of contraflexure for continuous beams. 5.4 Introduction to portal frames – Symmetrical and unsymmetrical portal frames with the concept of Bays and stories. (Numericals on Symmetrical portal frames only) 5.5 Drawing SF diagrams and BM diagrams for Symmetrical portal frames only.
Unit–VI Simple Trusses	6a. Select the type of truss for given situation with justification. 6b. Calculate the support reactions for the given simple truss using	6.1 Types of trusses (Simple, Fink, compound fink, French truss, Pratt truss, Howe truss, North light truss, King post and Queen post truss)



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	analytical method. 6c. Calculate axial forces for the given simple truss using method of joint and method of section. 6d. Calculate axial forces for the given simple truss using graphical method.	6.2 Calculate support reactions for trusses subjected to point loads at nodal points only. 6.3 Calculate forces in members of truss using method of joints and Method of sections. 6.4 Graphical method of analysis of truss. (No numerical on graphical method of analysis of truss)

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

7. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Direct And Bending Stresses	12	02	04	08	14
II	Slope And Deflection	10	02	04	06	12
III	Fixed Beam	10	00	04	04	08
IV	Continuous Beam	12	02	04	06	12
V	Moment Distribution Method	10	02	04	06	12
VI	Simple Trusses	10	02	04	06	12
Total		64	10	24	36	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

8. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Collect the data of existing structures where direct and bending stresses have a predominant role (for example: Leaning Tower Of Pisa)
- Study the deflected shape and measure maximum deflection in a simply supported beam in laboratory. Check the results using analytical method.
- Compare Fixed Beam with Simply Supported Beam of same span and loading.
- Analyse given continuous beam using different methods and compare the results.
- Collect the data from YouTube/videos showing change in deflected shape due to change in number of supports in a beam.
- Prepare truss using given number of members and joints to carry given load (use webtools/ video games available on internet such as Xconstruction)



9. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- a. Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- b. '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c. About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- e. Guide student(s) in undertaking micro-projects
- f. Use Flash/Animations to explain various theorems in circuit analysis
- g. Assign unit wise tutorials to group of 4 to 5 students for solving problems unit wise.
- h. Assign micro projects to group of 4 to 5 students and let them prepare and present the project through PPT. Group shall submit a report which is limited to 5 pages.
- i. Use of video animation films to explain concept, Facts and applications related to Theory of Structures.
- j. In respect of item 10 below teacher needs to ensure to create opportunity and provisions for such co curricular activities.

10. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

- a. Prepare a model to demonstrate effect of eccentricity.
- b. Prepare a chart showing values of maximum slope and deflection in a fixed beam and simply supported beam, under various loading conditions.
- c. Collect photographs of fixed beams from actual site.
- d. Collect information of continuous beams on actual sites and study the reinforcement provided.
- e. Collect information and photographs of simple truss, its span and type. Prepare a chart based on the information.
- f. Prepare models of different trusses.
- g. Compare member forces in different type of trusses of same span, rise and loading.



11. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Theory of Structures	Ramanrutham, S.	Dhanpatrai & Sons, Delhi ISBN : 978-93-84378-10-3
2	Theory of Structures	Khurmi, R. S.	S. Chand and Co., New Delhi, 2006 ISBN:978-81-21905-20-6
3	Structural Analysis Vol-1	Bhavikatti, S S	Vikas Publishing House Pvt Ltd. New Delhi; ISBN: 978-81-25927-90-7
4	Mechanics of structures, Volume-I and II	Junnarkar, S. B.	Charotar Publishing House, Anand ISBN:978-93-80358-99-4
5	Theory of Structures	Pandit, G.S. and Gupta, S.P.	Tata McGraw Hill, New Delhi, 2006 ISBN :978-00-74634-93-6

12. SUGGESTED SOFTWARE/LEARNING WEBSITES

- nptel.ac.in/courses/112107146/lects%20&%20pics/.../lecture30%20and%2031.htm
- www.nptel.ac.in/courses/105101085/downloads/lec-32.pdf
- www.facweb.iitkgp.ernet.in/~baidurya/CE21004/online_lecture_notes/m2112.pdf
- https://en.wikipedia.org/wiki/Theorem_of_three_moments
- https://en.wikipedia.org/wiki/Moment_distribution_method
- www.facweb.iitkgp.ernet.in/~baidurya/CE21004/online_lecture_notes/m3119.pdf
- www.bgstructuralengineering.com/BGSMA/ContBeams/BGSMA_CB_0201.htm
- www.facweb.iitkgp.ernet.in/~baidurya/CE21004/online_lecture_notes/m3119.pdf
- www.civilprojectsonline.com › Building Construction
- www.mathalino.com/reviewer/engineering.../method-sections-analysis-simple-trusses

13. COURSE CURRICULUM DEVELOPMENT COMMITTEE**MSBTE Resource Persons**

S. No.	Name and Designation	Institute	Contact No.	Email
1	Mr. R.T. Aghao Lecturer in App. Mechanics	Govt. Polytechnic Aurangabad (0019)	9326146501	rajesh_aghao@rediffmail.com
2	Mrs. A.A. Dixit HOD ,Civil Engineering	MIT Polytechnic Pune(0148)	9822172544	ashwiniadixit@gmail.com
3	Mrs. S.M. Kulkarni Lecturer in App. Mechanics	Govt. Polytechnic Pune (0006)	9422035228	smkpune@yahoo.com



Program Name : Civil Engineering Program Group
Program Code : CE/CR/CS
Semester : Fourth
Course Title : Railway and Bridge Engineering
Course Code : 22403

1. RATIONALE

Railway and Bridge Engineering is an important aspect in Civil Engineering; as the progress and integration of any country can be well judged by good network of railways and bridges. This course is expected to develop the competency to execute the construction and maintain the permanent way i.e. railways, associated bridges and tunnels. Bridge plays a vital role in better connectivity for our country during perennial seasons. Bridge engineering involves components of construction and maintenance of different types of bridges across the country. The tunnel engineering work is also quite crucial as it shortens the distances of travel. The civil engineering diploma holders (also called technologists) have to do the related construction and maintenance activities effectively, as safety is also the prime objective.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Execute the construction and maintenance of railways,, bridges and tunnels**

3. COURSE OUTCOMES (COs)

The theory should be taught and practical should be carried out in such a manner that students are able to acquire required learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

- Identify the components of railway tracks.
- Maintain the railway tracks.
- Diagnose the condition of bridges.
- Maintain different types of railway bridges and their components.
- Maintain different types of tunnels.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
4	-	-	4	3	70	28	30*	00	100	40	--	--	--	--	--	--

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment



5. COURSE MAP (with sample COs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

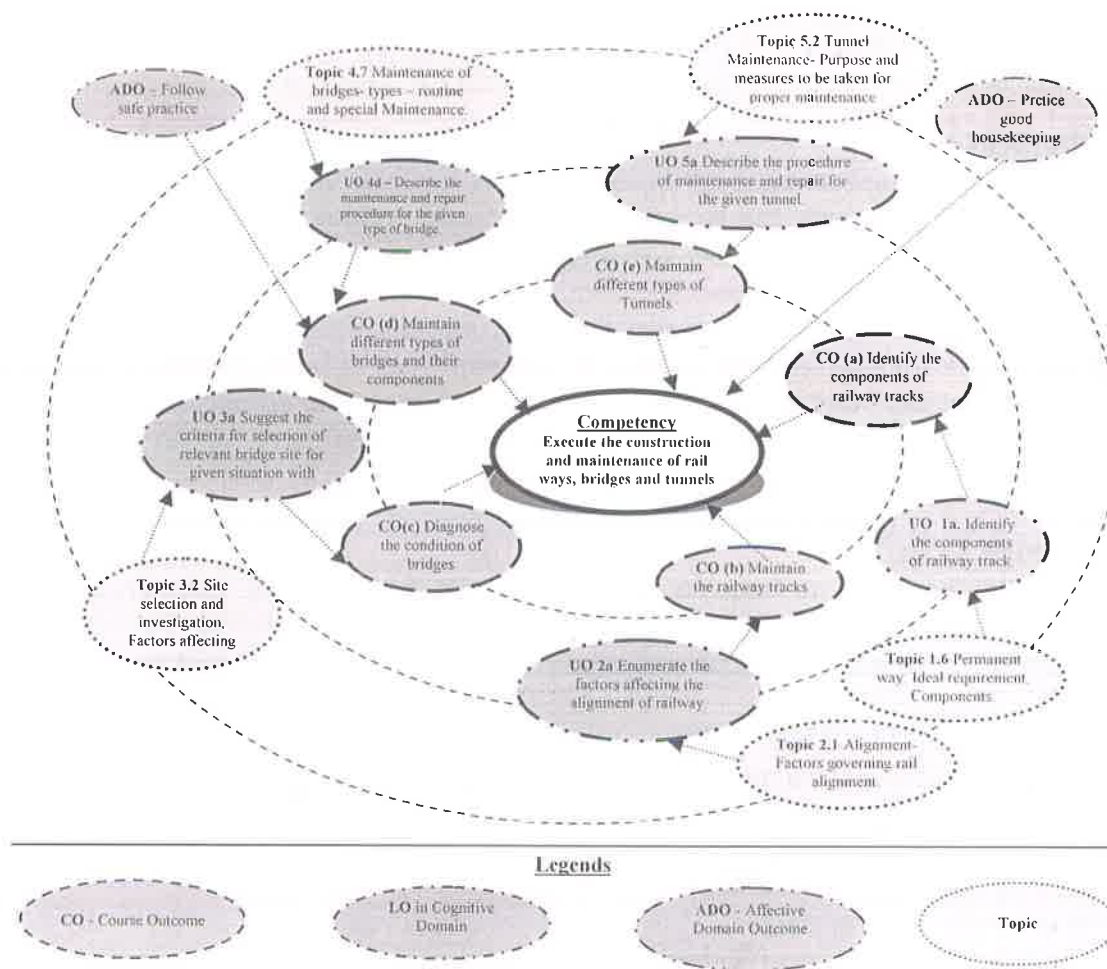


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

- Not applicable -

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

-Not applicable-

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit—I Basics of Railway Engineering	1a. Describe with sketches the given components of railway track in the diagram. 1b. Suggest the remedy for	1.1 Role of transportation in the development of nation; Modes of transportation system – land way, waterway, airway. Merits and demerits of roadway and railway; Classification of Indian Railways, zones of Indian Railway

	<p>the specified fault railway track with justification.</p> <p>1c. Suggest the type of rail track joint for the given situation with justification.</p> <p>1d. Suggest the type of fixtures and fastening for the given rail section with justification.</p>	<p>1.2 Permanent way: Ideal requirement, Components; Rail Gauge, types, factors affecting selection of a gauge.</p> <p>1.3 Rail material, Rail Joints - requirements, types.</p> <p>1.4 Creep of rail: causes and prevention of creep.</p> <p>1.5 Sleepers - functions and Requirement, types - concrete sleepers and their density</p> <p>1.6 Ballast - function and types, suitability.</p> <p>1.7 Rail fixtures and fastenings – fish plate, spikes, bolts, keys, bearing plates, chairs-types of anchors and anti creepers.</p>
Unit—II Track geometric s, Construct ion and Maintena nce	<p>2a. Explain the factors affecting the alignment of railway for the given terrain.</p> <p>2b. Explain with sketches the turn outs, points and crossings with for the given situation.</p> <p>2c. Describe with sketches the track geometrics elements for the given terrain.</p> <p>2d. Describe the process of rail track maintenance for the given season.</p> <p>2e. Describe the functions of the given tools and equipment required for maintaining the track in the specified terrain.</p>	<p>2.1 Alignment- Factors governing rail alignment.</p> <p>2.2 Track Cross sections – standard cross section of single and double line in cutting and embankment. Important terms-permanent land, formation width, side drains,</p> <p>2.3 Railway Track Geometrics : Gradient, curves- types and factors affecting, grade compensation, super elevation, limits of Super elevation on curves, cant deficiency negative cant, grade compensation on curves, Coning of wheel, tilting of rail.</p> <p>2.4 Branching of Tracks-Points and crossings- Turn out-left and right hand turnout, components and their functions, important technical terms, components, types and inspection, track junctions: crossovers, scissor cross over, diamond crossing, track triangle.</p> <p>2.5 Station and Yards-Purpose, requirement of railway station, important technical terms, types of railway station, factors affecting site selection for railway station.</p> <p>2.6 Station yard-Classification-Passenger, goods, locomotive and marshalling yards-function & drawbacks of marshalling yards.</p> <p>2.7 Steps involved in construction of rail track</p> <p>2.8 Track Maintenance- Necessity, Classification, Tools required for track maintenance with their function, Organisation of track maintenance, duties of permanent way inspector, gang mate and key man.</p>
Unit—III Overview of Bridge Engineeri ng	<p>3a. Propose the relevant type of bridge for the given situation on the basis of relevant criteria with justification.</p> <p>3b. Identify the components</p>	<p>3.1 Classification of bridges according to span, purpose, material, life, alignment, H.F.L., Loading, level of bridge floor.</p> <p>3.2 Site selection and investigation, Factors affecting selection of site for bridge, Bridge alignment-Factors controlling.</p>



	<p>of a given type of bridge with their functions.</p> <p>3c. Explain with sketches the bridge section for the given site conditions.</p> <p>3d. Propose the relevant type of foundation for the given type of bridge for the given situation with justification.</p>	<p>3.3 Important technical terms- waterway, economic span, afflux, scouring, freeboard, cut water, ease water.</p> <p>3.4 Component parts of bridge: pier, abutment, wing wall, foundation, bearing</p> <p>3.5 Piers-function, requirements, types.</p> <p>3.6 Abutment – function. types.</p> <p>3.7 Wing walls – functions and types.</p> <p>3.8 Foundation – function, types of bridge foundations</p> <p>3.9 Bearing – functions, types of bearing</p>
Unit—IV Construct ion and Maintena nce of bridge	<p>4a. Compare the structure of the permanent and temporary bridge with reference to the given criteria.</p> <p>4b. Suggest the type of bridge for the given site condition with justification.</p> <p>4c. Describe the construction procedure for given type of bridge.</p> <p>4d. Describe the maintenance and repair procedure for the given type of bridge.</p>	<p>4.1 Temporary Bridge- Necessity, Causeway- Flush, low level and high level causeway</p> <p>4.2 Permanent Bridges- Types of RCC Bridges- Slab, Girder, RCC girder,</p> <p>4.3 Pre-stressed bridge-Advantage & disadvantages</p> <p>4.4 Culvert-Types-Arch, Open or slab, Pipe and box</p> <p>4.5 Choice of type of bridge, Types of bridge foundations</p> <p>4.6 Steps involved in bridges construction</p> <p>4.7 Inspection of bridges-General points to be observed, Pre and post monsoon inspection</p> <p>4.8 Maintenance of bridges- types – routine and special Maintenance.</p>
Unit—V Construct ion and Maintena nce of tunnels	<p>5a. Describe the criteria for selection of the tunnel for given situation with justification.</p> <p>5b. Choose the relevant method of constructing the tunnel in the given situation with justification.</p> <p>5c. Explain the process of lining of the tunnel in the given situation justification.</p> <p>5d. Describe the type of ventilation provided for the given type of tunnel.</p> <p>5e. Describe the procedure of maintenance and repair for the given type of tunnel.</p>	<p>5.1 Tunnel - Classification of tunnels according to purpose, conveyance, material, position or alignment, shape and size of tunnels.</p> <p>5.2 Tunnels: Cross sections for highways and railways, Tunnel investigations and surveying, Tunnel Shaft - its purpose and construction.</p> <p>5.3 Methods of tunnelling in Soft rock-needle beam method, fore-poling method. Line plate method, shield method.</p> <p>5.4 Methods of tunnelling in Hard rock-Full-face heading method, Heading and bench method, drift method.</p> <p>5.5 Drilling equipment-drills and drills carrying equipments, Types of explosives used in tunnelling.</p> <p>5.6 Tunnel lining –Purpose, factors affecting type of lining, and methods</p> <p>5.7 Tunnel ventilation and drainage- Purpose and methods</p> <p>5.8 Tunnel Maintenance- Purpose and measures to be taken for proper maintenance</p>



Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Basics of Railway Engineering	12	04	04	04	12
II	Track geometrics, Construction and Maintenance	14	04	06	06	16
III	Overview of Bridge Engineering	14	04	08	04	16
IV	Construction and Maintenance of Bridge	10	02	04	04	10
V	Construction and Maintenance of Tunnels	14	04	06	06	16
Total		64	18	28	24	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Collect the statistical data of Indian Railways and prepare chart showing the development of railways.
- Prepare the scaled bridge model of any one type using ice-cream sticks.
- Collect the details of new technologies of tunnel excavation and prepare the report.
- Collect the data from YouTube/videos showing various concepts and technologies related to the subject under consideration.
- Visit the railway station nearby to understand the cross-section of rail components, arrangement of station yard and layout of railway station and prepare the detailed report with site photographs.
- Visit to any one type of bridge to summarize its components and its present condition and prepare the detailed report with site photographs.
- Visit to roadway tunnel or railway tunnel to verify the structural components and ty lining work and prepare the detailed report with site photographs.
- Library/ Internet survey of hydraulic structures.
- Prepare power point presentation or animation for understanding different principles of the course under consideration.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:



- a. Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- b. '**L**' in **item No. 4** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c. About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d. Teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- e. Guide student(s) in undertaking micro-projects
- f. Use Flash/Animations to explain various theorems, concepts and procedures related to the subjects under consideration.
- g. Demonstrate various concepts of components of railway, bridge using corresponding models.
- h. Encourage students to refer different websites to have deeper understanding of new concepts of railway, bridge and tunnel construction works.
- i. Recommend the students to collect statistical and physiological data of present railway, bridge and tunnel conditions across the country.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PROs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

- a. Draw the cross-section of rail components and layout of a railway station and yard. Prepare the detailed report with site photographs.
- b. Inspect the nearby railway track, bridge or tunnel (**any one**) to enumerate the defects (if any) and prepare the report suggesting the remedial measures for ensuring its stability.
- c. Prepare a model of a bridge/tunnel to demonstrate the relevant associated concept.
- d. Prepare a chart showing Classification of tunnels according to purpose, conveyance, material, position or alignment, shape and size of tunnels under different conditions
- e. Collect photographs of different types of bridge and tunnels from actual site and compare their relevance at that particular site.
- f. Prepare models of different gauges used in railways.



13. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Road, Railways, Bridge and Tunnel Engg	Birdi, Ahuja	Standard Book House, New Delhi, March 2010, ISBN: 978-8189401337
2	Traffic Engineering and Transport Planning	Kadiyali, L.R.	Khanna Publishers, New Delhi, 2008, ISBN: 978-8174092205
3	Bridge Engineering	Ponnuswamy, S.	McGraw-Hill Education, New Delhi, 2008, ISBN: 9780-070656956
4	Railway Engineering	Chandra, Satish and Agarwal, M.M.	Oxford University Press, New Delhi, 2013, ISBN: 978-0198083535
5	Railway Engineering	Rangwala, S.C.	Charotar Publishing House, Anand 2002, ISBN: 978-9380358772
6	Highway, Railway, Airport and Harbour Engineering	Subramanian, K.P.	Scitech Publications, Hyderabad, 2016, ISBN: 978-8183712712

14. SOFTWARE/LEARNING WEBSITES

- a. https://www.youtube.com/watch?v=w_4V8kwkdNU
- b. <http://www.nptel.ac.in/courses/105107123/14>
- c. <http://nptel.ac.in/courses/105107123/9>
- d. <https://www.youtube.com/watch?v=37WMS483T7Y>
- e. <http://onlinepubs.trb.org/onlinepubs/millennium/00014.pdf>
- f. <http://nptel.ac.in/courses/105103093/24>
- g. https://www.youtube.com/watch?v=qx_EjMILgqY
- h. <http://nptel.ac.in/courses/105103093/23>



Program Name : Civil Engineering Program Group
Program Code : CE/CR/CS
Semester : Fourth
Course Title : Geo-Technical Engineering
Course Code : 22404

1. RATIONALE

Geotechnical engineering is the important for every structure, since all structures rest on soil. The stability of these structures depends upon behavior of soil and bearing capacity of soil to carry loads under different loading conditions. Formation of soil and rocks, defects in rocks, soil behavior, and soil as an engineering material are essential parameter to an engineer. The design of foundation of buildings, dams, towers, embankments, roads, railways, retaining walls, bridges is mainly governed by these above stated parameters. The content of this subject are also useful in designing basement, underground tank and underwater structures. Knowledge of geology, soil characteristics, and stress distribution under loading on soil, bearing capacity of soil is also useful to every engineer in the design, execution and stability analysis of structures.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Evaluate soil properties for determining stability of foundation.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

- Identify types of rocks and sub soil strata of earth.
- Interprete the physical properties of soil related to given construction activities.
- Use the results of permeability and shear strength test for foundation analysis.
- Interpret the soil bearing capacity results.
- Compute optimum values for moisture content for maximum dry density of soil through various tests.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25#	10	25	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.



Legends: *L* - Lecture; *T* – Tutorial/Teacher Guided Theory Practice; *P* - Practical; *C* – Credit, *ESE* - End Semester Examination; *PA* - Progressive Assessment.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

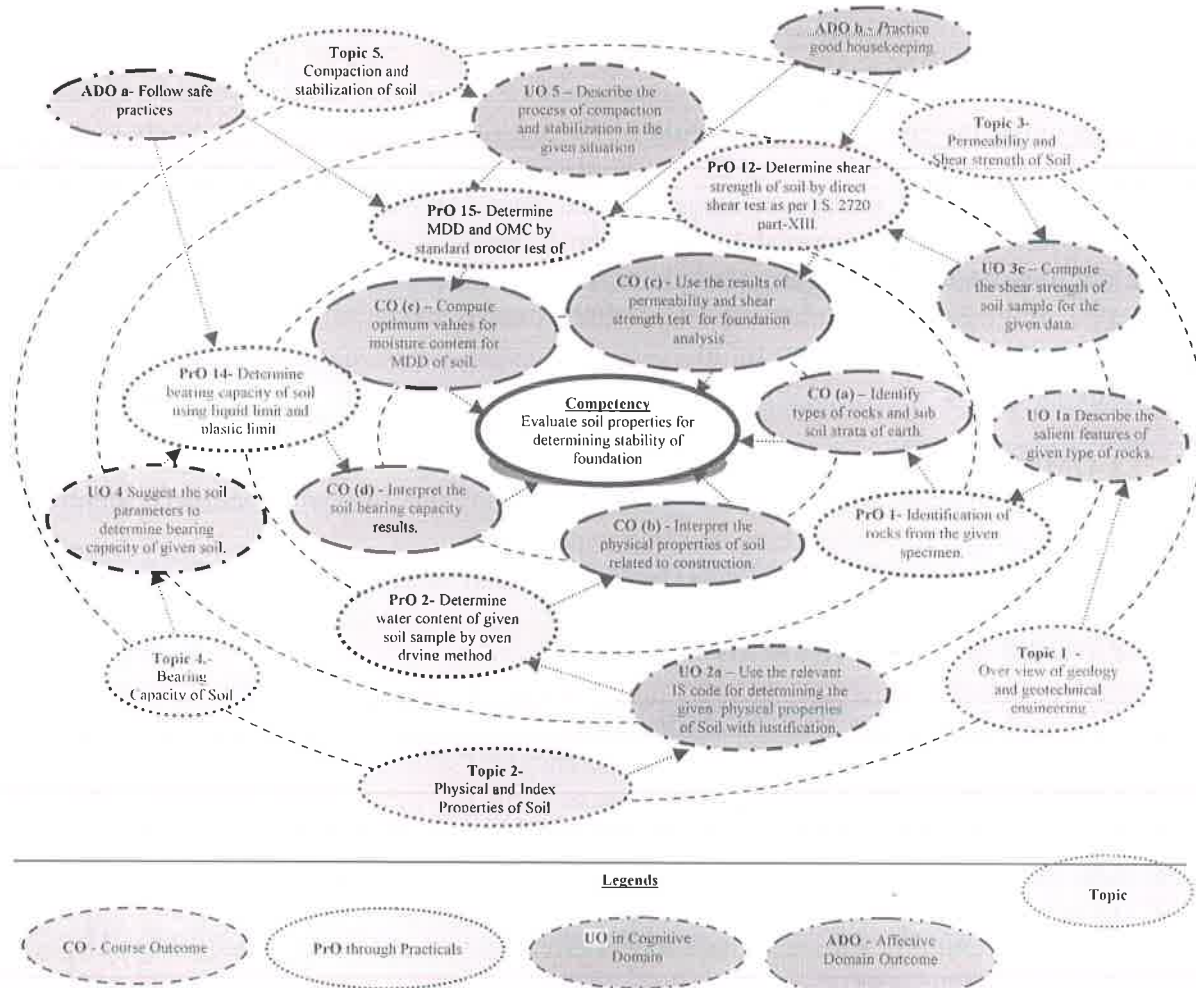


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Identification of rocks from the given specimen	I	02
2	Determine water content of given soil sample by oven drying method as per I.S. 2720 part- II	II	02*
3	Determine specific gravity of soil by pycnometer method as per I.S.	II	02*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	2720 part- III.		
4	Determine dry unit weight of soil in field by core cutter method as per I.S. 2720 (Part- XXIX).	II	02*
5	Determine dry unit weight of soil in field by sand replacement method as per I.S. 2720 (Part- XXVIII).	II	02
6	Determine Plastic Limit & Liquid Limit along with Plasticity Index of given soil sample as per I.S. 2720 I(Part- V).	II	02*
7	Determine Shrinkage limit of given soil sample as per I.S. 2720 (Part- V).	II	02
8	Determine grain size distribution of given soil sample by mechanical sieve analysis as per I.S. 2720 (Part- IV).	II	02*
9	Use different types of soil Identify and classify soil by conducting field tests-Through Visual inspection, Dry strength test, Dilatancy test and Toughness test .	II	02
10	Determine co efficient of permeability by constant head test as per I.S. 2720 (Part- XVII)	III	02
11	Determine co efficient of permeability by falling head test as per I.S. I.S. 2720 (Part- XVII)	III	02*
12	Determine shear strength of soil by direct shear test as per I.S. 2720 (Part-XIII)	III	02*
13	Determine shear strength of soil by vane shear test as per I.S. 2720 (Part-XXX)	III	02
14	Determine bearing capacity of soil using liquid limit and plastic limit	IV	02
15	Determine MDD and OMC by standard proctor test of given soil sample as per I.S. 2720 (Part- VII).	V	02*
16	Determination of CBR value on the field as IS.	IV	02
	Total		32

Note

- A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S.No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and Recording	10
5	Interpretation of result and Conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
	Total	100



The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical Practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year.
- 'Organising Level' in 2nd year.
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	Oven-thermostatically controlled to maintain temperature of 110° C to 115° C	2
2	Pycnometer – consisting of 1 kg. honey /fruit jar with plastic cone, locking ring and rubber seal.	3
3	Core cutter apparatus- cylindrical core cutter of steel 100 mm dia x 127.3mm high with 3mm wall thickness beveled at 1mm.	4
4	Sand replacement apparatus- as per IS: 2720(Part-28)	5
5	Casagrande liquid limit apparatus- as per IS: 9259-1979	6
6	Shrinkage limit apparatus as per IS: 2720(Part- V)	7
7	Mechanical sieve shaker- carries up to 7 sieves of 15 cm to 20 cm dia (as per IS 2720-(Part 4)1985)	8
8	Constant head permeameter- as per IS:2720(Part-4)1986	10
9	Falling head permeameter -as per IS:2720(Part-4)1986	11
10	Direct shear test apparatus- as per IS: 2720(Part 13) 1986	12
11	Vane shear test apparatus- as per 2720 (Part -30)	13
12	Proctor compactometer for light compaction as per IS specification	15
13	Field CBR apparatus as per IS specification	16

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Over view of	1a. Describe the salient features of given type of	1.1 Introduction of geology, different branches of geology. importance of geology for civil



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
geology and geotechnical engineering	rocks. 1b. Identify the given type of rocks. 1c. Suggest the type of soil for the given situation. 1d. Describe the applications of Geo-technical Engineering for the construction of the given civil structure.	engineering structure and composition of earth. 1.2 Introduction of petrology, definition of a rock, classification based on their genesis (mode of origin), formation, classification and engineering uses of igneous, sedimentary and metamorphic rocks. 1.3 IS definition of soil, Importance of soil in Civil Engineering as construction material in Civil Engineering Structures, as foundation bed for structures 1.4 Field application of geotechnical engineering for foundation design, pavement design, design of earth retaining structures, design of earthen dam.
Unit –II Physical and Index Properties of Soil	2a. Use the relevant IS code for determining the given physical properties of Soil with justification . 2b. Calculate Atterberg's limits of Consistency for the given data. 2c. Interpret Atterberg's limits of Consistency for the given data.. 2d. Classify the given soil sample as per IS provision. 2e. Interpret the particle size distribution curve for the given data.	2.1 Soil as a three phase system, water content, determination of water content by oven drying method as per IS code, void ratio, porosity and degree of saturation, density index, unit weight of soil mass – bulk unit weight, dry unit weight, unit weight of solids, saturated unit weight, submerged unit weight, determination of bulk unit weight and dry unit weight by core cutter method and sand replacement method as per IS code, specific gravity, determination of specific gravity by pycnometer. 2.2 Consistency of soil, stages of consistency, Atterberg's limits of consistency viz. Liquid limit, plastic limit and shrinkage limit, plasticity index, determination of liquid limit, plastic limit and shrinkage limit as per IS code. 2.3 Particle size distribution, mechanical sieve analysis as per IS code particle size distribution curve, effective diameter of soil, Uniformity coefficient and coefficient of curvature, well graded and uniformly graded soils, particle size classification of soils, I.S. classification of soil.
Unit III Permeability and Shear Strength of Soil.	3a. Identify the factors affecting the permeability of given type of soil sample. 3b. Compute the coefficient of permeability for a given soil sample data.	3.1 Definition of permeability, Darcy's law of permeability, coefficient of permeability, factors affecting permeability, determination of coefficient of permeability by constant head and falling head permeability tests, simple problems to determine coefficient of permeability



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	3c. Compute the shear strength of soil sample for the given data. 3d. Interpret the shear failure of soil sample for the given data. 3e. Use the application of flow net in the given situation.	Seepage through earthen structures, seepage velocity, seepage pressure, phreatic line, flow lines, application of flow net, (No numerical problems.) 3.2 Shear failure of soil, field situation of shear failure, concept of shear strength of soil, components of shearing resistance of soil – cohesion, internal friction. Mohr-coulomb failure theory, Strength envelope, strength Equation for purely cohesive and cohesion less soils. Direct shear test and vane shear test –laboratory methods.
Unit IV Bearing Capacity of Soil	4a. Suggest the soil parameters to determine bearing capacity of given soil sample with justification. 4b. Suggest the method to determine bearing capacity of the soil for the given strata with justification. 4c. Choose the relevant type of foundation using Rankine formula for the given situation. 4d. Correlate the effect of water table on bearing capacity of soil for the given data.	4.1 Bearing capacity and theory of earth pressure: Concept of bearing capacity, ultimate bearing capacity, safe bearing capacity and allowable bearing pressure, Introduction to Terzaghi's analysis and assumptions made, effect of water table on bearing capacity. 4.2 Field methods for determination of bearing capacity – Plate load test and standard penetration test. Test procedures as Per IS: 1888 & IS:2131 4.3 Definition of earth pressure, active earth pressure and passive earth pressure for no surcharge condition, coefficient of earth pressure, Rankine's theory and assumptions made for non-cohesive Soils.
Unit V Compaction and stabilization of soil	5a. Describe the process of compaction and stabilization in the given situation. 5b. Suggest the relevant compacting equipment for the given type soil sample with justification. 5c. Choose the relevant method of soil stabilization for the given situation with justification. 5d. Compute the CBR value for given data of soil sample.	5.1 Concept of compaction, purpose of compaction, field situations where compaction is required, Standard proctor test test procedure as per IS code, Compaction curve, optimum moisture content, maximum dry density, Zero air voids line, Modified proctor test, factors affecting compaction, field methods of compaction – rolling, ramming and vibration and Suitability of various compaction equipments-smooth wheel roller, sheep foot roller, pneumatic tyred roller, rammer and vibrator, difference between compaction and consolidation. 5.2 Concept of soil stabilization, necessity of soil stabilization, different methods of soil



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	5e. Interpret the value of CBR with reference to IS Provisions.	stabilization – mechanical soil stabilization, lime stabilization, cement stabilization, bitumen stabilization, fly-ash stabilization. California bearing ratio, C.B.R. test, meaning of C.B.R. value. 5.3 Necessity of site investigation and sub-soil exploration, types of exploration, criteria for deciding the location and number of test pits and bores. Field identification of soil – dry strength test, dilatancy test and toughness test.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	General Geology and Over view of Geotechnical Engineering	06	04	06	--	10
II	Physical properties of soil	12	04	04	08	16
III	Permeability and Shear strength of soil	12	04	04	08	16
IV	Bearing capacity of soil	06	04	04	04	12
V	Compaction and Stabilization of soil	12	04	04	08	16
Total		48	20	22	28	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Visit to different site and identify the type of strata encounter and judge the bearing capacity of strata and correlate with actual value adopted as per IS provision.
- Collection of soil sample of various types of soil.
- Collection of photographs of machines used for stabilization and compaction.
- Contribution of various scientists in geotechnical engineering.
- Preparation of chart showing engineering properties of soil along with IS specification
- Collection of data about soil deposits available in various region of India and showing it in the map of India.



11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Guide student(s) in undertaking micro-projects
- Use Flash/Animations to explain various theorems in Geotechnical Engineering.
- Demonstrate various concepts related to Geotechnical Engineering .
- Encourage students to refer different websites to have deeper understanding of new concepts of Geotechnical Engineering.
- Assign unit wise tutorials to group of 4 to 5 students for solving problems unit wise.
- Assign micro projects to group of 4 to 5 students and let them prepare and present the project through PPT. Group shall submit a report which is limited to 5 pages.
- Use of video animation films to explain concept, Facts and applications related to Geotechnical Engineering .
- In respect of item 10 above teacher needs to ensure to create opportunity and provisions for such co curricular activities.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

- Write a report on role of a geotechnical engineer in civil engineering practice.
- Taking the samples in field and test it in laboratory for different properties of soil.
- Calculate the bearing capacity of soil from the Atterberg limit values.
- Compute the plasticity index and toughness index for the given soil sample from given data.
- Select a soil sample from given one which contains more clay particle, has greater saturated unit weight, has a greater dry unit weight, has a greater void ratio.



- f. Derive the relation between discharge velocity and seepage velocity.
- g. Compute the permeability of a given soil sample of stratified soil deposits.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Soil Mechanics and Foundation Engineering	Punmia, B.C.	Laxmi Publication (P) Ltd., New Delhi, ISBN 9788170087915
2	A text book of soil mechanics and foundation Engineering	Murthy, V.N.S.	CBS Publishers & Distributors Pvt. Ltd., New Delhi 2016 ISBN: 9788123913629
3	Geotechnical Engineering(Soil Mechanics)	Ramamurthy, T.N. & Sitharam, T.G.	S Chand and Company LTD., New Delhi, ISBN: 9788121924573
4	Soil Mechanics and Foundation Engineering	Raj, P. Purushothama	Pearson India, New Delhi, 2014 ISBN: 9789332515123
5	Geotechnical Engineering	Kasamalkar, B. J.	Pune Vidyarthi Griha Prakashan, Pune

14. SOFTWARE/LEARNING WEBSITES

- a. www.nptelvideos.in
- b. [www.youtube.com /geotechnical engineering](http://www.youtube.com/geotechnical%20engineering)
- c. www.learnerstv.com (video lecture course – Engg Lectures-soil mechanics)
- d. www.whatisgeotech.org



Program Name : Civil Engineering Program Group
Program Code : CE/CR/CS
Semester : Fourth
Course Title : Building Planning and Drawing
Course Code : 22405

1. RATIONALE

This subject is core technology subject, enabling the principles of planning for drafting the content into graphical form and thereafter its execution. Civil Engineer has to convert design parameters and process details into actual practice. The principles of planning for buildings includes the entire facilities to be provided as per individual's requirements, economical status and suitable to the users. Therefore, students are required to understand, interpret and prepare working drawing. This will further lead into reading and understanding of drawing that will make the execution and implementation easy in the field. In long run construction industry should have orientation towards the skillful design, software skill and energy efficient technique. This will create confidence and share a grain of salt in building nation in a beautiful way of approach.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Prepare engineering drawings as per principles of planning using CAD Software.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

- Interpret the symbols, signs and conventions from the given drawing.
- Prepare line plans of residential and public buildings using principles of planning.
- Prepare submission and working drawing from the given requirement for Load Bearing Structure.
- Prepare submission and working drawing from the given requirement for Framed Structure.
- Draw Two point perspective drawing for given small objects.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	4	7	4	70	28	30*	00	100	40	50#	20	50	20	100	40

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.



Legends: *L*-Lecture; *T*- Tutorial/Teacher Guided Theory Practice; *P* - Practical; *C* - Credit, *ESE* - End Semester Examination; *PA* - Progressive Assessment.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

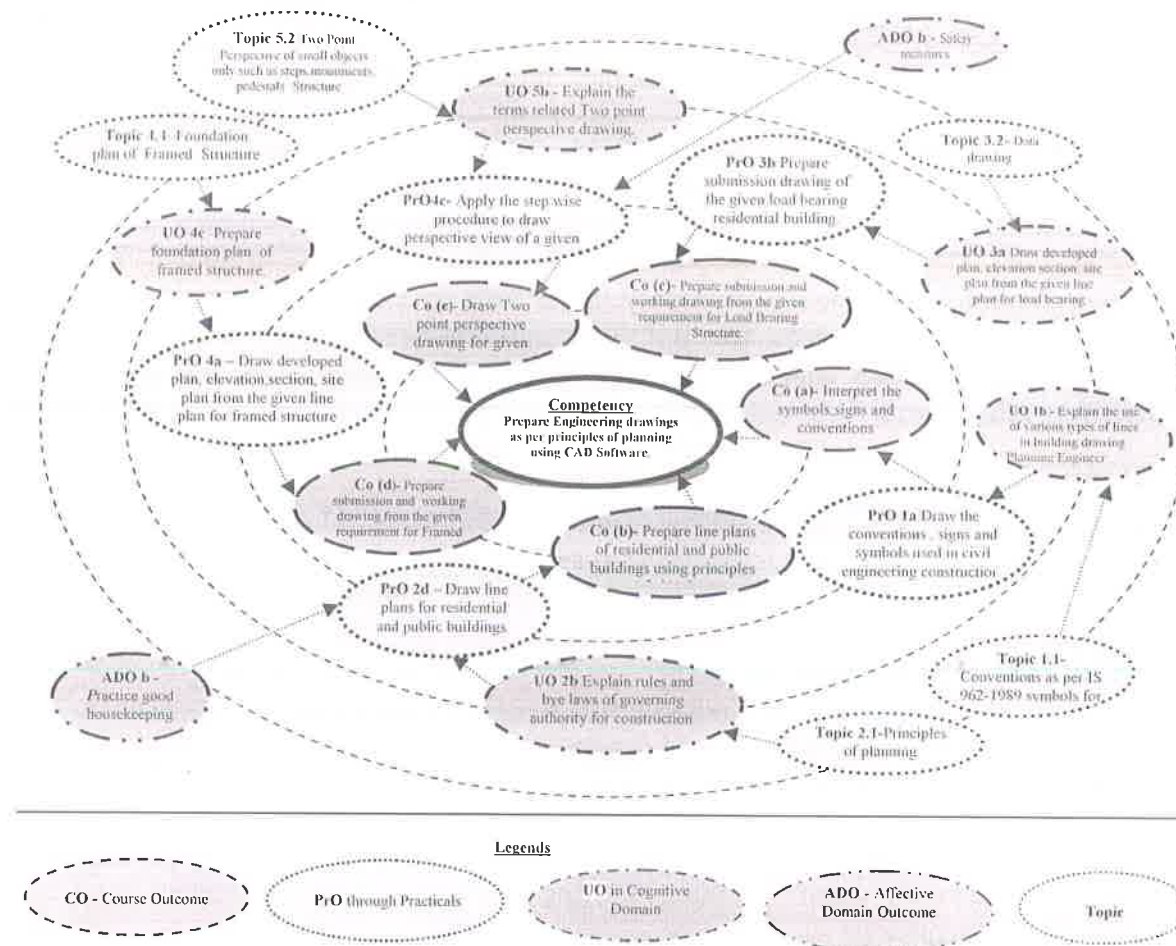


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
A. Sketch Book			
1	Draw various types of lines, graphical symbols for materials, doors and windows, symbols for sanitary, water supply and electrical installations and write abbreviations as per IS 962:1989.	1	02*
2	Write summary of observations of all technical details from the given drawing (One/Two BHK) obtained from the professional architect or civil engineer. (Group activity in 4 students)		02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
3	a) Measure the units of existing building (Load Bearing / Frame structure) .	II	02*
	b) Draw line plan of measured existing building at serial no 3a to the suitable scale.	II	02
4	Draw line plan to suitable scale (Minimum 1BHK, staircase, WC and Bathroom)		
	a) Residential Bungalows (Minimum three plans)	II	02
	b) Apartment (Minimum two plans)	II	02
5	Draw line plans to suitable scale for any Five Public Buildings from the following (School Building, Primary Health Centre, Bank, Post Office, Hostel, Restaurant , Community Hall and Library).	II	02
6	Draw the following plans for a Framed Structure (One/Two BHK) from given line plan.		
	a. Developed plan, Elevation,	II,IV	02*
	b. Section for above developed plan.	IV	02
	c. Site plan for above drawings including area statement, schedule of opening and construction notes .	IV	02
B. Full Imperial Size Sheet (A1)			
1	Draw submission drawing to the scale 1:100 of a single storey load bearing residential building (2BHK) with flat Roof and staircase showing ...		
	a) Developed plan and elevation	II,III	02*
	b) Section passing through Stair or W.C. and Bath	III	02
	c) Foundation plan and schedule of openings.	III	02
	d) Site plan (1:200), area statement, construction notes.	III	02
2	Draw submission drawing, to the scale 1:100, of (G+1) Framed Structure Residential Building (2BHK) with Flat Roof and staircase showing: a) Developed plan .	II,IV	02
	b) Elevation.	IV	02
	c) Section passing through Stair ,W.C. and Bath	IV	02
	d) Section passing through Stair ,W.C. and Bath	IV	02
	e) Site plan (1:200) and area statement	IV	02
	f) Schedule of openings and construction notes.	IV	02
3	Draw the above mentioned drawing at serial number (B-2) using CAD software and enclose the print out.	II, IV	02*
	a) Developed plan		
	b) Elevation.	IV	02
	c) Section passing through Stair, W.C. and Bath	IV	02
	d) Section passing through Stair, W.C. and Bath	IV	02
	e) Foundation plan .	IV	02
	f) Site plan (1:200), area statement, Schedule of openings and construction notes.	IV	02
4	Draw working drawing for above mentioned drawing at serial number (B-2) showing: a) Foundation plan to the scale 1:50	IV	02*
	b) Detailed enlarge section of of RCC column and footing with	IV	02



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	plinth filling		
	c) Detailed enlarge section of of RCC Beam, Lintel and Chajjas.	IV	02
	d) Detailed enlarge section of of RCC staircase and slab.	IV	02
5	Draw two point perspective drawing of small objects - steps, monuments, pedestals (any one) scale 1:50		
	a) Draw plan, elevation, eye level, picture plane and vanishing points	V	02*
	b) Draw perspective view.	V	02
	Total		64

Note

- A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Preparation of Sketch book	15
2	Prepare drawing sheets	30
3	Safety measures	05
4	Neatness and drawing skills	10
5	Attendance and punctuality	20
6	Answer to sample questions	10
7	Submission of report in time	10
	Total	100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/ a team member.
- Maintain tools and equipment.
- Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED



The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Pro. No.
1	Computer with specification as 2GB Ram,HDD 500GB,LCD Monitor with relevant CAD software.	B 3
2	Laser Printer preferably for the output of A3 size.	B 3

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Conventions and Symbols	1a. Draw the conventions , signs and symbols used in given civil engineering drawings. 1b. Explain the use of various types of lines in the given building drawing. 1c. Select relevant scale in given situation. 1d. Interpret the given drawings for the given civil structures.	1.1 Conventions as per IS 962-1989, symbols for different materials such as earthwork, brickwork, stonework, concrete ,woodwork and glass used in civil engineering. 1.2 construction, Graphical symbols for door and window, Abbreviations, symbols for sanitary and electrical installations 1.3 Types of lines- visible lines, centre line, hidden line, section line,dimension line, extension line, pointers, arrow head or dots. Appropriate size of lettering and numerals for Titles,sub titles , notes and dimensions . 1.4 Types of scale- Monumental, Intimate, criteria for Proper Selection of scale for various types of drawing. 1.5 Sizes of various standard papers/sheets. 1.6 Reading and interpreting readymade Architectural building drawing (To be procured from Architect, Planning Consultants, Planning Engineer)



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit-II Planning of Building	2a. Apply the norms for minimum dimensions to various units in a given residential building. 2b. Describe rules and bye laws of governing authority in a given area for construction. 2c. Compute built up, carpet and plinth, super built up area for the given building. 2d. Draw line plans for the given residential and public buildings.	2.1. Principles of planning of Residential and Public building- Aspect, Prospect, Orientation, Grouping, Privacy, Elegance, Flexibility, Roominess, Circulation, Furniture requirements, Sanitation, Economy. 2.2. Space requirement and norms for minimum dimension of different. 2.3. units in the residential and public buildings as per IS 962-1989. 2.4. Rules and bye-laws of sanctioning authorities for construction work. 2.5. Plot area, built up area, super built up area, plinth area, carpet area, floor area and FAR (Floor Area Ratio) / FSI. 2.6. Line plans for residential building of minimum three rooms including w/c, bath and staircase as per principles of planning. 2.7. Line plans for public building-school building, primary health centre, restaurant, bank, post office, hostel, Function Hall and Library.
Unit- III Drawing of Load Bearing Structure	3a. Draw developed plan, elevation, section, site plan from the given line plan for load bearing residential building. 3b. Prepare submission drawing of the given load bearing residential building. 3c. Prepare working drawing of the given load bearing residential building. 3d. Prepare foundation plan of the given load bearing residential building.	3.1. Drawing of Single storey Load Bearing residential building (2 BHK) with staircase. 3.2. Data drawing – developed plan, elevation, section, site plan, schedule of openings, construction notes with specifications, area statement. Planning and design of staircase- Rise and Tread for residential and public building. 3.3. Working drawing – developed plan, elevation, section passing through staircase or w.c. and bath. 3.4. Foundation plan of Load bearing structure.
Unit- IV Drawing of Framed Structure	4a Draw developed plan, elevation, section, site plan from the given line plan for framed structure residential building. 4b Prepare submission drawing of the given	4.1 Drawing of Two storey Framed Structure (G+1) residential building (2 BHK) with staircase. 4.2 Data drawing – developed plan, elevation, section, site plan, schedule of openings, construction notes with specifications, area statement. Planning and design of staircase.



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	framed structure residential building. 4c Prepare foundation plan of framed structure. 4d Draw component parts of the given framed structure. 4e Explain the functions of Draw and modify commands in the given CAD software. 4f Prepare the given drawing in minimum three layers using CAD software.	Rise and Tread for residential and public building. 4.3 Working drawing of Framed Structure – developed plan, elevation, section passing through staircase or w.c. and bath. 4.4 Foundation plan of Framed Structure. 4.5 Details of RCC footing, column, Beam, Chajjas Lintel, Staircase and slab. 4.6 Drawing with CAD- Draw commands, modify commands, layer commands.
Unit–V Perspective Drawing	5a. Explain the principles of perspective drawings in the given situation. 5b. Apply the step wise procedure to draw perspective view of the given object. 5c. Draw perspective drawing of the given object.	5.1 Definition, Types of perspective, terms used in perspective drawing, principles used in perspective drawing 5.2 Two Point Perspective of small objects only such as steps, monuments, pedestals.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Conventions And Symbols	04	02	04	-	06
II	Planning of Building	16	02	06	10	18
III	Drawing of Load Bearing Structure	08	-	04	12	16
IV	Drawing of Framed Structure	14	-	06	12	18
V	Perspective Drawing	06	-	-	12	12
Total		48	04	20	46	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.



10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare two line plans of bungalows using CAD.
- Prepare two line plans of Flat system using CAD.
- Prepare two line plan of public building using CAD.
- Collect detailed set of drawings of flat scheme .

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Use Flash/Animations to explain various theorems in circuit analysis
- Guide student(s) in undertaking micro-projects

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PROs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

- Prepare report on Provisions given in National Building Code 2005.
- Collect and study building Bye laws , rules and regulation for planning as per local competent authority.
- Prepare list of the documents required for obtaining permission for construction of residential building/apartment from competent authority and write report.
- Draw developed plan, Elevation, section, site plan, area statement, schedule of opening and construction notes for public building.



- e. Prepare list of the documents required for obtaining permission for construction of commercial building from competent authority and write report.
- f. Prepare a model of a simple building using card board showing different components with suitable colour.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Building Drawing	Shah. M.G. Kale, CM, Patki, S.Y.	Mcgraw Hill Publishing company Ltd. New Delhi 2002 ISBN: 9780074638767
2	Civil Engineering Drawing	Malik and Mayo	Computech Publication Ltd New Asian Publishers, 2009, New Delhi ISBN:978-8173180026
3	Principles of Perspective Drawing	M. G. Shah and C. M. Kale	Mcgraw Hill Publishing company Ltd. New Delhi, Edition 2002
4	Building Planning and Drawing	Swamy, Kumara; Rao, N, Kameshwara, A .	Charotar Publication, ANAND ISBN : 978-93-85039-12-6 (Ed.2015)
5	M RTP Act	Governmnet of Maharashtra	Governmnet of Maharashtra
6	Building Construction	Bhavikatti, S. S.	Vikas Publication House Pvt. Ltd., New Delhi, ISBN: 978-93259-6079-4
7	A to Z Building Construction	Mantri, Sandip	Satya Prakashan; 2 nd edition (2015), New Delhi, ISBN: 978-8176849692
8	Working with Auto CAD 2000	Singh, Ajit	Mcgraw Hill Publishing company Ltd. New Delhi, Edition 2002
9	Planning and design of Building	Sane, Y.S.	Allied Publishers, New Delhi ASIN : B0007JVH92

14. SOFTWARE/LEARNING WEBSITES

- a. <https://www.youtube.com/watch?v=bCn0X9RRjN0&list=PL060E3166E87E1FD5>
- b. <https://www.youtube.com/watch?v=VYiVjVulnm4>
- c. <https://www.youtube.com/watch?v=HTrZurVyHmw>
- d. <https://www.youtube.com/watch?v=rX6XfCMRYU0>
- e. https://www.youtube.com/watch?v=RpLJT_SHqpU
- f. <https://www.youtube.com/watch?v=218ToJIFQwo>
- g. <https://www.youtube.com/watch?v=NZ0IgP25sV8>
- h. <https://www.youtube.com/watch?v=Ib213mnC8hA>
- i. <https://www.youtube.com/watch?v=bCn0X9RRjN0>
- j. https://www.youtube.com/watch?v=mind4POSag&list=PLUjXrjdMJ1cxUKgVHHqbMnDMBo_ybJ-fb
- k. www.drawingnow.com
- l. www.learn-to-draw-.com



Program Name : Diploma in Production Engineering/Production Technology/
Mechanical Engineering/Civil Engineering/Electrical Engineering

Program Code : PG/PT/ME/CE/CR/CS/EE/EP/EU

Semester : Fourth

Course Title : Environmental Studies

Course Code : 22447

1. RATIONALE

The world today is facing the biggest challenge of survival. Degradation of ecosystem, depletion of natural resources, increasing levels of pollution pose major threat to the survival of mankind. The need of the hour, therefore, is to concentrate on the area of environmental aspects, which shall provide an insight into various environment related issues. Environmental studies are an interdisciplinary academic field that integrates physical, chemical and biological sciences, with the study of the environment. It provides an integrated, quantitative, and interdisciplinary approach to the study of environmental system & gives an insight into solutions of environmental problems.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Diagnose and manage environment related issues**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

- Develop Public awareness about environment
- Select alternative energy resources for Engineering Practice
- Conserve Ecosystem and Biodiversity
- Apply techniques to reduce Environmental Pollution
- Manage social issues and Environmental Ethics as lifelong learning

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme													
L	T	P		Theory								Practical					
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
3	-	-	3	90 Min	70*#	28	30*	00	100	40	--	--	--	--	--	--	

(#) Online Theory Examination.

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment



5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

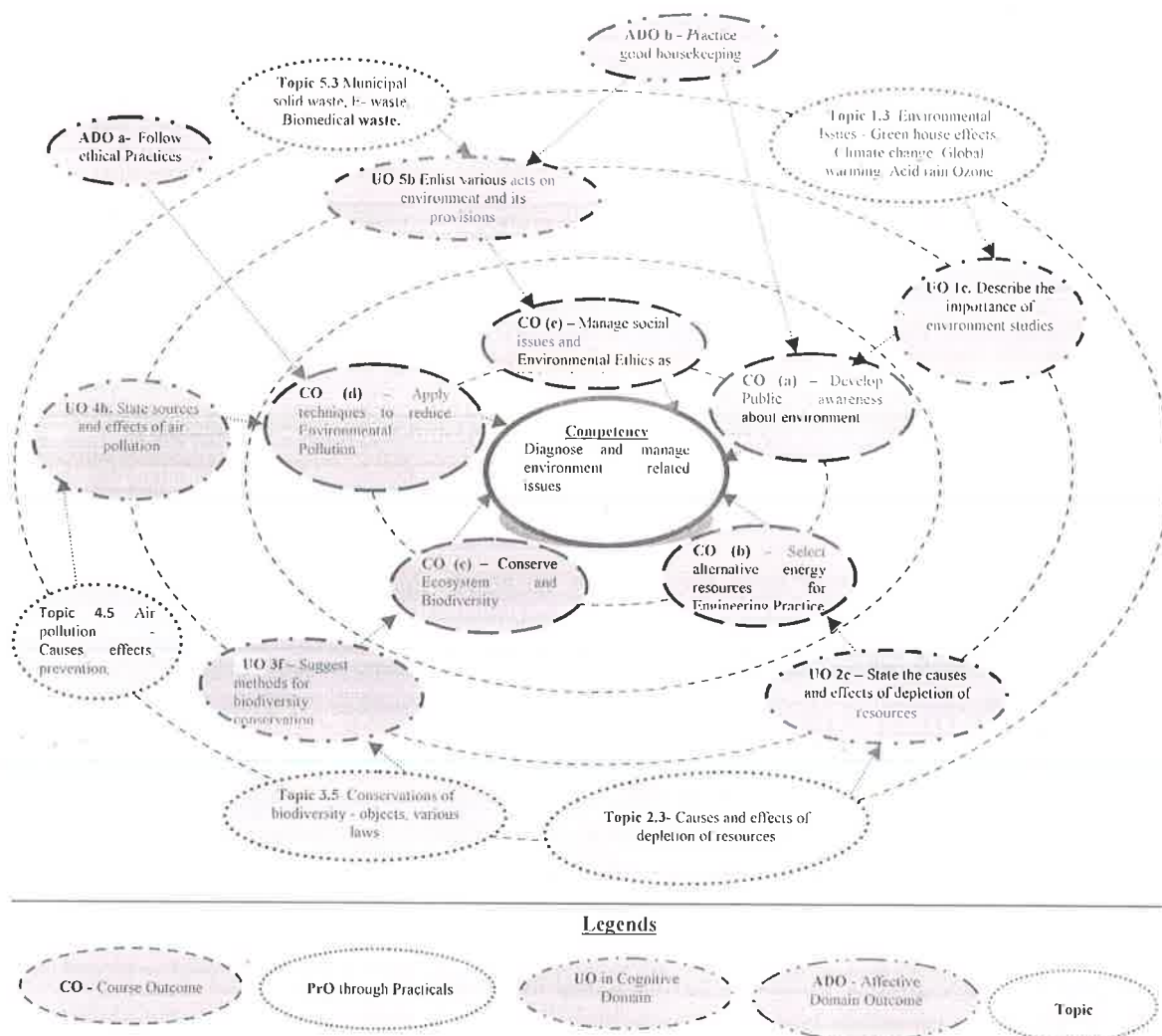


Figure 1 - Course Map

6. SUGGESTED EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency:

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	NIL		
	Total		

Note

- i. A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student

reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.

ii. The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	NIL	
Total		

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Practice energy conservation.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical Practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

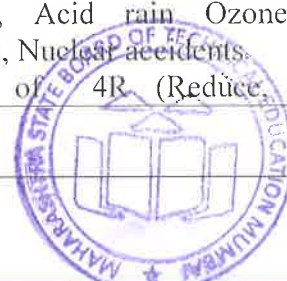
7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	NIL	-

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Environment	1a. Discuss the scope of Environment. 1b. Describe various types of environment 1c. Describe the importance of environment studies. 1d. Discuss about the need of public awareness about environment. 1e. Describe various	1.1 Definitions, need of environmental studies. 1.2 Segments of environment- Atmosphere, Hydrosphere Lithosphere, Biosphere. 1.3 Environmental Issues - Green house effects, Climate change, Global warming, Acid rain Ozone layer depletion, Nuclear accidents. 1.4 Concept of 4R (Reduce, Reuse,



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	environmental issues.	Recycle and Recover). 1.5 Public awareness about environment.
Unit- II Energy Resources	2a. List various natural resources. 2b. Describe Renewable, Nonrenewable and Cyclic resources. 2c. State the causes and effects of depletion of resources. 2d. State advantages and disadvantages of forms of energy. 2e. Select appropriate solutions of efficient use of energy. 2f. State the impacts of overuse of natural resources.	2.1 Natural Resources - Forest Resources, Water Resources, Energy Resources, Land resources, Mineral resources. 2.2 Renewable, Non-renewable and Cyclic Resources. 2.3 Causes and effects of depletion of resources. 2.4 Energy forms (Conventional and non-conventional). 2.5 Present global energy use and future demands. 2.6 Energy conservation. 2.7 Over use of natural resources and its impacts on environment.
Unit- III Ecosystem and Biodiversity	3a. State the aspects and division of ecosystem. 3b. State the general characteristics and function of ecosystem. 3c. List levels of biodiversity. 3d. Enlist the endangered species. 3e. Describe value of biodiversity. 3f. Suggest methods for biodiversity conservation.	3.1 Ecosystem - Definition, Aspects of ecosystem, Division of ecosystem, General characteristics of ecosystem, Functions of ecosystem. 3.2 Biodiversity - Definitions, Levels, Value and loss of biodiversity. 3.3 Biodiversity assessment initiatives in India. 3.4 Threats and Hotspots of biodiversity. 3.5 Conservations of biodiversity - objects, various laws.
Unit- IV Environmental Pollution	4a. Define pollution. 4b. State the sources of pollution. 4c. State the effects of land pollution on environment and lives. 4d. State various units and their functions of water treatment plant. 4e. State the needs of water conservation. 4f. State the impacts of sewage. 4g. State various units and their functions of sewage treatment plant. 4h. State sources and effects of air pollution. 4i. Describe various methods to prevent air pollution. 4j. State sources and effects of noise pollution.	4.1 Definition of pollution, types- Natural & Artificial (Man-made). 4.2 Soil / Land Pollution – Causes and effects on environment and lives, preventive measures. 4.3 Water Pollution - Sources of water (surface and sub surface), sources of water pollution, effects on environment and lives, preventive measures, BIS water quality standards, flow diagram of water treatment plant, Water conservation. 4.4 Wastewater - Generation (domestic and industrial), Impacts, flow diagram of sewage treatment plant, CPCB norms of sewage discharge. 4.5 Air pollution - Causes, effects, prevention, ambient air quality standards. 4.6 Noise pollution - Sources, effects,

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	4k. Describe preventive measures for noise pollution. 4l. State characteristics of solid waste. 4m. State the impacts of solid waste. 4n. Describe incineration, RDF and sanitary landfilling. 4o. State the standards limiting/controlling values of various types of pollution.	prevention, noise levels at various zones of the city. 4.7 Municipal Solid Waste, Bio-medical waste and E-waste - Sources, generation, characteristics, effects, and methods to manage.
Unit-V Social Issues and Environmental Education	5a. Elaborate article (48-A) and (51-A (g)) 5b. Enlist various acts on environment and its provisions. 5c. State the roles and responsibilities of CPCB. 5d. Define sustainable development, and EIA. 5e. Describe rain water harvesting and groundwater recharge. 5f. Differentiate between formal and non formal education.	5.1 Article (48-A) and (51-A (g)) of Indian Constitution regarding environment, Environmental protection and prevention acts, CPCB and MPCB norms and responsibilities. The role of NGOs. 5.2 Concept of sustainable development, EIA and environmental morality. 5.3 Management Measures - Rain Water harvesting, Ground water recharge, Green Belt Development, Use of Renewable energy, water shed management, interlinking of rivers. 5.4 Role of information technology in environment and human health.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Environment	06	4	6	-	10
II	Energy Resources	10	4	8	4	16
III	Ecosystem and Biodiversity	08	4	4	4	12
IV	Environmental Pollution	16	8	8	4	20
V	Social Issues and Environmental Education	08	4	4	4	12
Total		48	24	30	16	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual



distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity. also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Plant and adopt a tree in your nearby locality/Polytechnic campus and prepare report about its growth and survival after six months with photos.
- Organize seminar on air pollutants of relevant MIDC area/vehicle
- Organize poster exhibition about global warming and ozone depletion.
- Visit a nearest water purification/effluent treatment plant.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Guide student(s) in undertaking micro-projects.
- Use proper equivalent analogy to explain different concepts.
- Use Flash/Animations to explain various topics.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

- Prepare a report on visit to PUC Center.
- Visit a near by RO plant and prepare detail technical report
- Prepare report on Household water filtration unit



- d. Prepare a list of polluted natural resources which are responsible for pollution and collect information on how to manage them .
- e. **Collection of Data from Hospital:** Collect everyday information on percentage of solid hazardous and toxic waste for two month
- f. **Visit of Municipal Effluent Treatment Plant:** Visit effluent treatment plant and prepare report on waste management.
- g. **Visit of Water Treatment Plant:** Visit water treatment plant and prepare report on various units of water treatment and its management.
- h. **Preparation of report:** Prepare the chart of solid waste management showing effects on environment.
- i. **And any other relevant topic related to course**

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Basic Environmental Sciences	Michael Allaby	Routledge Publication, 2 nd Edition, 2000, ISBN: 0-415-21176-X
2	Environmental Science	Y. K. Singh	New Age International Publishers, 2006, ISBN: 81-224-2330-2
3	Environmental Studies	Erach Bharucha	University Grants Commission, New Delhi
4	Environmental Studies	Rajagopalan	Third Edition, Oxford University Press, USA, ISBN: 9780199459759, 0199459754
5	A text book of Environmental Science	Arvind Kumar	APH Publishing New Delhi
6	A text book of Environmental Studies	Shashi Chawla	Tata Mc Graw-Hill New Delhi

14. SOFTWARE/LEARNING WEBSITES

- a. www.eco-prayer.org
- b. www.teriin.org
- c. www.cpcb.nic.in
- d. www.indiaenvironmentportal.org.in
- e. www.whatis.techtarget.com
- f. www.sustainabledevelopment.un.org
- g. www.conserve-energy-future.com





Maharashtra State Board of Technical Education, Mumbai
Teaching and Examination Scheme for Post S.S.C. Diploma Courses

Program Name : Computer Engineering Groups

Program Code : CO/CM/CW

With Effect From Academic Year: 2017 - 18

Duration of Program : 6 Semesters

Duration : 16 Weeks

Semester : Fourth

Scheme : I

S. N.	Course Title	Course Abbre- viation	Course Code	Teaching Scheme			Credit (L+T+P)	Examination Scheme												Grand Total	
				L	T	P		Theory						Practical							
								Exam Duration in Hrs.	ESE		PA		Total		ESE		PA		Total		
									Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks		Min Marks
1	Java Programming	JPR	22412	3	-	4	7	3	70	28	30*	00	100	40	50#	20	50	20	100	40	200
2	Software Engineering	SEN	22413	3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150
3	Data Communication and Computer Network	DCC	22414	4	-	2	6	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150
4	Microprocessors	MIC	22415	4	-	2	6	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150
5	GUI Application Development using VB.Net	GAD	22034	2	-	4	6	--	--	--	--	--	--	--	50#	20	50~	20	100	40	100
Total				16	-	14	30	--	280	--	120	--	400	--	175	--	175	--	350	--	750

Student Contact Hours Per Week: **30 Hrs.**

Medium of Instruction: **English**

Theory and practical periods of 60 minutes each.

Total Marks : 750

Abbreviations: ESE- End Semester Exam, PA- Progressive Assessment, L - Lectures, T - Tutorial, P - Practical

@ Internal Assessment, # External Assessment, *# On Line Examination, ^ Computer Based Assessment

* Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain LOs required for the attainment of the COs.

~ For the courses having ONLY Practical Examination, the PA marks Practical Part - with 60% weightage and Micro-Project Part with 40% weightage

➤ **If Candidate not securing minimum marks for passing in the "PA" part of practical of any course of any semester then the candidate shall be declared as "Detained" for that semester.**

➤ **In-Plant Training during Summer vacation for minimum Six Weeks at the end of Fourth Semester (Second Year).**



Program Name : Computer Engineering Program Group
Program Code : CO/CM/IF/CW
Semester : Fourth
Course Title : GUI Application Development using VB.Net
Course Code : 22034

1. RATIONALE

VB.NET is the programming language based on Object Oriented Concepts which is prominently used to develop GUI based Applications. Graphical User Interface (GUI) based application includes various user friendly controls to accept or display data. This course will give the students an in-depth understanding of the concepts used in VB .NET and necessary skills to use programming techniques to develop .NET based applications and deploy the same.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Develop GUI based application using VB.net.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Use Visual Studio IDE to design application.
- Develop GUI Application using Form Controls and its events.
- Apply Object Oriented concepts in GUI Application.
- Use Data access controls to store data in Database and retrieve it.
- Use Data Binding in GUI Application.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
2	—	4	6	—	—	—	—	—	—	—	50#	20	50~	20	100	40

‘#’:No practical Examination, (~²): For the *practical only courses*, the PA has two components under practical marks i.e. the assessment of practicals (seen in section 6) has a weightage of 60% (i.e.30 marks) and micro-project assessment (seen in section 12) has a weightage of 40% (i.e.20 marks). This is designed to facilitate attainment of COs holistically, as there is no theory ESE.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment, ‘#’: No Theory Examination

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)



This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

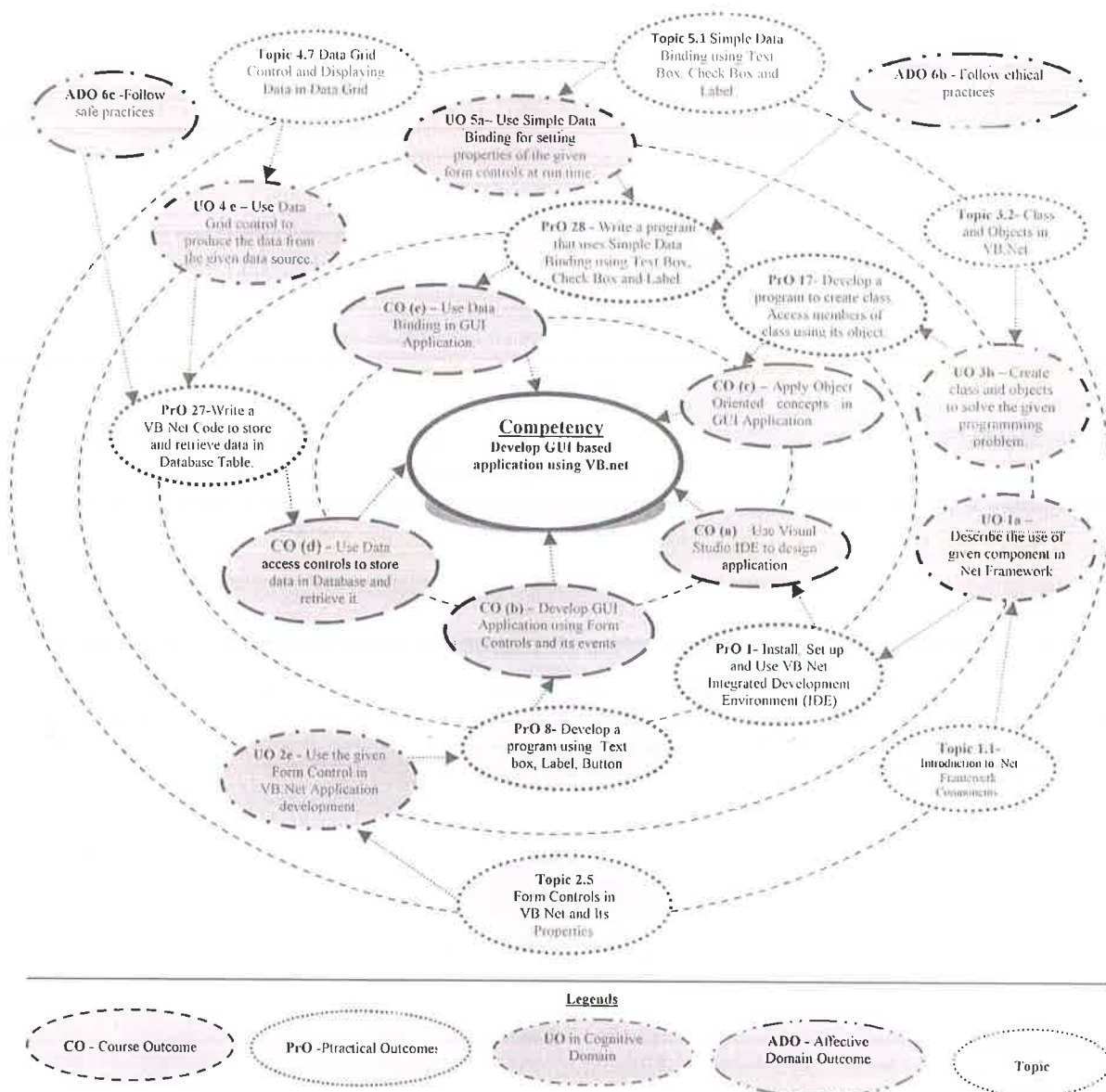


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1.	Install, Set up and Use VB.Net IDE (Integrated Development Environment).	I	
2.	Use Existing Namespaces and Create user defined Namespace in VB.Net.	I	



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
3.	(a) Write a simple program to display a welcome message using <i>msgbox()</i> . (b) Develop programs to solve Arithmetic expressions.	II	02*
4.	Develop programs to demonstrate use of <i>IF</i> , <i>IF-else</i> Control structures in VB.net.	II	02*
5.	Develop programs to demonstrate use of <i>Case</i> Control structures in VB.net.	II	02*
6.	Develop programs to demonstrate use of <i>While</i> , <i>DO Loops</i> in VB.net.	II	02*
7.	Develop programs to demonstrate use of <i>For</i> , <i>For-each</i> Loops in VB.net.	II	02*
8.	Develop a program using Text box, Label, Button	II	02*
9.	Develop a program using Radio button, check box,	II	02*
10.	Develop a program using List box, Combo box.	II	02*
11.	Write a program using Picture Box, Panel.	II	02*
12.	Write a program using Tab Control, and Timer.	II	02*
13.	Write a program to perform validation using regular expression and error provider.	II	02*
14.	Write a program to perform validation using regular expression and error provider.	II	02*
15.	Write a program to demonstrate use of Sub-procedures and Parameterized Sub-Procedures.	III	02
16.	Write a program to demonstrate use of Simple function and parameterized Functions.	III	02*
17.	Develop a program to create class. Access members of class using its object.	III	02*
18.	Create constructor to initialize object of class. Use Destructor to de-allocate memory using <i>finalize</i> method.	III	02*
19.	Develop a program to inherit members of super class in sub class using simple inheritance.	III	02*
20.	Develop a program to demonstrate Overloading a method	III	02*
21.	Develop a program to demonstrate Overriding in inheritance	III	02*
22.	Develop a program to demonstrate Shadowing in inheritance		02
23.	Construct a program to handle runtime errors by using Exception handling.	III	02*
24.	Write a program to fetch data from table and display in Data Grid.	IV	02*
25.	Write a program to perform following operation using Data Adapter: Fill and Update data in Database.	IV	02*
26.	Write a program to perform following operation using Data Adapter: Fetch data from multiple tables in Dataset.	IV	02
27.	Write a VB.Net Code to store and retrieve data in Database Table.	IV	02*
28.	Write a program that uses Simple Data Binding using Text Box, Check Box and Label.	V	02*
29.	Write a program that uses Complex Data Binding using Combo	V	02



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	Box.		
30.	Write a program that uses Complex Data Binding using List Box.	V	02
31.	Write a program to Navigate across existing data in table.	V	02
32.	Create Executable file of VB.Net Application and Deploy it to other computer.	V	02*
	Total		64

Note

- A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 24 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Application Level' of Bloom's Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO are to be assessed according to a suggested sample given below:

S.No.	Performance Indicators	Weightage in %
1	Use of relevant VB.Net tool to design given GUI application.	20
2	Write appropriate code to generate desired output in GUI Application.	30
3	Debug, test and execute the programs/modules.	30
4	Able to answer oral questions.	10
5	Submission of report in time.	10
	Total	100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Follow ethical practices.

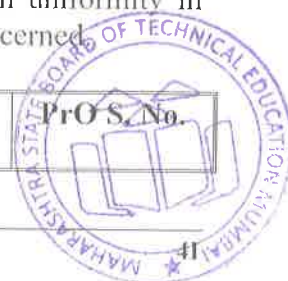
The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year and
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO S. No.
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S. No.	Equipment Name with Broad Specifications	PrO S. No.
1	Personal computer, (preferably i3-i5 processor based), RAM minimum 2 GB, Hard disk 10 GB minimum available space.	For all Experiments
2	Operating system: Windows 7/8/10	
3	Microsoft Visual Studio 2012 or later.	

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit – I Overview of GUI Program ming	1a. Describe use of the given component in .Net Framework. 1b. Describe use of use the given element in VB.Net IDE. 1c. Apply the given System Namespace in VB.net Application. 1d. Create Event Handler to respond to the given event.	1.1 Introduction to .Net Framework Components. i. Common Language Runtime (CLR) ii. Microsoft Intermediate Language (MSIL) iii. Just-In-Time Compiler 1.2 Exploring VB.Net IDE 1.3 System Namespaces in VB.Net 1.4 Events and Event handling
Unit– II Decision control and Loop control	2a. Select relevant data type for the given problem with justification. 2b. Write expression using operators for the given VB.Net Application. 2c. Use relevant control structure to apply the given criteria for decision making and branching. 2d. Implement relevant type of loop to solve the given iterative problem. 2e. Use the given Form Control in VB.Net Application development.	2.1 Data Types in VB.Net 2.2 Operators in VB. Net ii. Arithmetic Operators iii. Logical Operators iv. Bit Shift Operators v. Relational Operators vi. Assignment Operators 2.3 Control Structures ii. IF Statement iii. IF – ELSE Statement iv. Select Case Statement 2.4 Loops in VB.Net i. For Loop ii. While Loop iii. Do Loop iv. For Each Loop 2.5 Form Controls in VB.Net and Its Properties - Button, Text box, Label, Radio button, Check Box, List Box, Combo Box, Picture Box, Panel, Tab Control, Timer.
Unit– III Object Oriented	3a. Write Sub-procedure/function to solve the given problem. 3b. Create class and objects to solve	3.1 Sub Procedures and Functions 3.2 Class and Objects in VB.Net 3.3 Constructors and Destructors in



Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Programming in VB.Net	the given programming problem. 3c. Create constructor to initialize the given object. 3d. Apply Inheritance to inherit members of the super class in the given problem. 3e. Use Overloading/Overriding/Shadowing in the given situation. 3f. Develop exception handling mechanism to handle the given exception.	VB.Net 3.4 Inheritance in VB.Net, Simple Inheritance using <i>Override</i> Keyword 3.5 Overloading, Overriding and Shadowing 3.6 Exception Handling
Unit-IV Data access in VB.NET	4a. Use the relevant component of ADO.Net architecture based on the given situation. 4b. Select relevant data provider to solve the given problem. 4c. Use the given data provider to the given Access database. 4d. Produce data using Data Adapter Control for communication between the given dataset and the data source. 4e. Use Data Grid control to produce the data from the given data source.	4.1 Architecture of ADO.Net. 4.2 Accessing Data with Server Explorer. 4.3 Data Providers. 4.4 Connections, Data Reader, Data Adapters and Datasets. 4.5 Creating new Data Connection. 4.6 Creating Dataset. 4.7 Data Grid Control and Displaying Data in Data Grid. 4.8 Data Access using Data Adapter.
Unit –V Data Binding and Deployment	5a. Use Simple Data binding for setting properties of the given form control at run time. 5b. Use Complex Data binding for setting properties of the given form control at run time. 5c. Implement VB.Net Application to navigate data in the given database. 5d. Deploy the given VB.Net Application.	5.1 Simple Data Binding using Text Box, Check Box and Label. 5.2 Complex Data Binding using Combo box and List box. 5.3 Navigating Database. 5.4 Deploying VB.Net Application.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER

–Not Applicable–

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:



- a. Prepare journals based on practical performed in laboratory.
- b. Library/E-Book survey regarding 'VB.Net' used in software industries.
- c. Undertake a survey of different GUI applications and compare with the following points.
 - i. Available Applications.
 - ii. Application Profile.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- a. Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- b. '**L**' in *item No. 4* does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c. About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- e. Guide student(s) in undertaking micro-projects.
- f. Demonstrate students thoroughly before they start doing the practice.
- g. Observe continuously and monitor the performance of students in Lab.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PROs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

- a. **Hotel Management applications**– Prepare
 - Hotel room booking system having variety of rooms,
 - Hotel billing system for various services used by the guest.
- b. **Store Management Application** - Prepare a menu driven application for inventory management in Store.
- c. **Students' Record System** -Prepare a menu driven application to Maintain Academic record of students from multiple streams.
- d. **Traffic signals control Design**- Design an application for traffic signal control using Timer Control.

13. SUGGESTED LEARNING RESOURCES



S. No.	Title of Book	Author	Publication
1	Visual Basic .NET The Complete Reference	Jeffrey R. Shapiro	McGraw-Hill, California, USA ISBN0-07-213381-3
2	Visual Basic .NET Programming Black Book	Holzner Steven	Dreantech Press, 2015, New Delhi, ISBN-13:978-81-7722-609-6.
3	Beginning Visual Basic 2012	Bryan Newsome	Wrox Press, USA, Edition: 2012; ISBN: 9781118311813,
4	GUI Application Development using VB.Net	Dr. Rajendra Kawale	Devraj Publication,

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

- a. <http://www.vbtutor.net/index.php/visual-basic-2012-tutorial>
- b. <http://howtostartprogramming.com/vb-net>
- c. <https://www.tutorialspoint.com/vb.net>
- d. <http://vb.net-informations.com>
- e. <http://www.java2s.com/Tutorial/VB/CatalogVB.htm>
- f. <http://www.functionx.com/vbnet>
- g. <http://www.dfit.dfinalsolution.com/dotnet%20tutorial%20for%20beginners.pdf>



Program Name : Computer Engineering Program Group
Program Code : CO/CM/IF/CW
Semester : Fourth
Course Title : Java Programming
Course Code : 22412

1. RATIONALE

Java is platform independent, open-source object oriented programming language enriched with free and open source libraries. In current industrial scenario Java has the broad industry support and is prerequisite with many allied technologies like Advanced Java, Java Server Pages, and Android Application Development. Thus, current industrial trends necessitate acquiring Java knowledge for Computer Engineering and Information Technology graduates. This course develops necessary skills in students to apply object oriented programming techniques in Java so that students will be able to develop complete applications using core Java.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Develop Applications using Java.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Develop programs using Object Oriented methodology in Java.
- Apply concept of inheritance for code reusability.
- Develop programs using multithreading.
- Implement Exception Handling.
- Develop programs using graphics and applet.
- Develop programs for handling I/O and file streams.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	4	7	3	70	28	30*	00	100	40	50#	20	50	20	100	40

(*): Under the theory PA; Out of 30 marks, 10 marks of theory PA are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P -Practical; C – Credit, ESE -End Semester Examination; PA - Progressive Assessment.

5. COURSE MAP(with sample COs, PrOs, UOs, ADOs and topics)



This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

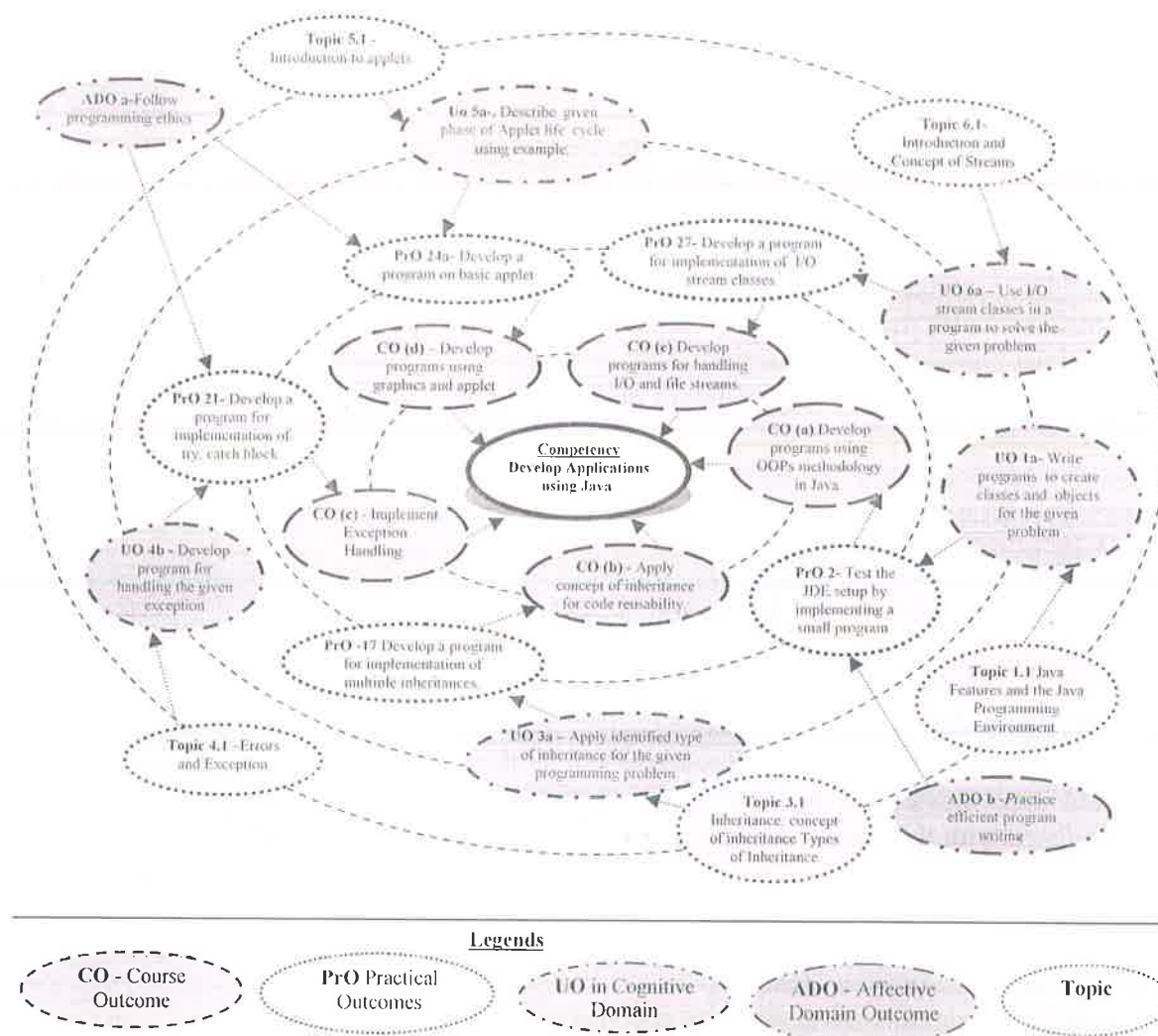


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1.	Setup a Java Programming development environment by using: a) Command prompt.(Classpath and path setup) b) Any IDE (Eclipse, Jcreator etc.).	I	02*
2.	Test the JDE setup by implementing a small program.	I	02
3.	Develop programs to demonstrate use of if statements and its different forms.	I	02*
4.	Develop programs to demonstrate use of- a) Switch – Case statement b) Conditional if (?:)	I	02*
5.	Develop programs to demonstrate use of Looping Statement ‘for’	I	02*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
6.	Develop programs to demonstrate use of 'while', 'do-while'	I	02*
7.	Develop a program for implementation of implicit type casting in Java. Part-I	I	02
8.	Develop a program for implementation of implicit type casting in Java. Part-II	I	02
9.	Develop a program for implementation of explicit type conversion in Java.		02*
10.	a) Develop a program for implementation of Constructor. b) Develop a program for implementation of multiple constructors in a class.	II	02*
11.	Develop a program for implementation of different functions of String Class. Part-I	II	02
12.	Develop a program for implementation of different functions of String Class. Part-II	II	02
13.	Develop a program for implementation of Arrays in Java.	II	02*
14.	Develop a program for implementation of Vectors in Java.	II	02*
15.	Develop a program for implementation of Wrapper Class to convert primitive into object.	II	02*
16.	Develop a program for implementation of Wrapper Class to convert object into primitive.	II	02*
17.	Develop program which implements the concept of overriding.	II	02*
18.	Develop a program for implementation of Single and Multilevel inheritance.	III	02*
19.	Develop a program for implementation of multiple inheritances.	III	02*
20.	Develop a program to import different classes in package.	III	02*
21.	Develop a program for implementation of multithreading operation Part-I	IV	02*
22.	Develop a program for implementation of multithreading operation Part-II	IV	02
23.	Develop a program for implementation of try, catch block. Part-I	IV	02
24.	Develop a program for implementation of try, catch block. Part-II	IV	02
25.	Develop a program for implementation of try, catch and finally block.	IV	02*
26.	Develop programs for implementation of throw, throws clause. Part-I	IV	02*
27.	Develop programs for implementation of throw, throws clause. Part-II	IV	02*
28.	Develop minimum two basic Applets. Display output with applet viewer and browser. a) Develop a program on basic applet.	V	02*
	b) Develop a program using control loops in applets.	V	02
29.	Write a program to create animated shape using graphics and applets. You may use following shapes: a) Lines and Rectangles. b) Circles and Ellipses.	V	02*
	c) Arcs d) Polygons with fillPolygon method.		02
30.	Develop a program to draw following shapes, graphics and applets. a) Cone b) Cylinders	V	02*



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	c) Cube		
	d) Square inside a circle e) Circle inside a square		02
31.	Develop a program for implementation of I/O stream classes.	VI	02*
32.	Develop a program for implementation of file stream classes.	VI	02*
	Total		64

Note

- A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 24 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Application Level' of Bloom's Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO are to be assessed according to a suggested sample given below:

Sr. No.	Performance Indicators	Weightage in %
1	Representation of classes and objects.	10
2	Coding.	40
4	Testing and Debugging of the Program.	30
5	Correctness of Program Output.	10
6	Submission of report in time.	10
	Total	100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year and
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.



S. No.	Equipment Name with Broad Specifications	Pro S.No.
1	Computer with JDK1.8 or above	All
2	Any IDE for Java Programming such as Eclipse, Jcreator or any other product.	

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Basic Syntactical constructs in Java	1a. Write programs to create classes and objects for the given problem. 1b. Explain the characteristics of the given Java token. 1c. Explain the function of the given operator with example. 1d. Construct the expressions using implicit and explicit type conversions to solve the given problem. 1e. Develop the programs using relevant control structure to solve the given problem.	1.1 Java Features and the Java Programming Environment, Object Oriented, Compiled, Interpreted, Platform independent, Portable, Robust and Secure, Dynamic. 1.2 Defining a class, creating object, accessing class members 1.3 Java Tokens and Data types, Constants and Symbolic Constants, variables, dynamic initialization, data types, array and string, scope of variable, typecasting, and standard default values. 1.4 Operators and Expressions, Arithmetic Operators, Relational Operators, Logical Operators, Increment and Decrement, Conditional Operators, Bit wise Operators, Instance of Operators, Dot Operators, Operator precedence and associativity, Evaluation of Expressions, Type conversions in expressions, Mathematical Functions - min(), max(), sqrt(), pow(), exp(), round(), abs(). 1.5 Decision making and looping: If statement, if else statement, nested if else statement, if else if ladder, the switch statement, nested switch statement, The ?:operator, The while statement, the Do while statement, the 'for' statement, break, continue and return statement, nested loops, labeled loops, for-each version of the for loop.
Unit-II Derived Syntactical Constructs in Java	2a. Use Constructors for the given programming problem. 2b. Identify scope and lifetime of a variable in the given program code. 2c. Describe the given visibility control with example. 2d. Write the programs by implementing arrays to solve	2.1 Constructors and methods, types of constructors, nesting of methods, argument passing the 'this' keyword, command line arguments, varargs: variable-length arguments, garbage collection, finalize() method, the object class. 2.2 Visibility Control Public, Private, Protected, default, friendly private



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	the given problem. 2e. Develop programs using vectors and wrapper classes for the given problem.	Protected access. 2.3 Arrays and Strings: Types of arrays, creating an array, strings, string classes and string buffer, vectors, wrapper classes, enumerated types.
Unit– III Inheritance , Interface and Package	3a. Apply the identified type of inheritance for the given programming problem. 3b. Differentiate between overloading and overriding for the given example. 3c. Develop program using the specified interface. 3d. Create user defined package for the given problem. 3e. Add class and interface to the given package.	3.1 Inheritance: concept of inheritance Types of Inheritance 3.2 Single Inheritance, multilevel Inheritance, Hierarchical Inheritance, method and constructor overloading and overriding, dynamic method dispatch, final variables, final methods, use of super, abstract methods and classes, static members. 3.3 Interfaces: Define Interface, implementing interface ,accessing interface, variables and methods, extending interfaces, interface references, nested interfaces 3.4 Package: Define package, type of package naming and creating packages, accessing package, import statement, static import, adding class and interfaces to a package.
Unit– IV Exception Handling and Multithreadi ng	4a. Distinguish the errors and exceptions (if any) in the given example. 4b. Develop program for handling the given exception. 4c. Crate threads to run the given multiple processes in the given program. 4d. Explain the function of the specified phase in thread life cycle using the given example.	4.1 Errors and Exception :Types of errors, exceptions, try and catch statement, nested try statement, throws and Finally statement, build-in exceptions, chained exceptions, creating own exception(throw clause), subclasses. 4.2 Multithreaded Programming Creating a Thread: By extending to thread class and by implementing runnable Interface, Life cycle of thread: Thread Methods:wait(), sleep(), notify(), resume(), suspend(), stop().Thread exceptions, thread priority and methods, synchronization, inter-thread communication, deadlock.
Unit –V Java Applets and Graphics Programmin g	5a. Describe the given phase of applet life cycle using a typical example. 5b. Develop programs using applet implementation for the given problem. 5c. Develop program for implementing the given geometric shape. 5d. Develop program for implementing the given font	5.1 Introduction to applets: Applet, Applet life cycle (skeleton), Applet tag, Adding Applet to HTML file, passing parameter to applet, embedding <applet> tags in java code, adding controls to applets. 5.2 Graphics Programming: Graphics classes, lines, rectangles, ellipse, circle, arcs, polygons, color and fonts, setColor(), getColor(), setForeground(), setBackground(), font class, variable defined by font class: name, pointSize.



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	settings.	size, style, font methods: getFamily(), getFont(), getFontname (), getSize(), getStyle(), getAllFonts() and get available font family name() of the graphics environment class.
Unit –VI Managing Input /Output/ Files in Java	6a. Use I/O stream classes in a program to solve the given problem. 6b. Write programs for reading and writing character streams to and from the given files. 6c. Write programs for reading and writing bytes to and from the given files. 6d. Write program to demonstrate use of primitive Data types with the specified stream.	6.1 Introduction and Concept of Streams. 6.2 Stream Classes. 6.3 Byte Stream Classes: Input Stream Classes, Output Stream Classes. 6.4 Character Stream Classes, Using streams. 6.5 Using File Class: I/O Exceptions, Creation of Files, Reading/Writing characters, Reading/Writing Bytes, Handling Primitive Data types.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Basic Syntactical constructs in Java	06	02	04	04	10
II	Derived Syntactical Constructs in Java	10	02	06	10	18
III	Inheritance, Interface and Package	10	02	04	06	12
IV	Exception Handling and Multithreading	08	02	04	06	12
V	Java Applets and Graphics Programming	08	02	04	04	10
VI	Managing Input/Output/Files in Java	06	02	02	04	08
Total		48	12	24	34	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:



- a. Prepare journals based on practical performed in laboratory.
- b. Follow coding standards.
- c. Develop variety of programs to improve the logical skills.
- d. Develop Application oriented real world programs.
- e. Prepare power point presentation or animation for understanding different Object Oriented Concepts.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- a. Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- b. '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c. About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- e. Use different Audio Visual media for Concept understanding.
- f. Guide student(s) in undertaking micro-projects.
- g. Demonstrate students thoroughly before they start doing the practice.
- h. Observe continuously and monitor the performance of students in Lab.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

- a. Mini Banking System for handling deposits and withdrawal.
- b. Medical Store stock Management System.
- c. Library book issue Management System.
- d. Bus Reservation System.
- e. Attendance Management System.
- f. Develop a small animation using applet, graphics and multithreading.

GUIDELINES FOR DEVELOPING MICRO PROJECTS:

- i. Declare four to five classes and may include Interfaces if required.
- ii. Must use Most of the Object Oriented Concepts.



- iii. Must implement concepts of Inheritance and Exception Handling.
- iv. Must Create Own Package.
- v. May use the constructor overloading and overriding.
- vi. May Use Multithreading if required.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	Programming with JAVA	Balagurusamy E.	Mcgraw Hill Education (India) Private Limited, New Delhi, 5th Edition ISBN-13: 978-93-5134-320-2
2.	Java 8 Programming Black Book	DT Editorial Services	Dreamtech Press, New Delhi, ISBN:978-93-5119-758-4
3.	Java Complete Reference	Schildt Herbert	Mcgraw Hill Education, New Delhi ISBN:9789339212094
4.	Advanced Java Programming	Roy Uttam K	Oxford University Press, New Delhi ISBN :0-19-945550-3
5.	Jawa Programming	Dr. Rajendra Kawale	Devraj Publication

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

- a. <https://docs.oracle.com/javase/8/docs/>
- b. http://www.nptelvideos.com/java/java_video_lectures_tutorials.php
- c. <http://nptel.ac.in/courses/106105084/25>
- d. <http://www.iitk.ac.in/esc101/08Jul/notes.html>



Program Name : Computer Engineering Program Group
Program Code : CO/CM/IF/CW
Semester : Fourth
Course Title : Software Engineering
Course Code : 22413

1. RATIONALE

Software Engineering is the foundation for professional processes to be followed involving principles, techniques, and practices for software development. The course provides a framework for software professionals for building quality assured software products. It enables students to blend the domain specific knowledge with the programming skills to create quality software products.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Use relevant software process model for developing software products.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above-mentioned competency:

- Select suitable Software Process model for software development.
- Prepare software requirement specifications.
- Use Software modeling to create data designs.
- Estimate size and cost of software product.
- Apply project management and quality assurance principles in software development.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20

(*): Under the theory PA; Out of 30 marks, 10 marks of theory PA are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course. in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.





The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
6	Develop the activity diagram to represent flow from one activity to another for software development.	II	02
7	Develop data designs using DFDs (data flow diagram), Decision tables and E-R (entity-relationship) diagram.	III	02*
8	Draw class diagram, Sequence diagram, Collaboration diagram, State Transition Diagram for the assigned project.	III	02
9	Write test cases to validate requirements of assigned project from SRS document.	III	02*
10	Identify risks involved in the project and prepare RMMM (RMMM-Risk Management, Mitigation and Monitoring) plan.	IV	02
11	Evaluate size of the project using Function point metric for the assigned project.	IV	02*
12	Estimate cost of the project using COCOMO (Constructive Cost Model) / COCOMO II approach for the assigned project.	IV	02*
13	Use CPM (Critical Path Method) / PERT (Programme Evaluation and Review Technique) for scheduling the assigned project.	V	02*
14	Use Timeline charts/ Gantt charts to track progress of the assigned project.	V	02
15	Prepare SQA plan that facilitates various attributes of quality of process.	V	02*
16	Prepare SQA plan that facilitates various attributes of quality of product.	V	02*
Total			32

Note

- To carry out above listed practical /tasks, relevant software tool may be chosen (preferably open-source based).
- A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Application Level' of Bloom's Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S.No.	Performance Indicators	Weightage in %
1	Problem selection and its feasibility study	20
2	Logical thinking to decompose problem into modules	30
3	Ability to Estimate size and cost of a software	30
4	Presentation and technical documentation skills	10
5	Submission of reports within time.	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.



d. Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year and
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Pro. S. No.
1	Hardware: Personal computer. (i3-i5 preferable), RAM minimum 2 GB	For all Experiments
2	Operating system: Windows 7/Windows 8/Windows 10/LINUX or any other .	
3	Software tools: Any UML tool	

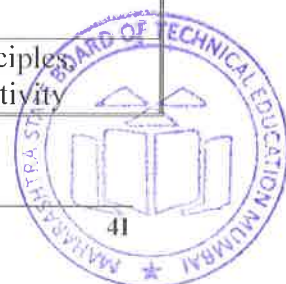
8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Software Development Process	1a. Suggest the attributes that match with standards for the given software application. 1b. Recommend the relevant software solution for the given problem with justification. 1c. Select the relevant software process model for the given problem statement with justification. 1d. Suggest the relevant activities in Agile Development Process in the given situation with justification	1.1 Software, Software Engineering as layered approach and its characteristics, Types of software. · 1.2 Software development framework. 1.3 Software Process Framework, Process models: Perspective Process Models, Specialized Process Models. 1.4 Agile Software development: Agile Process and its importance, Extreme Programming, Adaptive Software Development, Scrum, Dynamic Systems Development Method (DSDM), Crystal. 1.5 Selection criteria for software process model.
Unit– II Software Requirement Engineering	2a. Apply the principles of software engineering for the given problem. 2b. Choose the relevant	2.1 Software Engineering Practices and its importance, Core principles. 2.2 Communication Practices, Planning Practices, Modelling practices.



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	<p>'requirement engineering' steps in the given problem.</p> <p>2c. Represent the 'requirement engineering' model in the given problem.</p> <p>2d. Prepare SRS for the given problem.</p>	<p>construction practices, software deployment (Statement and meaning of each principle for each practice).</p> <p>2.3 Requirement Engineering: Requirement Gathering and Analysis, Types of requirements (Functional, Product, organizational, External Requirements), Eliciting Requirements, Developing Use-cases, Building requirement models, Requirement Negotiation, Validation.</p> <p>2.4 Software Requirement Specification: Need of SRS, Format, and its Characteristics.</p>
Unit- III Software Modelling and Design	<p>3a. Identify the elements of analysis model for the given software requirements.</p> <p>3b. Apply the specified design feature for software requirements modeling.</p> <p>3c. Represent the specified problem in the given design notation.</p> <p>3d. Explain the given characteristics of software testing.</p> <p>3e. Prepare test cases for the given module.</p>	<p>3.1 Translating Requirement model into design model: Data Modelling.</p> <p>3.2 Analysis Modelling: Elements of Analysis model.</p> <p>3.3 Design modelling: Fundamental Design Concepts (Abstraction, Information hiding, Structure, Modularity, Concurrency, Verification, Aesthetics).</p> <p>3.4 Design notations: Data Flow Diagram (DFD), Structured Flowcharts, Decision Tables.</p> <p>3.5 Testing – Meaning and purpose, testing methods - Black-box and White-box, Level of testing – Unit testing.</p> <p>3.6 Test Documentation – Test Case Template, test plan, Introduction to defect report, test summary report.</p>
Unit-IV Software Project Estimation	<p>4a. Estimate the size of the software product using the given method.</p> <p>4b. Estimate the cost of the software product using the given empirical method.</p> <p>4c. Evaluate the size of the given software using CoCoMo model.</p> <p>4d. Apply the RMMM strategy in Identified risks for the given software development problem.</p>	<p>4.1 The management spectrum – 4P's</p> <p>4.2 Metrics for Size Estimation: Line of Code(LoC), Function Points(FP).</p> <p>4.3 Project Cost Estimation Approaches: Overview of Heuristic, Analytical, and Empirical Estimation.</p> <p>4.4 COCOMO (Constructive Cost Model), COCOMO II.</p> <p>4.5 Risk Management: Risk Identification, Risk Assessment, Risk Containment, RMMM strategy.</p>
Unit –V Software	<p>5a. Use the given scheduling technique for the</p>	<p>5.1 Project Scheduling: Basic principles, Work breakdown structure, Activity</p>



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
quality assurance and Security	identified project. 5b. Draw the activity network for the given task. 5c. Prepare the timeline chart/ Gantt chart to track progress of the given project. 5d. Describe the given Software Quality Assurance (SQA) activity. 5e. Describe features of the given software quality evaluation standard.	network and critical path Method, Scheduling techniques (CPM, PERT). 5.2 Project Tracking: Timeline charts, Earned Value Analysis, Gantt Charts 5.3 Software Quality Management vs. Software Quality Assurance. Phases of Software Quality Assurance: Planning, Activities, audit, and review 5.4 Quality Evaluation standards: Six Sigma, ISO for software, CMMI: Levels, Process areas. 5.5 Software Security, Introduction to DevOps, Secure software engineering

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Software development process	08	04	04	04	12
II	Software Requirement Engineering	10	02	04	08	14
III	Software Modelling and Design	10	-	04	10	14
IV	Software Project Estimation	10	04	04	08	16
V	Software Project Management and quality assurance	10	04	04	06	14
Total		48	14	20	36	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

This specification table also provides a general guideline for teachers to frame internal end semester practical theory exam paper which students have to undertake.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare journals based on practical performed in laboratory.
- Give seminar on relevant topics.
- Study and analyze college website from perspective of software application.
- Study and analyze any available application software from perspective of software engineering.



11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- a. Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- b. '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c. About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- e. Guide student(s) in undertaking micro-projects.
- f. Demonstrate students thoroughly before they start doing the practice.
- g. Encourage students to refer different websites to have deeper understanding of the subject.
- h. Observe continuously and monitor the performance of students.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

- a. Study and analyze given software and write the characteristics and functions of the same.
- b. Case study of application specific software product for requirement engineering
 - i. Identify the problem statement
 - ii. Perform feasibility analysis
 - iii. Identify application specific requirements by following RE steps
 - iv. Prepare SRS
- c. Choose any problem statement and use data models to represent the solution
 - i. Search and utilize different UML tools to represent models
- d. Choose a problem, create activity network and use different project scheduling and tracking tools for the same.

13. SUGGESTED LEARNING RESOURCES



S. No.	Title of Book	Author	Publication
1	Software Engineering: A practitioner's approach	Pressman, Roger S.	McGraw Hill Higher Education, New Delhi, (Seventh Edition) ISBN 978-0-07-337597-7
2	Software Engineering Concepts	Fairly, Richard	McGraw Hill Education New Delhi – 2001, ISBN-13: 9780074631218
3	Software Engineering: Principles and practices	Jain, Deepak	Oxford University Press, New Delhi ISBN 9780195694840

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

- <http://www.rspa.com/spi/>
- www.tutorialspoint.com/software_engineering/
- www.versionone.com/agile-101/
- www.sei.cmu.edu
- www.nptel.ac.in/courses/
- <https://techbeacon.com/secure-devops>



Program Name : Computer Engineering Program Group
Program Code : CO/CM/IF/CW
Semester : Fourth
Course Title : Data Communication and Computer Network
Course Code : 22414

1. RATIONALE

A data communication and computer networks has been growing with rapid technological progress. Computer communication through networking becomes essential part of our life. By considering importance of networking in day today life, it is essential for students to know the basic concept of networks like network classification, network topologies, network devices. This course deal with the important concepts and techniques related to data communication and enable students to have an insight in to technology involved to make the network communication possible.

2. COMPETENCY

The aim of this course is to help the student to attain the following *industry identified* competency through various teaching learning experiences:

- **Maintain data communication and computer network**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

- Analyze the functioning of data communication and computer network.
- Select relevant transmission media and switching techniques as per need.
- Analyse the transmission errors with respect to IEEE standards.
- Configure various networking devices.
- Configure different TCP/IP services.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme														
L	T	P		Theory								Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total			
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min		
4	=	2	6	3	70	28	30*	00	100	40	25@	10	25	10	50	20		

(*): Under the theory PA; Out of 30 marks, 10 marks of theory PA are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the



course. in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

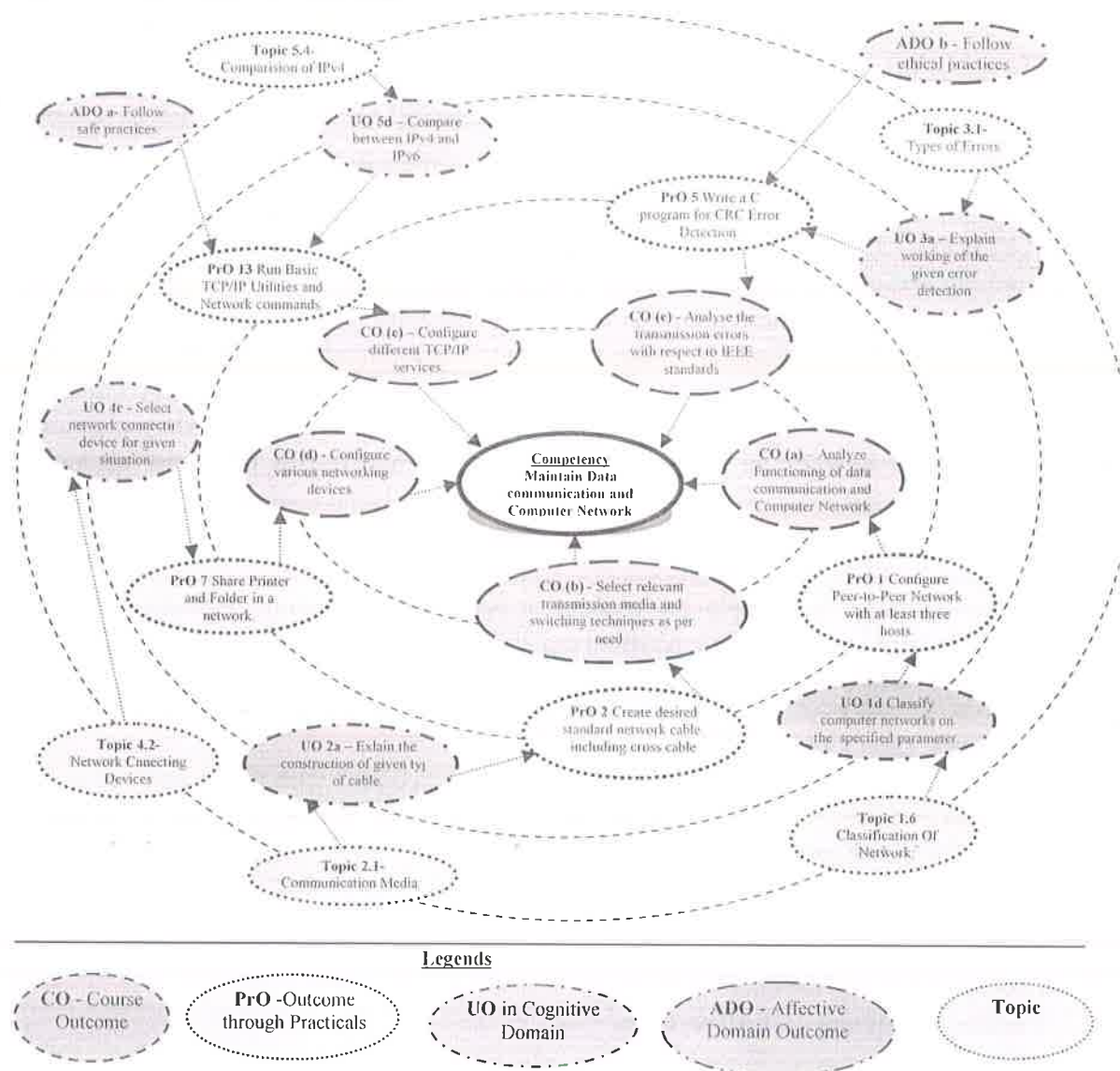


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1.	Configure Peer-to-Peer Network with at least three hosts.	I	02*
2.	Create desired standard network cable including cross cable and test by using cableTester	II	02*
3.	Connect Computers using given topology with wired media	III	02*
4.	Connect Computers using wireless media	III	02
5.	Write a C program for CRC Error Detection.	III	02
6.	Create a Network Using Bluetooth-(Piconet/Scatternet)	III	02
7.	Share Printer and Folder in a network and transfer a file from one computer to another.	IV	02



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
8.	Install operating system(Windows/Linux-RedHat/Ubuntu)	IV	02*
9.	Configure File Server	IV	02
10.	Configure Client To File Server and use file services.	IV	02
11.	Configure Static and Dynamic IP addresses	V	02*
12.	Configure DHCP server.	V	02*
13.	Run Basic TCP/IP Utilities and Network commands : ipconfig, ping , tracert, netstat, pathping, route	V	02*
14.	Install Wireshark and configure as packet sniffer	V	02
15.	Set access rights and security permissions for user	V	02
16.	Create IPV6 based small computer network using a simulator (prferebaly open source based simulator)	V	02
17.	Setting up a wireless network	IV	02
Total			34

Note

- A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 24 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
a.	Effective practical implementation within specified time	60
b.	Effective handling of network component	10
c.	Answer to sample questions	20
d.	Submit report in time	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Handle network components carefully.
- Demonstrate working as a leader/a team member.
- Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year and
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. S. No.
1.1	Computer system (Any computer system with basic configuration)	All
1.2	Network connecting device, transmission media	All
1.3	Network cable Tester, crimping tool, RJ-45 connectors, Ethernet cable	2
1.4	Wireshark sniffing tool	15

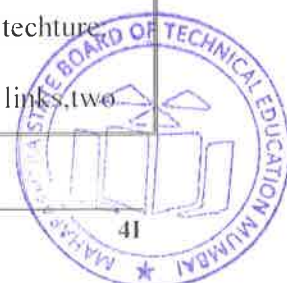
8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added:

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Fundamentals of Data Communication and Computer Network	1a. Describe role of the given component in the process of data communication. 1b. Compare the characteristic of analog and digital signals on the given parameter. 1c. Explain the process of data communication using the given mode. 1d. Classify computer networks on the specified parameter. 1e. Select network architecture for the given situation with justifications.	1.1 Process of data communication and its components: Transmitter, Receiver, Medium, Message, Protocol. 1.2 Protocols, Standards, Standard organizations. Bandwidth, Data Transmission Rate, Baud Rate and Bits per second. 1.3 Modes of Communication (Simplex, Half duplex, Full Duplex). 1.4 Analog Signal and Digital Signal, Analog and Digital transmission: Analog To Digital, Digital To Analog Conversion 1.5 Fundamental Of Computer Network: Definition And Need Of Computer Network, Applications, Network Benefits. 1.6 Classification Of Network: LAN, WAN, MAN 1.7 Network Architecture: Peer To Peer, Client Server Network
Unit-II Transmission Media and Switching	2a. Explain with sketches the construction of given type of cable. 2b. Explain with sketches the characteristics of the given type of unguided transmission media. 2c. Explain with sketches the working of the given Multiplexing technique. 2d. Describe with sketches the working principle of the given switching technique.	2.1 Communication Media: Guided Transmission Media Twisted-Pair Cable, Coaxial Cable Fiber-Optic Cable 2.2 Unguided Transmission Media Radio Waves, Microwaves, Infrared, Satellite 2.3 Line-of-Sight Transmission Point to Point, Broadcast 2.4 Multiplexing: Frequency-Division Multiplexing Time-Division Multiplexing 2.5 Switching: Circuit-switched networks.



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	2e. Compare different Switching techniques on the given parameter.	Packet -switched networks
Unit– III Error Detection,C orrection and Wireless Communica tion	3a. Explain working of the given error detection and correction method. 3b. Explain features of the given IEEE communication standard. 3c. Explain characteristics of the given layer in IEEE 802.11 architecture. 3d. Compare the specified generations of mobile telephone system on the given parameter. 3e. Explain with sketches the process of creating Bluetooth environment using the given architecture.	3.1 Types of Errors:Single Bit Error and Burst Error, Redundancy 3.2 Error Detection:Longitudinal Redundancy Check(LRC),Vertical Redundancy Check(VRC),Cyclic Redundancy Check(CRC)Forward 3.3 Error Correction: Forward error Correction 3.3 IEEE standards: 802.1, 802.2, 802.3, 802.4, 802.5 3.4 Wireless LANs: 802.11 Architecture, MAC Sublayer,Addressing Mechanism 3.5 Bluetooth Architecture: Piconet, Scatternet 3.6 Mobile Generations: 1G, 2G, 3G, 4G and 5G
Unit– IV Network Topologies And Network Devices	4a. Identify relevant network topology for the given situation. 4b. Compare different topologies on the given parameter. 4c. Select network connecting device for the given situation. 4d. Describe with sketches the procedure to configure the given networking device.	4.1 Network Topologies : Introduction, Definition, Selection, Criteria, Types of Topology- i) Bus ii) Ring iii) Star iv)Mesh v)Tree vi)Hybrid 4.2 Network Connecting Devices:Hub, Switch, Router, Repeater, Bridge, Gateway, Modem, Wireless infrastructure Components
Unit –V Reference Models	5a. Identify functions and features of the given layer of OSI Reference model. 5b. Compare the specified service on the given parameters. 5c. Classify IP Addresses on the basis of its class from the given set of addresses. 5d. Distinguish between IPv4 and IPv6 on the given parameters. 5e. Describe with sketches the	5.1 OSI Reference Model: Layered Architecture , Peer-to- Peer Processes- Interfaces between Layer, Protocols, Organization of the Layers, Encapsulation Layers of the OSI Reference Model (Functions and features of each Layer) – Physical Layer, Data-Link Layer, Network Layer, Transport Layer, Session Layer, Presentation Layer, Application Layer 5.2 TCP/IP Model: Layered Architecture Data Link Layer:Nodes and links,services,two categoriesof links,two



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	procedure to configure the given TCP/IP service.	<p>sub layers, Link layer addressing: three types of addresses, address resolution protocol (ARP), Network Layer: Addresses: address space, classful and classless addressing, dynamic host configuration protocol (DHCP), network address resolution (NAT). Transport layer protocol: transport layer services, connectionless and connection oriented protocol.</p> <p>5.3 Introduction – Addressing mechanism in the Internet IP Addressing – IP Address classes, classless IP addressing, Subnetting, supernetting, Masking,</p> <p>5.4 IPv4 and IPv6</p> <p>5.5 OSI and TCP / IP Network Model.</p>

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Fundamental Of Data Communication And Computer Network	10	04	04	04	12
II	Transmission Media and Switching	14	04	06	06	16
III	Error Detection, Correction and Wireless Communication	14	02	04	06	12
IV	Network Topologies And Network Devices	10	02	04	04	10
V	Reference Models	16	06	06	08	20
Total		64	18	24	28	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of LOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare specification table for Guided media and Unguided media.
- Classify network connecting devices with their specifications.



11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Use animations to explain various network topologies, OSI Layers, network connecting devices.
- Guide student(s) in undertaking micro-projects

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should not exceed three.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than 16 (sixteen) student engagement hours during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

- Create a small Network install, configure various devices and perform at least one peer-to-peer service and client/server service over it.
- Prepare a report on recent and widely used Unguided media in industries depending on Cost, speed, efficiency, reliability.
- Design layout of a Network for department, Deciding upon type of network, number/length of components with their specifications.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Data communications and networking.	Forouzan Behrouz A.	Tata McGraw Hill, New Delhi, 2006, ISBN : 9780-07-296775-3
2	Computer Networks	Tanenbaum Andrew S.	PHI Learning Pvt Ltd, Delhi ISBN-13: 978-0-13-212695-3



S. No.	Title of Book	Author	Publication
3	Data Communication and Networks	Godbole Achyut	Tata McGraw Hill, New Delhi, 2006, ISBN : 0070472971
4	Internetworking with TCP/IP Principles, Protocols and Architectures	Comer Douglas E.	PHI Learning Pvt Ltd, Delhi ISBN: 81-203-2065-4
5	Computer Networking	T. M. Bansod	

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

- www.nptelvideos.in/2012/11/data-communication.html
- <http://www.myreadingroom.co.in/notes-and-studymaterial/68-dcu/750-analog-to-analog-conversion-techniques.html>
- http://www.tutorial-reports.com/wireless/wlanwifi/wifi_architecture.php
- <http://standards.ieee.org/about/get/802/802.11.html>
- www.tutorialspoint.com/data_communication_computer_network/
- <http://www.studytonight.com/computer-networks/overview-of-computer-networks>
- http://whirlpool.net.au/wiki/windows_nw_diag_cmds
- <http://nptel.ac.in/downloads/106105080/>
- <http://scanfree.com/programs/c/c-program-to-implement-crc-cyclic-redundancy-code/>



Program Name : Computer Engineering Program Group
Program Code : CO/CM/CW
Semester : Fourth
Course Title : Microprocessors
Course Code : 22415

1. RATIONALE

Microprocessor is the main component of computer where 8086 is the base of all upward developed processors till current processors. This course will cover the basics of 8086 and its architecture along with instruction set, assembly language programming with effective use of procedure and macros. This course also covers the architectural issues such as instruction set program and data types. On top that, the students are also introduced to the increasingly important area of parallel organization. This subject serves as a basic to develop hardware related projects. This course will enable the students to inculcate assembly language programming concepts and methodology to solve problems.

2. COMPETENCY

The aim of this course is to help the student to attain the following *industry identified* competency through various teaching learning experiences:

- Develop assembly level language programming using 8086.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

- Analyze the functional block of 8086 microprocessor.
- Write assembly language program for the given problem.
- Use instructions for different addressing modes.
- Develop an assembly language program using assembler.
- Develop assembly language programs using procedures, macros and modular programming approach.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
4	-	2	6	3	70	28	30*	00	100	40	25@	10	25	10	50	20

(*): Under the theory PA; Out of 30 marks, 10 marks of theory PA are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit
 ESE - End Semester Examination; PA - Progressive Assessment, ‘#’: No Theory Examination



5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

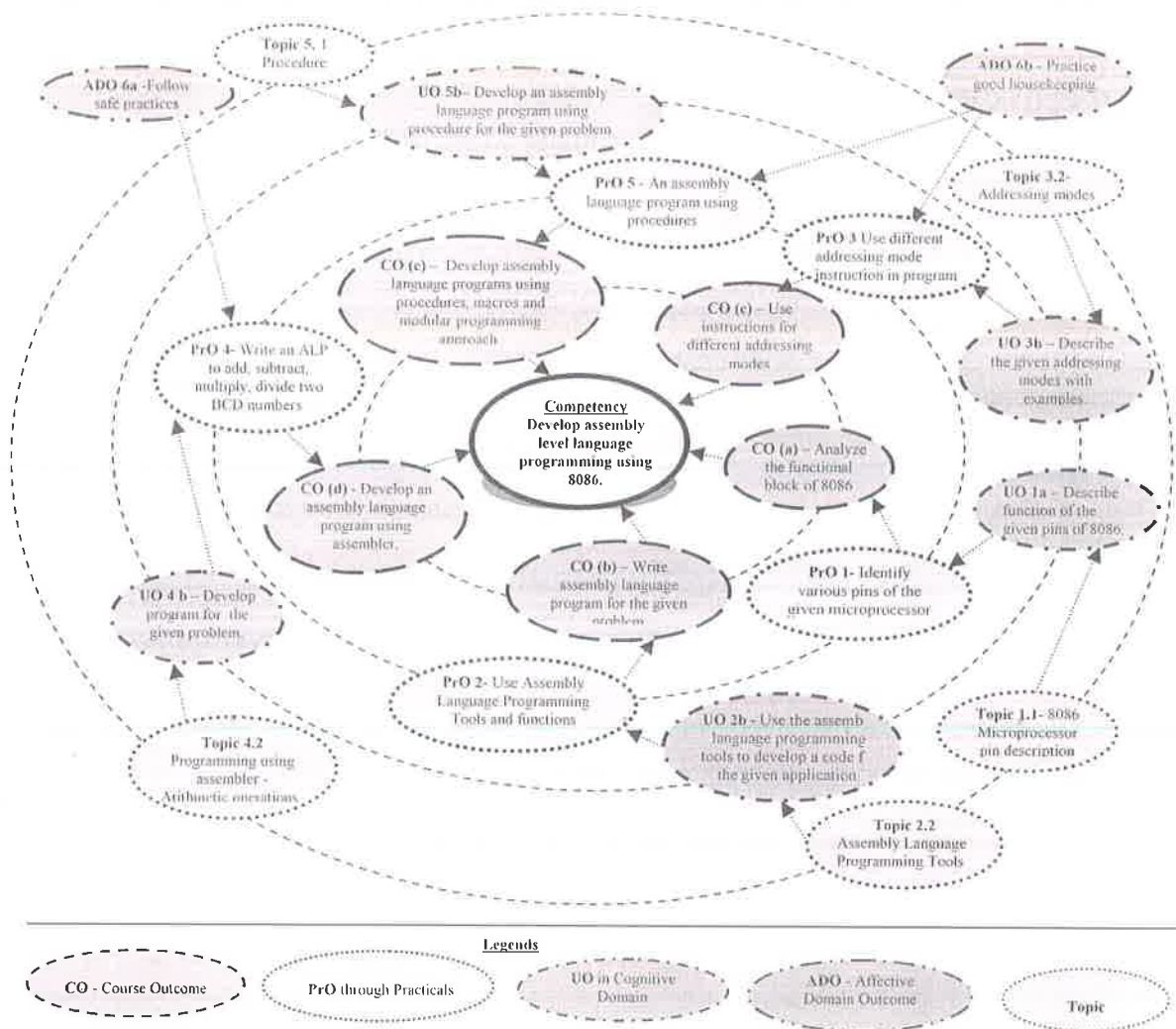


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Identify various pins of the given microprocessor.	I	02*
2	Use Assembly Language Programming Tools and functions	II	02*
3	Use different addressing mode instruction in program (a) Write an Assembly Language Program (ALP) to add two given 8 and 16 bit numbers.	III	02*



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	(b) Write an Assembly Language Program (ALP) to subtract two given 8 and 16 bit numbers.		
4	(a) Write an ALP to multiply two given 8 and 16 bit unsigned numbers. (b) Write an ALP to multiply two given 8 and 16 bit signed numbers.	III	02
5	(a) Write an ALP to perform block transfer data using string instructions (b) Write an ALP to perform block transfer data without using string instructions.	III	02
6	(a) Write an ALP to compare two strings without using string instructions. (b) Write an ALP to compare two strings using string instructions	III	02
7	(a) Write an ALP to divide two unsigned numbers (b) Write an ALP to divide two signed numbers	III	02
8	Write an ALP to add, subtract, multiply, divide two BCD numbers.	IV	02
9	Implement loop in assembly language program (a) Write an ALP to find sum of series of Hexadecimal Numbers. (b) Write an ALP to find sum of series of BCD numbers.	IV	02*
10	(a) Write an ALP to find smallest number from array of n numbers. (b) Write an ALP to find largest number from array of n numbers.	IV	02 *
11	(a) Write an ALP to arrange numbers in array in ascending order. (b) Write an ALP to arrange numbers in array in descending order.	IV	02
12	(a) Write an ALP to arrange string in reverse order (b) Write an ALP to find string length. (c) Write an ALP to concatenation of two strings.	IV	02
13	(a) Write an ALP to check a given number is ODD or EVEN. (b) Write an ALP to count ODD and/or EVEN numbers in array.	IV	02
14	(a) Write an ALP to check a given number is POSITIVE or NEGATIVE (b) Write an ALP to count POSITIVE and/or NEGATIVE numbers in array.	IV	02
15	(a) Write an ALP to count number of '1' in a given number (b) Write an ALP to count number of '0' in a given number	IV	02
16	An assembly language program using procedures (a) Write an ALP for addition, subtraction, multiplication and division. (b) Write an ALP using procedure to solve equation such as $Z = (A+B)*(C+D)$	V	02*
17	Write an assembly language program using macros. (a) Write an ALP for addition, subtraction, multiplication and division. (b) Write an ALP using MACRO to solve equation such as $01Z =$	V	02*



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	(A+B)*(C+D)		
	Total		34

Note

- A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 24 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S.No.	Performance Indicators	Weightage in %
1	Able to write algorithm and draw flow chart.	20
2	Use Assembly language programming tools to create, edit, assemble and link the assembly language programs.	40
3	Debug, test and execute the programs	20
4	Able to answer oral questions.	10
5	Submission of report in time.	10
	Total	100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organizing Level' in 2nd year and
- 'Characterizing Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. S. No.
1	Hardware: Personal computer, (i3-i5 preferable), RAM minimum 2GB onwards.	For all Experiments

S. No.	Equipment Name with Broad Specifications	PrO. S. No.
2	Operating system: Windows XP/Windows 7 onward	
3	Software: Editor: EDIT, NOTEPAD Assembler: TASM/MASM Linker: TLINK/LINK Debugger: TD/Debug of Windows Operating System	

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I 8086- 16 Bit Microproc essor	1a. Describe function of the given pin of 8086. 1b. Explain with sketches the working of given unit in 8086 microprocessor. 1c. State functions of the given registers of 8086 microprocessor. 1d. Calculate the physical address for the given segmentation of 8086 microprocessor.	1.1 8086 Microprocessor: Salient features, Pin descriptions 1.2 Architecture of 8086: Functional Block diagram, Register organization 1.3 Concepts of pipelining 1.4 Memory segmentation, Physical memory addresses generation
Unit– II The Art of Assembly Language Programm ing	2a. Describe the given steps of program development /execution. 2b. Write steps to develop a code for the given problem using assembly language programming. 2c. Use relevant command of debugger to correct the specified programming error. 2d. Describe function of the given assembler directives with example.	2.1 Program development steps: Defining problem and constraints, Writing Algorithms, Flowchart, Initialization checklist, Choosing instructions, Converting algorithms to assembly language programs 2.2 Assembly Language Programming Tools: Editors, Assembler, Linker, Debugger 2.3 Assembler directives
Unit– III Instruction Set of 8086 Microproc essor	3a. Determine the length of the given instruction. 3b. Describe the given addressing modes with examples. 3c. Explain the operation performed by the given instruction during its execution. 3d. Identify the addressing modes in the given instructions.	3.1 Machine Language Instruction format 3.2 Addressing modes 3.3 Instruction set, Groups of Instructions: Arithmetic instructions, Logical Instructions, Data transfer instructions, Bit manipulation instructions, String Operation instructions, Program control transfer or branching instructions, Process control instructions



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit-IV Assembly Language Programm ing	4a. Use the given model of assembly language programs for the given problem. 4b. Develop the relevant program for the given problem. 4c. Apply relevant control loops in the program for the given problem. 4d. Use string instructions for the given strings/block to manipulate its elements.	4.1 Model of 8086 assembly language programs 4.2 Programming using assembler : Arithmetic operations on Hex and BCD numbers, Sum of Series, Smallest and Largest numbers from array, Sorting numbers in Ascending and Descending order, Finding ODD, EVEN, Positive and Negative numbers in the array, Block transfer, String Operations - Length, Reverse, Compare, Concatenation, Copy, Count Numbers of '1' and '0' in 16 bit number.
Unit –V Procedure and Macro	5a. Apply the relevant 'parameter-passing' method in the given situation. 5b. Develop an assembly language program using the relevant procedure for the given problem. 5c. Develop an assembly language program using MACROS for the given problem. 5d. Compare procedures and macros on the basis of the given parameters.	5.1 Procedure: Defining and calling Procedure - PROC, ENDP, FAR and NEAR Directives; CALL and RET instructions; Parameter passing methods, Assembly Language Programs using Procedure 5.2 Macro: Defining Macros, MACRO and ENDM Directives, Macro with parameters, Assembly Language Programs using Macros

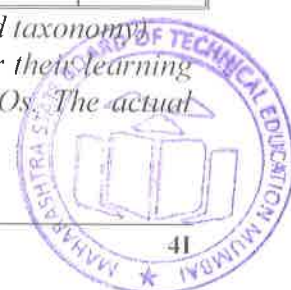
Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	8086- 16 Bit Microprocessor	08	02	02	10	14
II	The Art of Assembly Language Programming	12	-	02	06	08
III	Instruction Set of 8086 Microprocessor	16	02	04	10	16
IV	Assembly Language Programming	16	02	02	16	20
V	Procedure and Macro	12	02	02	08	12
Total		64	8	12	50	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual



distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare journals based on practical performed in laboratory.
- Library/E-Book survey regarding assembly language programming used in Computer industries.
- Prepare power point presentation for showing different types of Assembly language Programming Applications.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Guide student(s) in undertaking micro-projects.
- No. of practical's selection to be performed should cover all units.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should not exceed three.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than 16 (sixteen) student engagement hours during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

- Conversion of Number System** - Each group will develop a program to perform following operations (Any One):
 - Convert Hexadecimal number to equivalent BCD,



- ii. Convert BCD number to Equivalent Hexadecimal Number
- b. **Array** - Each group will develop a program to perform following operations (Any One):
 - i. Separate ODD and EVEN number from given array, store them in separate array and find the sum.
 - ii. Separate ODD and EVEN number from given array, store them in separate array and find the smallest or largest among them.
 - iii. Separate ODD and EVEN number from given array, store them in separate array and sort numbers in ascending or descending order.
- c. **Basic mathematic functions** - Each group will develop a program to perform following operations (Any One):
 - i. Generate Fibonacci Series
 - ii. Find Factorial of Number
- d. **String Manipulation project** - Each group will develop a program to perform following operations (Any One):
 - i. Convert lower case string to upper case string and vice versa.
 - ii. Check string for Palindromes.
 - iii. Search given character in string; find how many times it is present in string and its position.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Microprocessor and interfacing (programming and hardware)	Hall, Douglas V.	McGraw Hill Education, New Delhi, 2015, ISBN-13: 978-0070257429
2	The 8088 and 8086 Microprocessors	Triebel, Walter A., Singh, Avtar	Pearson Publications, New Delhi, 2015, ISBN 13: 9780130930811
3	Microprocessors and Microcontrollers	Latha, C., Murugeshwari, B.	SCITECH Publications, Chennai, 2015, ISBN: 978-81-8371-702-1

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

- a. Assembler TASM/MASM, Linker LINK/TLINK, Debugger OS Debuge/ID
- b. www.intel.com
- c. www.pcguides.com/ref/CPU
- d. www.CPU-World.com/Arch/
- e. www.techsource.com/engineering-parts/microprocessor.html
- f. <https://www.elprocus.com/8051-assembly-language-programming/>
- g. https://www.tutorialspoint.com/assembly_programming/
- h. http://www.slideshare.net/search/slideshow?searchfrom=headerandq=assembly+language+programming+of+8086andud=anyandft=allandlang=**andsort=





Maharashtra State Board of Technical Education, Mumbai

Teaching and Examination Scheme for Post S.S.C. Diploma Courses

Program Name : Civil Engineering Groups

Program Code : CE/CR/ CS

With Effect From Academic Year: 2017 - 18

Duration of Program : 6 Semesters

Duration : 16 Weeks

Semester : Fifth

Scheme - I

S. N.	Course Title	Course Abbreviation	Course Code	Teaching Scheme			Credit (L+T+P)	Examination Scheme													Grand Total		
				L	T	P		Theory								Practical							
								Exam Duration in Hrs.	ESE		PA		Total		ESE		PA		Total				
									Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks			
1	Water Resource Engineering	WRE	22501	3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150		
2	Design of Steel and RCC Structures	DSR	22502	4	1	2	7	4	70	28	30*	00	100	40	25#	10	25	10	50	20	150		
3	Estimating and Costing	EAC	22503	3	-	4	7	3	70	28	30*	00	100	40	50#	20	50	20	100	40	200		
4	Public Health Engineering	PHE	22504	3	-	2	5	3	70	28	30*	00	100	40	25#	10	25	10	50	20	150		
Elective (Any One)																							
5	Rural Development	RDE	22505	3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150		
	Energy Conservation and Green Building	ECG	22506	3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150		
	Traffic Engineering	TEN	22507	3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150		
	Precast and Pre-Stressed Concrete	PPC	22508	3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150		
6	Industrial Training	ITR	22057	-	-	6	6	--	--	--	--	--	--	--	75#	30	75	30	150	60	150		
7	Capstone Project Planning	CPP	22058	-	-	2	2	--	--	--	--	--	--	--	25@	10	25	10	50	20	50		
Total				16	1	20	37	--	350	--	150	--	500	--	250	--	250	--	500	--	1000		

Student Contact Hours Per Week: **37 Hrs.**

Medium of Instruction: **English**

Theory and practical periods of 60 minutes each.

Total Marks : **1000**

Abbreviations: ESE- End Semester Exam, PA- Progressive Assessment, L - Lectures, T - Tutorial, P - Practical



@ Internal Assessment, # External Assessment, *# On Line Examination, @^ Computer Based Assessment
*** Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain LOs required for the attainment of the COs.**
~ For the courses having ONLY Practical Examination, the PA marks Practical Part - with 60% weightage and Micro-Project Part with 40% weightage
> If Candidate not securing minimum marks for passing in the "PA" part of practical of any course of any semester then the candidate shall be declared as "Detained" for that semester.
> Evaluation of Industrial Training and its reports is to done after completion of Industrial Training. Credits of Industrial Training will not affect the framing of time table.



Program Name : All Branches of Diploma in Engineering and Technology.
Program Code : CE/CR/CS/CH/CM/CO/IF/CW/DE/EJ/EN/EQ/ET/EX/IE/
 MU/EE/EP/EU/IS/IC/AE/FG/ME/PG/PT/DC/TX/TC
Semester : Fifth
Course Title : Capstone Project – Planning
Course Code : 22058

1. RATIONALE

According to the requirement of National Board of Accreditation (NBA), 'learning to learn' is an important Graduate Attribute (GA No.11). It is required to develop this skill in the students so that they continue to acquire on their own new knowledge and skills from different 'on the job experiences' during their career in industry. An educational 'project' just does that and may be defined as *'a purposeful student activity, planned, designed and performed by a student or group of students to solve/ complete the identified problem/task, which require students to integrate the various skills acquired over a period to accomplish higher level cognitive and affective domain outcomes and sometimes the psychomotor domain outcomes as well'*. Projects mainly serve this purpose of developing learning-to-learn skills with an aim to develop the following attributes in the students:

- a) Initiative, confidence and ability to tackle new problems
- b) Spirit of enquiry
- c) Creativity and innovativeness
- d) Planning and decision making skills
- e) Ability to work in a team and to lead a team
- f) Ability of self directed learning which is required for lifelong learning
- g) Persistence (habit of not giving up quickly and trying different solutions in case of momentary failures, till success is achieved)
- h) Resourcefulness
- i) Habit of keeping proper records of events and to present a formal comprehensive report of their work.

2. COMPETENCY

The course should be taught and implemented with the aim to develop the required course outcomes (COs) so that students will acquire following competency needed by the industry:

- **Plan innovative/creative solutions independently and/or collaboratively to integrate various competencies acquired during the semesters to solve/complete the identified problems/task/shortcomings faced by industry/user related to the concerned occupation.**

3. COURSE OUTCOMES (COs)

The following could be some of the major course outcomes depending upon the nature of the projects undertaken. However, in case of some projects few of the following course outcomes may not be applicable.

- a) Write the problem/task specification in existing systems related to the occupation.
- b) Select, collect and use required information/knowledge to solve the problem/complete the task.
- c) Logically choose relevant possible solution(s).
- d) Consider the ethical issues related to the project (if there are any).
- e) Assess the impact of the project on society (if there is any).
- f) Prepare 'project proposals' with action plan and time duration scientifically before beginning of project.



- g) Communicate effectively and confidently as a member and leader of team.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme													
L	T	P		Theory								Practical					
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
–	–	2	2	–	–	–	–	–	–	–	25@	10	25	10	50	20	

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment

5. Capstones Project

One of the dictionary meaning is the ‘crown’ or the stone placed on top of the building structure like ‘kalash on top of Temples and Mosques’ or ‘Cross on top of churches’. Capstone projects are culminating experiences in which students synthesize the competencies acquired over whole programme. In some cases they also integrate cross-disciplinary knowledge. Thus Capstone projects prepare students for entry into a career and can be described as a ‘rite of passage’ or ‘minimal threshold’ through which participants change their status from student to graduate. A capstone project therefore should serve as a synthesis — reflection and integration— to bridge the real-world preparatory experience to real life. Thus capstone project should have emphasis on integration, experiential learning, and real-world problem solving and hence these projects are very important for students. To develop the highly essential industry oriented skills and competencies in the students, the capstone projects are offered in the last two semesters to serve for following purposes:

- Integrate the competencies acquired by the students in the previous and current semesters.
- Provide opportunities for interdisciplinary work in tackling problems likely to be faced by them in industry which are exciting and challenging.

6. Capstone Project Planning

Students are supposed to find out a suitable project and prepare a detailed plan in fifth semester so that it can be executed smoothly in sixth semester. The main characteristic of any project whether small or big is that it requires simultaneous application of various types of skills in the different domains of learning. Moreover, project normally do not have a predefined single solution, in other words for the same problem different students may come up with different but acceptable solutions. Further, in the process of arriving at a particular solution, the student must be required to make a number of decisions after scrutiny of the information s/he has accumulated from experiments, analysis, survey and other sources.

The projects will have a detailed project proposal, which must be executed or implemented within the time allocated, simultaneously maintaining a logbook periodically monitored by the teacher. A detailed project report is to be prepared as project progresses, which has to be submitted after the project is over. For self assessment and reflection students have to also prepare a portfolio of learning.

During the guidance and supervision of the project work, teachers’ should ensure that students acquire following *learning outcomes* (depending upon the nature of the project work some of these learning outcomes may not be applicable):

- Show the attitude of enquiry.
- Identify the problems in the area related to their programme.
- Identify the information suggesting the cause of the problem and possible solutions.
- Assess the feasibility of different solutions and the financial implications.



- e) Collect relevant data from different sources (books/internet/market/suppliers/experts etc. through surveys/interviews).
- f) Prepare required drawings and detailed plan for execution of the work.
- g) Work persistently and participate effectively in group work to achieve the targets.
- h) Work independently for the individual responsibility undertaken.
- i) Ask for help from others including guide, when required.
- j) Prepare portfolio to reflect (*chintan-manan*) on experiences during project work.
- k) Prepare seminar presentations to present findings/features of the project.
- l) Confidently answer the questions asked about the project.
- m) Acknowledge the help rendered by others in success of the project.

If students are able to acquire these *learning outcomes*, then they would be able to acquire the COs as discussed in section 3.

7. Scopes of Projects

Scope of the project work should be decided based on following criteria:

- a) **Relation to diploma programme curriculum:** When students intend to select topics for the project work they need to choose a project which relates well to their curriculum (It may be beyond curriculum, but it should relate to it) and requires implementation of theories already learnt and skills already possessed by them from the previous semesters.
- b) **Abilities possessed by the group of students:** Projects should be chosen so that it can be completed mainly using students' problem solving capabilities and depth of learning. It is natural that highly motivated students or high achievers may come out with projects which are more complex and challenging. Teachers should guide students to choose challenging projects according to the students' ability.
- c) **Resources Available:** Students and Guides should keep in mind the availability of resources while deciding the topic and the scope of the project. Some of the important resources which need consideration are:
 - i. Time available
 - ii. Raw Material/Components required
 - iii. Manufacturing/Fabrication equipment and tools required
 - iv. Testing/Measuring equipment and instruments required
 - v. Access to Journals (Library/Digital)
 - vi. Expertise for theoretical guidance (available in polytechnic, nearby institutes or nearby industries)
 - vii. Expertise and technology required for fabrication (if required)
 - viii. Software required.

An important aspect to be considered is to decide who will choose a project. The best practice is that teacher should guide students about the above factors to be considered for choosing the project and based on these factors students should do the ground work and identify the possible projects and teachers should work as only facilitator and Guide in final selection of the project title and its scope.

d) Suggested Type of Capstone Projects

In general, the projects that the students can take up could be of the following types;

- i. Feasibility studies.
- ii. Design projects
- iii. Market surveys about raw material, components or finished products.
- iv. Prototype (design, make, test and evaluate).
- v. Advanced experimental work requiring the development of existing equipment to be used and developed.
- vi. Field works: This could include surveys, using equipment, charting data and information from visual observation.



- vii. Comparative Studies: Theoretical study of two systems/mechanisms/ processes in detail and comparing them on the basis of cost/energy conservation/impact on environment/technology used etc.
- viii. Application of Emerging technology: Theoretical study of some emerging technology and feasibility of its application in some real life situation in detail.
- ix. Fabrication of some equipment/machine etc.
- x. Construction of some structure.
- xi. Development of software or use of software for solving some broad-based problem.

8. GUIDELINES FOR UNDERTAKING A PROJECT

The selection of the *Capstone Project title* must have emphasis to the Elective courses/ Elective Group taken for the study and exam for 5th and 6th semester. The students will then work on the identified problem/task through a rigorous process of understanding and analyzing the problem, conducting a literature search, deriving, discussing (monitored by the guide every fortnight) and designing the *Semester V 'Project Proposal'* with the following *sub-titles*:

- a) Rationale (one page)
- b) Introduction
- c) Literature Survey
- d) Problem Definition
- e) Proposed Methodology of solving Identified problem
- f) In-case some prototype has to be fabricated then its tentative design and procedure for making it should be part of the proposal.
- g) Resources and consumables required.
- h) Action Plan (sequential list of activities with probable dates of completion)

As soon as the 'Project Proposal' is approved by the teacher, the student will begin to maintain a dated '*Project Logbook*' for the whole semester. This is a sort of a 'weekly diary' indicating all the activities conducted by the student every week in the semester to complete the project. This '*project logbook*' should be got signed by the teacher at regular intervals for progressive assessment to match the project proposal. If this is maintained sincerely and truthfully by the student, it will be very helpful in compiling the 'Project Report' at the end of the semester by him/her.

9. PORTFOLIO FOR SELF-DIRECTED LEARNING

To ensure that students acquire these outcomes, students should also be guided to prepare a '*Portfolio*', so that they may reflect on their weaknesses/mistakes and learn from them. *Students should also be encouraged to discuss with their guide and record not only technical problems but also problems related to group work, planning, execution, leadership in the team etc., so that students can also identify their weaknesses in affective domain and take remedial actions to overcome the same.* If they wish, the students can also show their portfolio to their teachers (whom they trust) for obtaining teachers' comments on their reflection for pointing out their mistakes so that they can improve their performance.

'*Portfolio*' is the record of the reflection (thinking or *chintan-manan*) on experiences to which students undergo during the different stages of the project. In a portfolio, students record their critical experiences and reflect (think or do *chintan-manan*) on them in writing. This process of reflecting on the experiences make them learn from their mistakes and build on their strengths. To help students in reflection, a Portfolio format with reflective prompts (simple thought provoking questions) for different stages of the project is given as annexure B.

12.1 Purposes of Portfolio Preparation



Reflection by self is important since group work is so complex that it is difficult for teachers to appreciate the real problems amongst the students. In a portfolio, prompts (simple thought provoking questions) are given to trigger reflection on different aspects of project work. Prompts help the students to ask questions from themselves regarding different aspects of the project work and interpersonal relationships. Process of answering these questions forces students to think about behavioral problems and possible remedies/solution to deal with those problems. Portfolio preparation therefore helps in reflection on building the strengths and elimination of the weaknesses of the students pertaining to following qualities which the industry also need.

- a) Plan properly for execution of given work.
- b) Take appropriate decisions.
- c) Arrange resources.
- d) Work as member and leader of team.
- e) Communicate properly.
- f) Resolve the conflicts.
- g) Manage the time well.
- h) Have concern for ethical, societal and environmental issues.
- i) Learn-to-learn from experiences.

It may be seen that these qualities are not directly related with the theoretical subject knowledge and can be developed only through real life experiences. Project work is one such type of experience where opportunity is available to develop all these qualities.

However, even during project work, emphasis of most of the students and teachers remains on development of the technical knowledge and skills while development of above qualities is neglected. Students can develop these qualities if they reflect (do thinking or *Chintan-Manan*) on their experiences from the point of view of these qualities and find out their own weaknesses and strengths. Because if somebody wants to improve his/her abilities then first step for that person is to have self awareness about his/her weaknesses and strengths.

Though portfolio preparation requires considerable time, it is essential, if we want to learn from the experiences and develop these qualities. Writing down reflections helps in better reflection as it is well known that when a person starts writing something he/she becomes more cautious about his/her view and evaluate those views before writing. Thus process of writing improves the quality of reflection or thinking. Moreover, if reflections on different stages of work are written down, over a period of time a large amount of reflection can be generated, and if this reflection is looked back, it may help in identifying some pattern of behaviour in individual which may be improved or rectified latter on as per requirement.

12.2 Guidelines for Portfolio Preparation and assessment

The main purpose of portfolio preparation is learning based on self-assessment and ***portfolio is not to be used for assessment in traditional sense.***

- a) Each student has to prepare his/her portfolio separately. However, he/she can discuss with the group members about certain issues on which he/she wants to write in the portfolio.
- b) For fifth semester and sixth semester, there will be only one portfolio but it will have two separate parts, first part for project planning (having two sections A and B) second part for project execution. (having two sections C and D)
- c) Whatever is written inside the ***portfolio is never to be used for assessment***, because if teachers start giving marks based on whatever is written in the portfolio, then students would hesitate in true self-assessment and would not openly describe their own mistakes or shortcomings.



- d) Some marks are allocated for portfolio, these marks are to be given based on how sincerely portfolio has been prepared and not based on what strengths and weaknesses of the students are mentioned in the portfolio.
- e) Portfolio has to be returned back to the students after assessing it (assessment is only to see that whether portfolio is completed properly or not) by teachers. Because student is the real owner of the portfolio.
- f) Students mainly learn during portfolio preparation, but they can further learn if they read it after a gap. And hence they are supposed to keep the portfolios with them even after completion of the diploma because it is record of their own experiences (it is like diary some people write about their personal experiences), because they can read it again after some time and can revise their learning (about their own qualities)

Even after completion of Diploma programme, students can continue to prepare portfolio related to different experiences in their professional and personal life and by refereeing back to old portfolios after a gap of some years, they can learn that how their personality has evolved over the years. They can also see a pattern of behaviour in their own personality which may be source of their weaknesses or strengths and they can take remedial measures based on this study of their portfolios.

Note

Since some sections of the portfolio are related with interpersonal relationships and student may find it difficult to write these experiences in English. Language should not be the barrier in reflection and hence students should be allowed to prepare the portfolio in their preferred language such as *Marathi* or *Hindi* if they find it difficult to write in English.

The amount and type of mistakes identified by students would not affect the marks received by the students. The total 7 Marks allocated for portfolio (4 marks for PA and 3 for ESE) are only for proper completion of the portfolio.

10. PROJECT REPORT

At the end of fifth Semester, the student will prepare a Semester V 'Project Report' with the following sub-titles:

- Certificate (in the Format given in this document as annexure A)
- Acknowledgements
- Abstract (in one paragraph not more than 150 words)
- Content Page
- Chapter-1 Introduction and background of the Industry or User based Problem
- Chapter-2 Literature Survey for Problem Identification and Specification,
- Chapter-3 Proposed Detailed Methodology of solving the identified problem with action plan
- References and Bibliography

Note: The report should contain relevant diagrams and figures, charts.

11. ASSESSMENT OF CAPSTONE PROJECT – PLANNING

Like other courses, assessment of Project work also has two components, first is progressive assessment, while another is end of the term assessment. The mentor faculty will undertake the progressive assessment to develop the COs in the students. They can give oral informal feedback about their performance and their interpersonal behaviour while guiding them on their project work every week. The following characteristics/ qualities informally or formally should be considered during different phases of the project work which will be assessed thrice as discussed in sub-section.

(A) Initial Phase

- i. **Definition of the Problem**
 - a) Accuracy or specificity



- b) Appropriateness with reference to desired course outcomes.
- ii. **Methodology of Conduction the Project**
 - a) Appropriateness
 - b) Flexibility
 - c) Clarity
- iii. **General Behaviour**
 - a) Initiative
 - b) Resourcefulness
 - c) Reasoning ability
 - d) Imagination/creativity
 - e) Self-reliance

(B) Intermediate Phase

- i. **Performance of Student**
 - a) Ability to follow correct procedure
 - b) Manipulative skills
 - c) Ability to collect relevant information
 - d) Ability to observe, record & interpret
 - e) Ingenuity in the use of material and equipment
 - f) Target achievement
- ii. **General Behaviour**
 - a) Persistence
 - b) Interest
 - c) Commitment
 - d) Confidence
 - e) Problem solving ability
 - f) Decision making ability
 - g) Initiative to act
 - h) Team spirit.
 - i) Sharing of material etc.
 - j) Participation in discussion
 - k) Completion of individual responsibilities

(C) Final Phase

- i. **Quality of Product**
 - a) Dimensions
 - b) Shape
 - c) Tolerance limits
 - d) Cost effectiveness
 - e) Marketability
 - f) Modernity
- ii. **Quality of Report**
 - a) Clarity in presentation and organization
 - b) Styles and language
 - c) Quality of diagrams, drawings and graphs
 - d) Accuracy of conclusion drawn
 - e) Citing of cross references
 - f) Suggestion for further research/project work
- iii. **Quality of presentation**
 - a) Understanding of concepts, design, methodology, results, implications etc
 - b) Communication skills
 - c) Ability to draw conclusions and generalization



12. PROGRESSIVE ASSESSMENT (PA) GUIDELINES

15 Marks are allocated for the formal progressive assessment. However, following points need consideration during the three times of formal progressive assessment of the students at the end of 4th, 12th and 14th week.

- Fortnightly monitoring** by the mentoring teachers is necessary and marks given progressively (even the gradual chapter preparation) so that that students will not copy earlier reports or get things done or reports from the market. The **students should not be awarded marks** if they have not done on their own.
- For progressive assessment at the end of 14th week, students should be asked to give the power point presentation before group of teachers and junior students (so that junior students may also get awareness about the capstone project work they have to carry out in future).
- Although marks for *portfolio preparation* is to be given at the end of 14th week, students should be asked to bring their partly prepared portfolio (relevant sections prepared) also during their assessment at the end of 4th week and 12th week.
- Marks for portfolio preparation should be based only on proper preparation of portfolio by writing answers to most of the prompts (self-questions to students) in the portfolio. These marks should not be based on the mistakes indicated by students in their working (while answering the prompts) and corrective actions taken by them.
- The students would be awarded marks for their efforts (In some cases it may happen that due to some reasons such as unavailability of some material or component or some other resources, students may not be able to complete the project, but they have tried their best, in such cases students would be given appropriate marks if they have done enough efforts.)
- Originality of the report** (written in own words) would be given more importance rather than use of glossy paper or multi-colour printing.

12.1 Progressive Assessment (PA) Criteria

Allocation Criteria of the **25 marks** are for the Progressive Assessment (PA).

S. No.	Criteria	Marks
First Progressive Assessment at the end of 4th week		
1	Problem Identification/Project Title (Innovation /Utility of the Project for industry/ User/Academia) marks to be also given based on (i) Accuracy or specificity of the scope and (ii) Appropriateness of the work with reference to desired course outcomes.	02
2	Industrial Survey and Literature Review: marks to be given based on extent/volume and quality of the survey of Industry / Society / Institutes/Literature/Internet for Problem Identification and possible solutions	02
3	General Behaviour: initiative, resourcefulness, reasoning ability, imagination/creativity, self-reliance to be assessed Note: Oral feedback on general behaviour may also be given whenever relevant/ required during day to day guidance and supervision. Only written feed-back/suggestions	00
Second Progressive Assessment at the end of 12th week		
4	Project Proposal: Marks to be given also based on appropriateness, flexibility, detail and clarity in methods/planning. (In case of working models, detailed design and planning of fabrication/assembly of the prototype has to be also assessed). This proposal should include whole project including work to be done in sixth semester	03



S. No.	Criteria	Marks
5	Execution of Plan in fifth semester (Since project is to be fully completed in sixth semester, the part of the project which is planned to be completed in fifth semester is only to be evaluated: marks to be also given based on ability to collect relevant information, ability to follow correct procedure, manipulative skills, ability to observe, record & interpret, ingenuity in the use of material and equipment, target achievement) In case of working models, quality of workman ship (including accuracy in dimensions, shape, tolerance limits), appropriateness of raw materials/components/ technology being used, functioning of the prototype, cost effectiveness, marketability, modernity etc. has to be also assessed.	02
6	Log book (for work done in fifth semester, detailed and regular entry would be basis of marks)	02
7	General Behaviour (persistence, interest, confidence, problem solving ability, decision making ability, initiative to act, team spirit, sharing of material etc., participation in discussions, completion of individual responsibilities, leadership) Note: Oral feedback on general behaviour should also be given whenever relevant/ required during day to day guidance and supervision. Only written feed-back./suggestions	00
Third Progressive Assessment at the end of 14th week		
8	Portfolio for Self learning and reflection (marks based on amount of reflection and completion of the portfolio for work done in fifth semester)	04
9	Final Report writing including documentation. (marks based on: clarity in presentation and organization; styles and language; quality of diagrams, drawings and graphs; accuracy of conclusion drawn; citing of cross references; suggestion for further research/project work) Report has to be prepared for work done in fifth semester and planning for sixth semester work.	06
10	Presentation (presentation skills including communication skills to be assessed by observing quality of presentations and asking questions during presentation and viva/voce) Report has to be prepared for work done in fifth semester and plan for sixth semester.	02
11	Defence (ability to defend the methods/materials used and technical knowledge, and involvement of individual to be assessed by asking questions during presentation and viva/voce)	02
Total		25

13. END-SEMESTER-EXAMINATION (ESE) ASSESMENT GUIDELINES

The **remaining 25 marks** are for the end-semester-examination (ESE). And marks would be given according to following criteria. Moreover, the suggested evaluation scheme can be changed slightly by the external faculty according to nature of problem / project following University guidelines..

- For each project, the one or two students from the concerned group of students should be asked to present the power point presentation before the external and internal (for about 10 minutes) and then external should ask the questions from each member of the group separately to ascertain the contribution made by each student.
- The students would be awarded marks for their efforts (In some cases it may happen that due to some reasons such as unavailability of some material or component or some other resources, students may not be able to complete the project, but they have tried their best, in such cases students would be given appropriate marks commensurate with their efforts.)



- c) The students would not be awarded marks if they have completed the project by getting done the work from market or some professionals (taking help and guidance is different as compared to getting the work or maximum part of the work completed from others on payment basis).
- d) Originality of the report (written in own words, even if there are grammatical and spelling mistakes) would be given more importance rather than quality of printing and use of glossy paper (and preparing report by copy pasting from other reports).

Note: It is very common that people are not able to complete the project in time despite best of their efforts. (Please recall that how many times people are able to complete in time, personal projects such as building own house or professional projects such as developing the lab in the institute). So if students have put in enough genuine efforts but could not complete the project in time then we should consider it sympathetically and they should be given marks based on their efforts and they should get more marks as compared to students who have got their projects completed by taking major help from others/market.

13.1 End-Semester-Examination (ESE) Assessment Criteria.

Allocation Criteria of the **25 marks** are for the end-semester-examination (ESE)

S. No.	Description	Marks
1	Problem Identification/Project Title (innovation /utility of the project for industry/ user/academia) marks to be also given based on (i) accuracy or specificity of the scope and (ii) appropriateness of the work with reference to desired course outcomes.	02
2	Industrial Survey and Literature Review (marks to be given based on extent/volume and quality of the survey of industry / society / institutes/literature/internet for problem identification and possible solutions)	02
3	Project Proposal: Marks to be given also based on appropriateness, flexibility, detail and clarity in methods/planning. (In case of working models, detailed design and planning of fabrication/assembly of the prototype has to be also assessed). This proposal should include whole project including work to be done in sixth semester.	02
4	Execution of Plan in fifth semester (Since project is to be fully completed in sixth semester, the part of the project which is planned to be completed in fifth semester is only to be evaluated: marks to be also given based on ability to collect relevant information, ability to follow correct procedure, manipulative skills, ability to observe, record & interpret, ingenuity in the use of material and equipment, target achievement) In case of working models, quality of workman ship (including accuracy in dimensions, shape, tolerance limits), appropriateness of raw materials/components/ technology being used, functioning of the prototype, cost effectiveness, marketability, modernity etc. has to be also assessed.	02
5	Log book (for work during fifth semester, marks to be given based on detailed and regular entry	03
6	Portfolio for Self learning and reflection (for work during fifth semester) Marks based on amount of reflection and completion of portfolio.	03
7	Project Report including Documentation (for work during fifth semester and planning for sixth semester) (marks based on: clarity in	04



S. No.	Description	Marks
	presentation and organization; styles and language; quality of diagrams, drawings and graphs; accuracy of conclusion drawn; citing of cross references; suggestion for further research/project work)	
8	Presentation (presentation skills including communication skills to be assessed by observing the quality of presentations and asking questions during presentation and viva/voce) Presentation should be based on work done in fifth semester and planning for sixth semester.	03
9	Defence (ability to defend the methods/materials used and technical knowledge, and involvement of individual to be assessed by asking questions during presentation and viva/voce)	04
Total		25

14. SPECIAL TEACHING STRATEGIES (If any)

- Teacher's should not spoon feed the students and let them try on their own at different stages of the project work and even first let them strive hard and only when efforts of students have failed, then teacher should guide them. Guidance should be in initially in the form of clues or hints rather than complete explanation, detailed explanation should be given only when students are not able to work based on clues/hints. The role of teacher should be limited to guide and facilitator
- Teachers should guide students in selecting a topic which is relevant and challenging (but within capacity) for students according to their abilities.
- Teachers should ensure that students prepare the project plan in as much detail as possible, since this way only they would learn the importance of planning and how to do the detail planning. Teachers should allow students to proceed ahead only when they have detailed plan with them.
- Teachers should motivate students to maintain log book and prepare portfolio. They should explain benefits of these activities to students and also train them in these activities, because most of them may be doing this first time.
- Teachers should also encourage students to openly discuss their weaknesses and shortcomings in portfolio and teachers should develop confidence in students that admitting mistakes and weaknesses helps in improving them and their marks would not be affected by revealing their mistakes. Marks related to portfolio are awarded based only on the sincerity with which it is prepared and not based on strengths and weaknesses of students.
- Teachers should continuously discuss with students about working of group and progress in the project and from this discussion should identify their personal qualities (both strengths and weaknesses) and suggest to them ways for improving those qualities.
- Internal as well as external examiners should reward students for original work and efforts of students even if they are not fully successful or not able to complete the project in comparison to those students who have taken paid help from others to complete their project.



Annexure A

CERTIFICATE

This is to certify that Mr./Ms.....

FromCollege having Enrolment No:

has completed *Report on the Problem Definition/ Semester V Project Report/ Final Project*

Report having title

individually/ in a group consisting of..... persons under the guidance of the Faculty Guide.

.....
The mentor from the industry for the project

Name:

Telephone:.....

Annexure B

Portfolio for Self Directed Learning for Major Project Work

Name of Student:.....

Semester:.....Programme/Branch:.....

Roll Number:.....

Title of the Project:.....

Name and Designation of Project Guide:.....

Name of Polytechnic:.....

Part A: Selecting the Project and Team (Answers to the following questions to be included in 'Portfolio' as Reflection related to formation of group and finalization of project topic).

Note: This section has to be prepared just after the finalization of the Project topic and formation of the Project Team .

1. How many alternatives we thought before finalizing the project topic?
2. Did we consider all the technical fields related to branch of our diploma programme?
3. Why we found present project topic as most appropriate?
4. Whether all the group members agreed on the present project topic? If not? What were the reasons of their disagreements?
5. Whether the procedure followed in assessing alternatives and finalizing the project topic was correct? If not, discuss the reasons.
6. What were the limitations in other alternatives of project topic?
7. How we formed our team?
8. Whether we faced any problem in forming the team? If yes, then what was the problem and how was it resolved?



9. Am I the leader of our project team? If yes, then why was I chosen? If not, why I could not become the project team leader?
10. Do I feel that present team leader is the best choice available in the group? If yes, then why? If not, then why?
11. According to me who should be the leader of the team and why?
12. Can we achieve the targets set in the project work within the time and cost limits?
13. What are my significant good/ bad sharable experiences while working with my team which provoked me to think? What I learned from these experiences?
14. Any other reflection which I would like to write about formation of team and finalization of project title, if any?

Part B: Reflection related to project planning (Answers to the following questions to be included in 'Portfolio' as reflection on planning)

Note: This section has to be prepared just after the finalization of the 'Project Proposal'.

1. Which activities are having maximum risk and uncertainty in our project plan?
2. What are most important activities in our project plan?
3. Is work distribution is equal for all project group members? If not? What are the reasons? How we can improve work distribution?
4. Is it possible to complete the project in given time? If not what are the reasons for it? How can we ensure that project is completed within time.
5. What extra precaution and care should be taken in executing the activities of high risk and uncertainty? If possible, how such risks and uncertainties can be reduced?
6. Can we reduce the total cost associated with the project? If yes, then describe the ways?
7. For which activities of our project plan, arrangement of resources is not easy and convenient?
8. Did we make enough provisions of extra time/expenditure etc. to carry out such activities?
9. Did we make enough provisions for time delays in our project activity? In which activities there are more chances of delay?
10. In our project schedule, which are the days of more expenditure? What provisions we have made for availability and management of cash?
11. Any other reflection which I would like to write about project planning?



Teacher Evaluation Sheet (ESE) for Capstone Project Planning

Name of Student:

Name of Programme..... Semester:

Course Title and Code:.....

Title of the Capstone Project:

A. POs addressed by the Capstone Project (Mention only those predominant POs)

- a)
- b)
- c)
- d)

B. COs addressed by the Capstone Project (Mention only those predominant POs)

- a)
- b)
- c)
- d)

C. OTHER LEARNING OUTCOMES ACHIEVED THROUGH THIS PROJECT

a) Unit Outcomes (Cognitive Domain)

- i.
- ii.
- iii.
- iv.

b) Practical Outcomes (in Psychomotor Domain)

- i.
- ii.
- iii.
- iv.

c) Affective Domain Outcomes

- i.
- ii.
- iii.
- iv.

D. SUGGESTED RUBRIC FOR ASSESSMENT OF CAPSTONE PROJECT

(please tick below the appropriate rating i.e. poor, average etc., for each characteristic to be assessed and give marks in the respective cell according to performance of student)

S. No.	Characteristic to be assessed	Poor	Average	Good	Excellent	Max. Marks	marks obtained
First Progressive Assessment (at the end of 4 th week)							



S. No.	Characteristic to be assessed	Poor	Average	Good	Excellent	Max. Marks	marks obtained
1	Problem/Task Identification (Project Title)	Relate to very few POs Scope of Problem not clear at all	i. Related to some POs ii. Scope of Problem/Task vague	i. Take care of at-least Three POs ii. Scope of Problem/task not very specific	i. Take care of more than three POs ii. Scope of problem/task very clear	02	
2	Literature Survey /Industrial Survey	Not more than ten sources (primary and secondary), very old reference	At-least 10 relevant sources, at least 5 latest	At –least 15 relevant sources, most latest	About 20 relevant sources, most latest	02	
Second Progressive Assessment (at the end of 12th week)							
3	Project proposal	Methods are not appropriate, All steps not mentioned, Design of prototype not started (if applicable).	Appropriate plan but not in much detail. Plan B for critical activities not mentioned. Time line is not developed. Design of Prototype is not complete. (if applicable)	Appropriate and detailed plan with Plan B for critical activities mentioned, but clarity is not there in methods, time line is given but not appropriate. Design of prototype is not detailed (if applicable)	Appropriate and detailed plan with Plan B for critical activities mentioned, clarity in methods with time line, Detailed design of prototype (if applicable)	02	
4	Execution of Plan in fifth semester (please write by hand about students performance in appropriate column)					02	
5	Log Book	Entries for most weeks are missing. There is no proper sequence and details are not correct.	Entries for some weeks are missing, details are not appropriate, not signed regularly by the guide.	Entries were made every week but are not in detail. Signed and approved by guide every week	Entries were made every week in detail, signed and approved by guide every week	03	
Third progressive Assessment at the end of 14th week							
6	Portfolio Preparation	Answer to only few of the 'questions from self' (prompts)	Answer to only about 50% of the 'questions from self'	Answer to most of the 'questions from self' (prompts) written. Some	Answer to nearly all the 'questions from self' (prompts) written in detail	03	



S. No.	Characteristic to be assessed	Poor	Average	Good	Excellent	Max. Marks	marks obtained
		written. Answers are not in much detail	(prompts) written. Answers are not in much detail	answers are not in much detail			
7	Final Report Preparation	Very short, poor quality sketches, Details about methods, material, precaution and conclusions omitted, some details are wrong Nearly sufficient and correct details about methods, material, precautions and conclusion. but clarity is not there in presentation, not enough graphic description.	Detailed, correct and clear description of methods, materials, precautions and	Conclusions. Sufficient Graphic Description.	Very detailed, correct, clear description of methods, materials, precautions and conclusions. Enough tables, charts and sketches	04	
8	Presentation	Major information is not included, information is not well organized .	Includes major information but not well organized and not presented well	Includes major information and well organized but not presented well	Well organized, includes major information ,well presented	03	
9	Defense	Could not reply to considerable number of question.	Replied to considerable number of questions but not very properly	Replied properly to considerable number of question.	Replied to most of the questions properly	04	
Total marks						25	

Any Other Comment:

.....

.....

Name and designation of the Faculty Member.....

Signature.....



Program Name : Civil Engineering Program Group
Program Code : CE/CR/CS
Semester : Fifth
Course Title : Water Resource Engineering
Course Code : 22501

1. RATIONALE

Water is very important resource for the life of humans and plants and therefore need to be optimally used and conserved. In today's age, there is demand of water and is growing day by day, thus resulting in scarcity of water. Moreover, in India there is uncertain and inequitable rainfall. Therefore, every drop of water is required to be harnessed appropriately using the relevant technological tools and principles. Accordingly, Irrigation structures (dams, canals and allied structures etc), which basically are the backbone structures in the system used to preserve and conserve the water source. In the planning, design, construction, and maintenance of these structures, Civil engineers have a significant role to play. Thus, this course will enable the students to apply and use the basic principles and practices related to irrigation engineering at site. This will help them to implement various schemes like farm ponds, Jalayukt shivar etc. along with conventional irrigation systems.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Design simple irrigation systems.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Estimate hydrological parameters.
- Estimate crop water requirements of a command area and capacity of canals.
- Maintain irrigation structures.
- Execute the Minor and Micro Irrigation Schemes.
- Select the relevant Diversion Head works for the specific site conditions.
- Design, construct and maintain simple Canal structures.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.



Legends: *L* - Lecture; *T* – Tutorial/Teacher Guided Theory Practice; *P* - Practical; *C* – Credit, *ESE* - End Semester Examination; *PA* - Progressive Assessment.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

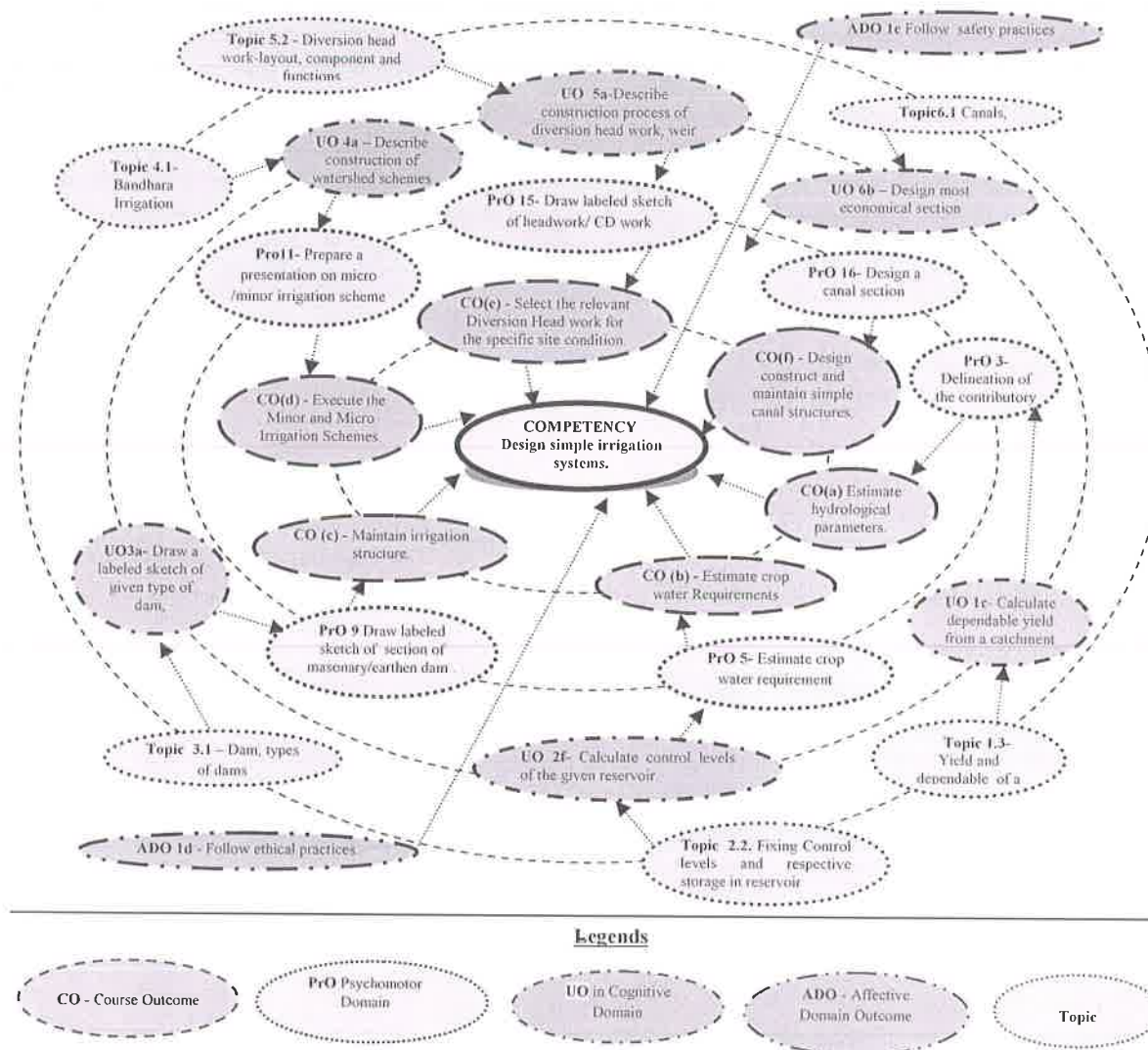


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Calculate average rainfall for the given area using arithmetic mean method .	I	2*
2	Calculate average rainfall for the given area using isohyetal ,Theissen polygon method .	I	2*
3	Delineation of the contributory area for the given outlet from the	I	2*



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
	given topo-sheet.		
4	Compute the yield of the Catchment area demarcated in Sr.No.2.	I	2*
5	Estimate crop water requirement for the given data.	II	2*
6	Estimate capacity of the canal for the given data.	II	2*
7	Calculate reservoir capacity from the given data.	II	2*
8	Calculate control levels for the given data for the given reservoir.	II	2*
9	Draw a labeled sketch of the given masonry/earthen dam section.	III	2
10	Draw the theoretical and practical profile of the given gravity dam section.	III	2
11	Prepare a presentation on the technical details of any one micro or minor irrigation scheme.	IV	2
12	Prepare a model of any irrigation structure using suitable material.	IV	2
13	Prepare a maintenance report for any major/minor irrigation project site in the vicinity of your area, based on field visit.	I,IV	2*
14	Prepare summary of the technical details of any existing water resource project in the vicinity of your area.	III,IV	2*
15	Draw a labeled sketch of the given diversion head works and CD works.	V,VI	2*
16	Design a canal section for the given conditions with estimation of the quantity of material required for lining of the given canal.	VI	2*
	Total		32

Note

- A suggestive list of **PrOs** is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO of the laboratory/workshop/field work is to be assessed according to a suggested sample given below:

S.No.	Performance Indicators	Weightage in %
1	Initiative of student in collecting data and computation.	20
2	Ability to work with the team/group.	10
3	Comprehension and presentation skill.	30
4	Correctness of design calculations and drawings.	30
5	Punctuality and neatness.	10
	Total	100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices on site.
- Demonstrate working as a leader/a team member.
- Maintain and preserve reference drawings, maps and equipment.
- Follow ethical practices.



The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year.
- 'Organising Level' in 2nd year.
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by administrators.

S. No.	Equipment Name with Broad Specifications	PrO. S. No.
1	Technical Drawings, maps, topo-sheets	1
2	Digital planimeter.	2
3	Drawings sheet	4
4	Drawing instruments	5
5	Computing devices	6

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs in cognitive domain for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Introduction to Irrigation and Hydrology	1a. Estimate average rainfall in the given situation using the given method. 1b. Estimate runoff and flood discharge in the given situation. 1c. Calculate dependable yield from the given catchment for the given data. 1d. Describe ill effects of excess irrigation in the given situation. 1e. Classify the irrigation projects on the basis of given condition. 1f. Justify the need of Irrigation for the given area. 1g. Describe the advantages and ill effects of the Irrigation in the given situation. 1h. Explain the construction and functioning of the given type of rain gauge. Compute the Maximum Flood Discharge using the relevant	1.1. Irrigation and its Classification on the basis of purpose and surface. 1.2. Hydrology : Definition and Hydrological cycle, 1.3. Rain Gauge : Symons rain gauge, automatic rain gauge, 1.4. Methods of calculating average rainfall: Arithmetic mean, Isohyetal, and Thiessen polygon method. 1.5. Runoff, Factors affecting Run off, Computation of run –off. 1.6. Maximum Flood Discharge measurement : Rational method and empirical methods. Simple numerical problems. 1.7. Yield and Dependable yield of a catchment, determination of dependable yield.



	method from the given data.	
Unit – II Water Requirement of Crops and Reservoir Planning	2a. Estimate crop water requirement in the given situation. 2b. Estimate capacity of canal for the given data. 2c. Undertake/conduct survey for the given irrigation project. 2d. Calculate reservoir capacity from the given data. 2e. Suggest relevant measures of silt control in a given situation with justification. 2f. Calculate control levels for the given reservoir from the given data. 2g. Establish the relationship between duty, delta and base period.	2.1 Crop Water requirement : Cropping seasons, Crop period, base period, Duty, Delta, CCA, GCA, intensity of irrigation, factors affecting duty, Problems on water requirement and capacity of canal. 2.2 Methods of application of irrigation water and its assessment. 2.3 Surveys for irrigation project, data collection for irrigation project. 2.4 Area capacity curve. 2.5 Silting of reservoir : Rate of silting, factors affecting silting and control measures. 2.6 Control levels in reservoir. 2.7 Simple numerical problems on Fixing Control levels.
Unit- III Dams And Spillways	3a. Draw a labeled sketch of given type of dam. 3b. Draw theoretical and practical profile of given gravity dam section. 3c. Suggest preventive measures for the given type of dam failure with justification. 3d. Propose the types of spillways and energy dissipaters for the given type of dam with justification. 3e. Suggest the relevant type(s) of gate for the given type of dam(s) with justification. 3f. Suggest suitable measures to maintain the given earthen dam with justification. 3g. Compare the earthen dam with gravity dams with respect to the given criteria such as seepage, foundation, construction and maintenance.	3.1 Dam and its classification: Earthen dams and Gravity dams (masonry and concrete). 3.2 Earthen Dams –Components with function, typical cross section, seepage through embankment and foundation and its control. 3.3 Methods of construction of earthen dam, types of failure of earthen dam and preventive measures. 3.4 Gravity Dams –Forces acting on dam, Theoretical and practical profile, typical cross section, drainage gallery, joints in gravity dam, concept of high dam and low dam. 3.5 Spillways-Definition, function, location and components. 3.6 Emergency and service spillway - ogee spillway and bar type spillway, discharge over spillway. Energy dissipation, Spillway with and without gates. 3.7 Gates- Radial and Vertical.
Unit- IV Minor and Micro Irrigation	4a. Describe the process of construction of watershed scheme of farm pond for the given area.	4.1 Bandhara irrigation : Layout, components, construction and working, solid and open bandhara. 4.2 Percolation Tanks – Need, selection



	<p>4b. Explain the procedure of construction of Bandhara, Percolation tanks and any type of minor and micro irrigation schemes.</p> <p>4c. Prepare a checklist for maintenance of Bandhara irrigation, Percolation tanks and any type of minor and micro irrigation schemes.</p> <p>4d. Identify the components of Drip and Sprinkler Irrigation system in the given situation.</p> <p>4e. Identify the need for drip/sprinkler irrigation scheme for the given area.</p> <p>4f. Suggest the relevant layout for the specified crop in the given site conditions.</p>	<p>of site.</p> <p>4.3 Lift irrigation scheme-Components and their functions, lay out.</p> <p>4.4 Drip and Sprinkler Irrigation- Need, components, Layout, operation and Maintenance.</p> <p>4.5 Farm ponds, Jalayukt shivar schemes.</p> <p>4.6 Well irrigation: types of wells, yield of well, advantages and disadvantages of well irrigation.</p>
Unit– V Diversion Head Works	<p>5a. Describe the process of construction of diversion head work, weir and barrage in the given situation.</p> <p>5b. Prepare a checklist for maintenance of the diversion head work, weir and barrage in the given situation.</p> <p>5c. Draw a labeled sketch of the given type of diversion head work, weir and barrage.</p>	<p>5.1. Weirs – components parts, types. K.T. weir – components and construction</p> <p>5.2. Diversion head works – layout, components and their function.</p> <p>5.3. Barrages – components and their functions. Difference between weir and Barrage.</p>
Unit– VI Canals	<p>6a Estimate the balancing depth of the given canal(s).</p> <p>6b Design a most economical section for the designed discharge under specified condition for the given type of canal section.</p> <p>6c Prepare a checklist for the maintenance of the given type of CD work and canal regulator.</p> <p>6d Estimate the quantity of material for lining of given canal.</p> <p>6e Prepare a checklist for maintenance of the given canal.</p> <p>6f Classify the canal on the basis of alignment and position in the given canal network.</p>	<p>6.1. Canals – Classification according to alignment and position in the canal network, Cross section of canal in embankment and cutting, partial embankment and cutting, balancing depth. Design of most economical canal section.</p> <p>6.2. Canal lining - Purpose, material used and its properties, advantages.</p> <p>6.3. CD works- Aqueduct, siphon aqueduct, super passage, level crossing.</p> <p>6.4. Canal regulators- Head regulator, Cross regulator, Escape, Falls and Outlets.</p> <p>6.5. Canal maintenance.</p>

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.



9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to Irrigation and Hydrology	12	4	4	6	14
II	Water Requirement of Crops and Reservoir Planning:	12	2	8	6	16
III	Dams And Spillways	14	4	4	4	12
IV	Minor and Micro Irrigation	08	-	4	6	10
V	Diversion Head Works	08	4	4	-	08
VI	Canals	10	-	4	6	10
Total		64	14	28	28	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Collect data and drawings from various departments.
- Assimilate data to be used in required form.
- Interpret data.
- Prepare drawings and design calculations.
- Draw inference from designs.
- Prepare presentations.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- 'L' in item No. 4** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Guide student(s) in undertaking micro-projects.
- Demonstrate thoroughly the relevant experiment to the students before they start doing the practice.



- g. Encourage students to refer different websites to have deep in-depth knowledge of the subject.
- h. Continuous observation and monitoring of the performance of students in the Laboratory.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

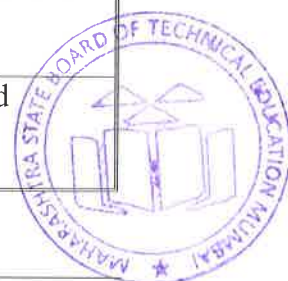
The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

- a. Prepare a report of cropping pattern, for the given minor or major irrigation project in your area with reference to growth in yield, increase in command and culturable area and economic status of the concern people.
- b. Conduct online/internet survey for Water shed management project (s) in the Maharashtra State with a detailed report of all relevant technical inputs.
- c. Prepare a report on the executed system of rain water harvesting with reference to its necessity, broad design parameters, economics in your area along with your comments.
- d. Summarize the relevant information in the form of the report from internet regarding types of satellite imagery to capture the necessary details of the given water resource projects.
- e. Prepare a report on the on any one executed system of Farm ponds/Jalayukt shivar schemes/drip irrigation scheme with emphasis on its suitability, costing, utility and maintenance after undertaking the visit to it.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Irrigation and water power Engineering	Punmia, B.C., Pande, B, Lal	Lakshmi Publications, New Delhi - 110 002. Edition 2016 ISBN 13: 9788131807637
2	Irrigation Engineering	Sharma, R.K. and Sharma, T.K.	S.Chand and Company Ltd. Delhi ISBN 13: 9788121921282 Ed. 2002
3	Irrigation Engineering	Basak, N.N.	McGraw Hill Education India Pvt. Ltd. New Delhi. Edition 1999 ISBN 13: 9780074635384
4	Irrigation and water resource Engineering	Asawa, G.L.	New Age International(P) Limited Publishers. January, 2005 ISBN (13) : 978-81-224-1673-2



S. No.	Title of Book	Author	Publication
5	Irrigation Engineering	Dahigaonkar, J.G.	Asian Book Pvt. Ltd., New Delhi ISBN 13: 9788184120080
6	Irrigation and Hydraulic structures	S.K.Garg	Khanna Publishers, Delhi. ISBN: 978-81-7409-047-9
7	Irrigation Engineering	Priyani V.B.	Charotar Book Stall, Anand.

IS, BIS and International Codes:

1. IS: 4410-Part-V-1982-Canals
2. IS: 4410-Part-VI-1983-Reservoirs.
Part- VII-1968-Dams.
Part-XVII-1977-Water Requirement of Crops
3. IS: 5477-Part-II, III and IV -1969-71-Storage zones of reservoirs.

14. SOFTWARE/LEARNING WEBSITES/LEARNING RESOURCES

- a. <http://nptel.ac.in/courses/105105110/>
- b. <https://wrd.maharashtra.gov.in>
- c. <http://www.imd.gov.in>
- d. <http://www.mahahp.gov.in>
- e. http://bhuvan.nrsc.gov.in/bhuvan_links.php
- f. Charts/Models/Drawings



Program Name : Civil Engineering Program Group
Program Code : CE/CR/CS
Semester : Fifth
Course Title : Estimating and Costing
Course Code : 22503

1. RATIONALE

In the construction of any civil structure, specifications of the civil work are the significant parameters in deciding the cost of the project. In construction, it is often required to use the local material for which the rates are varying in greater extent across the country. The rate analysis justifies the rates to be finalized for various items of works based on local market survey for budget provision. Therefore there emerges the need of a discipline to suggest a specific scientific technique to determine the quantities and cost of the materials along with its justification. Thus, this course provides the necessary knowledge and skills in developing the competency in the areas mentioned above in professional manner. Today being the era of technology, a provision has also been made to use the various software's for more accuracy and speedy determination of quantities.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Prepare the estimate of civil engineering works.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Select the modes of measurements for different items of works.
- Prepare approximate estimate of a civil engineering works.
- Prepare detailed estimate of a civil engineering works.
- Justify the rate for given items of work using rate analysis techniques.
- Use relevant software for estimating the quantities and cost of items of works.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
I.	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	4	7	3	70	28	30*	00	100	40	50#	20	50	20	100	40

(*): Under the theory PA; Out of 30 marks, 10 marks of theory PA are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P – Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment.



5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

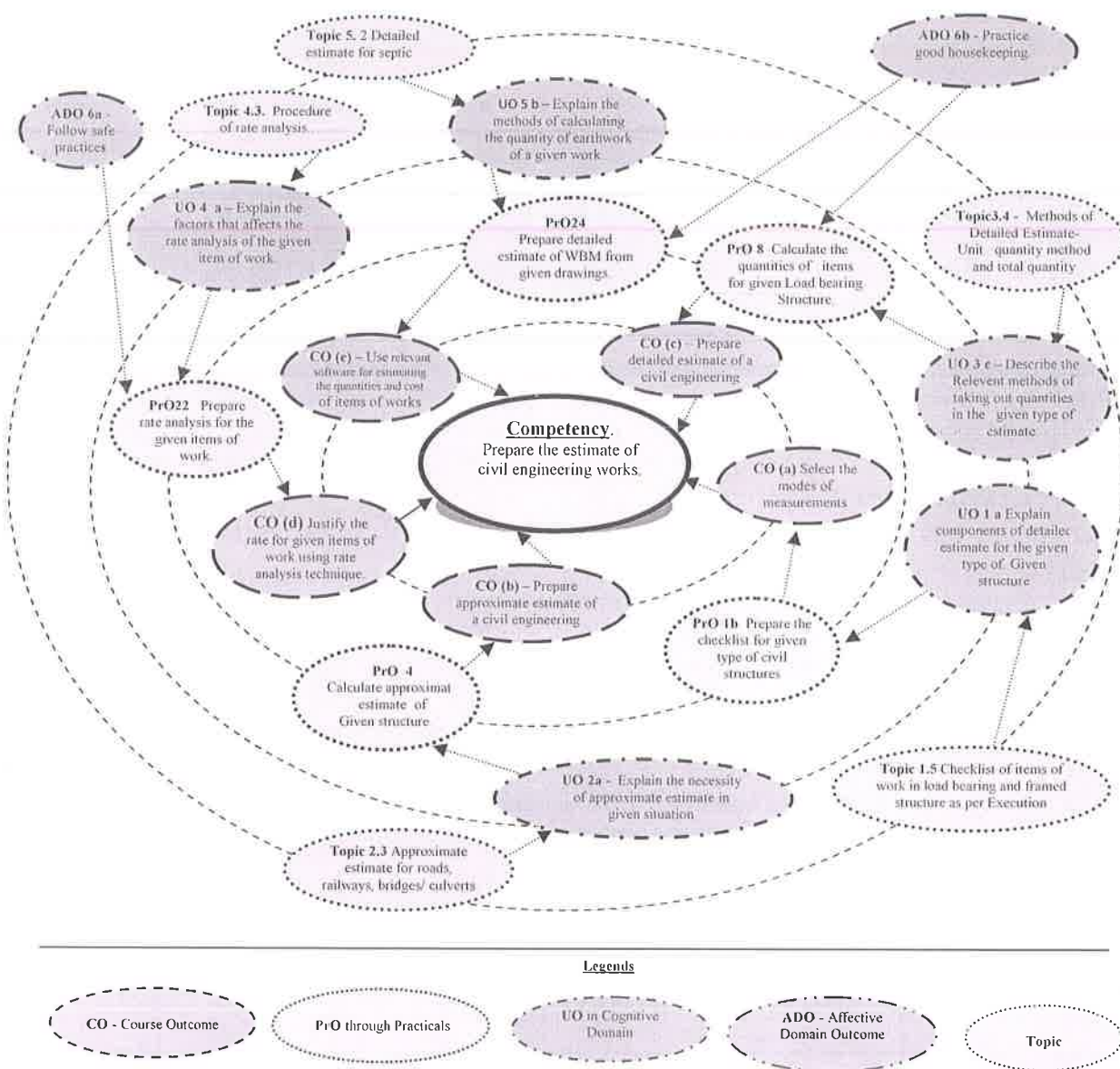


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1.	Prepare the check list of items to be executed with units for detailed estimate of the given structure from the given drawing.	I	02*
2.	Prepare a report on market rates for given material, labour wages, hire charges of tools & equipments required to construct the	IV	02*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	given structure as mentioned in at Serial number 1 above.		
3.	Prepare the detailed Specification for the given items using DSR (for any ten item)	I	02*
4.	Prepare the approximate estimate for the given civil engineering works.	II	02*
5.	Prepare approximate estimate for the given civil engineering works.	II	02*
6.	Prepare bill of quantities of given item from actual measurements. (any four items).	III	02*
7.	Prepare bill of quantities of given item from actual measurements. (any four items).	III	02*
8.	Calculate the quantity of items of work from the given set of drawings using standard measurement sheet for load bearing residential structure using description of item from DSR (1BHK Building with staircase).	III	02*
9.	Calculate the quantity of items of work from the given set of drawings using standard measurement sheet for load bearing residential structure using description of item from DSR (1BHK Building with staircase).	III	02*
10.	Calculate the quantity of items of work from the given set of drawings using standard measurement sheet for load bearing residential structure using description of item from DSR (1BHK Building with staircase).	III	02*
11.	Calculate the quantity of items of work from the given set of drawings using standard measurement sheet for load bearing residential structure using description of item from DSR (1BHK Building with staircase).	III	02
12.	Prepare detailed estimate from the given set of drawings using "standard measurement and abstract format" for RCC framed structure using description of item from DSR along with face sheet and prepare quarry chart ,lead statement (G+1 Building) .	III	02*
13.	Prepare detailed estimate from the given set of drawings using "standard measurement and abstract format" for RCC framed structure using description of item from DSR along with face sheet and prepare quarry chart ,lead statement (G+1 Building) .	III	02*
14.	Prepare detailed estimate from the given set of drawings using "standard measurement and abstract format" for RCC framed structure using description of item from DSR along with face sheet and prepare quarry chart ,lead statement (G+1 Building) .	III	02*
15.	Prepare detailed estimate from the given set of drawings using "standard measurement and abstract format" for RCC framed structure using description of item from DSR along with face sheet and prepare quarry chart ,lead statement (G+1 Building).	III	02*
16.	Prepare detailed estimate from the given set of drawings using "standard measurement and abstract format" for RCC framed structure using description of item from DSR along with face sheet and prepare quarry chart ,lead statement (G+1 Building).	III	02
17.	Calculate the reinforcement quantities from the given set of drawings for a room size of 3 m X 4 m with bar bending schedule	III	02*



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	(footing, column, beam, lintel with chajja, slab)		
18.	Calculate the reinforcement quantities from the given set of drawings for a room size of 3 m X 4 m with bar bending schedule (footing, column, beam, lintel with chajja, slab)	III	02*
19.	Calculate the reinforcement quantities from the given set of drawings for a room size of 3 m X 4 m with bar bending schedule (footing, column, beam, lintel with chajja, slab)	III	02*
20.	Calculate the reinforcement quantities from the given set of drawings for a room size of 3 m X 4 m with bar bending schedule (footing, column, beam, lintel with chajja, slab)	III	02*
21.	Calculate the reinforcement quantities from the given set of drawings for a room size of 3 m X 4 m with bar bending schedule (footing, column, beam, lintel with chajja, slab)	III	02
22.	Prepare the rate analysis for the given five item of works	IV	02*
23.	Prepare the rate analysis for the given five item of works	IV	02
24.	Prepare detailed estimate of W.B.M. Road of one kilometer length from the given drawing.	V	02*
25.	Prepare detailed estimate of W.B.M. Road one kilometer length from the given drawing.	V	02
26.	Prepare detailed estimate of small Septic tank from the given set of drawings.	V	02*
27.	Prepare detailed estimate of small Septic tank from the given set of drawings.	V	02
28.	Prepare detailed estimate of well from the given set of drawing.	V	02*
29.	Prepare detailed estimate of well from the given set of drawing.	V	02
30.	Use the relevant software to prepare detailed estimate of any one of the WBM Road/Septic Tank/ well.	V	02*
31.	Use the relevant software to prepare detailed estimate of any one of the WBM Road/Septic Tank/ well.	V	02*
32.	Use the relevant software to prepare detailed estimate of any one of the WBM Road/Septic Tank/ well.	V	02
	Total		64

Note

- A suggestive list of **PrOs** is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 24 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO of the laboratory/workshop/field work is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
a.	Calculation of quantities.	40
b.	Preparing measurement sheet	20
c.	Preparing Abstract sheet	20
d.	Answer to sample questions	10



S. No.	Performance Indicators	Weightage in %
e.	Submit report in time	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Practice good housekeeping.
- Follow the provisions laid in IS 1200.
- Practice to follow DSR.
- Demonstrate working as a leader/a team member.
- Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year and
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. S. No.
1.1	Computer system (Any computer system with basic configuration)	30,31,32
1.2	Available Software of estimating and Costing.	30,31,32

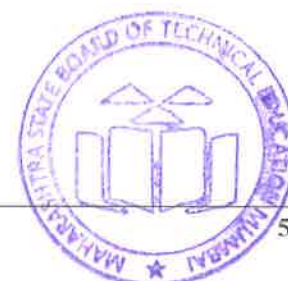
8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs in cognitive domain for achieving the COs to attain the identified competency. More UOs could be added.

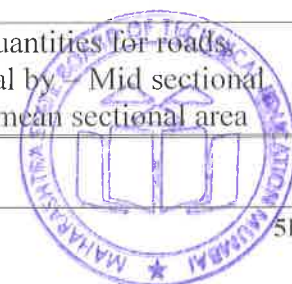
Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
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Unit – I Fundamentals of estimating and costing	1a. Explain the procedure of the detailed estimate for the given structure. 1b. Prepare the checklist for the given type of the civil structure. 1c. Select the mode of measurements for given items of work as per IS: 1200. 1d. Describe the required specifications for the given item of structure. 1e. Apply the rules of deduction as per IS 1200 for calculating the quantities of a structure. 1f. Explain the salient features of the administrative and technical approval for the given project. 1g. Classify the given type of estimate on the basis of the purpose and type of work.	1.1 Estimating and Costing – Meaning, purpose, Administrative Approval, Technical Sanction and Budget provision. 1.2 Types of estimates – Approximate estimate and detailed estimate. 1.3 Detailed Estimate- of New work. 1.4 Types and Uses of Estimates: Revised estimate, supplementary estimate, revised and supplementary estimate, repair and maintenance estimate, renovation Estimate. 1.5 Roles and responsibility of Estimator. 1.6 Checklist of items of work in load bearing and framed structure as per Execution. 1.7 Modes of measurement and Desired accuracy in measurements of different items of work as per IS:1200. 1.8 Rules for deduction in Masonry work , Plastering and Pointing and Painting work as per IS:1200. 1.9 Description / specification of items of building work as per PWD /DSR. 1.10 Standard formats of Measurement sheet, Abstract sheet, Face sheet.
Unit -II Approximate Estimates	2a. Explain the necessity of approximate estimate in the given situation. 2b. Describe the methods used in determining the approximate estimate for the given structure. 2c. Prepare the approximate estimate for given civil engineering works. 2d. Select the relevant method of approximate estimate for the given structure. 2e. Calculate approximate cost of the given structure.	2.1 Approximate estimate- Definition, Purpose. 2.2 Methods of approximate estimate - Service unit method, Plinth area rate method, Cubical content method, Typical bay method, Approximate quantity method. 2.3 Approximate estimate for roads, Railways, bridges/culvert, irrigation projects and water supply projects. 2.4 Numericals on service unit method and Plinth area rate method.



Unit-III Detailed Estimate	<p>3a. Describe the procedure of preparation of detailed estimate for the given civil structure.</p> <p>3b. Identify the data required for given type of estimate.</p> <p>3c. Describe the relevant methods of taking out quantities in the given type of estimate.</p> <p>3d. Calculate the quantities of the given items for the given Load bearing structure.</p> <p>3e. Calculate the quantities of the given items (of footing, column, beam, Lintel, chajja, slab and Brickwork) for the given RCC Framed structure.</p> <p>3f. Calculate the approximate quantity of steel for the given RCC member such as footing, column, beam, Lintel, chajja and slab.</p> <p>3g. Prepare the bill of quantity for the given type of civil work.</p>	<p>3.1 Detailed Estimate- Definition and Purpose, Data required for detailed estimate, Procedure of preparation of detailed estimate- Taking out quantities and Abstracting.</p> <p>3.2 Methods of Detailed Estimate- Unit quantity method and total quantity method.</p> <p>3.3 Long wall and Short wall method (out to out and in to in method or PWD method), Centre line method.</p> <p>3.4 Bar bending schedule.</p> <p>3.5 Steel requirement for footing, column, beam, Lintel, chajja and slab.</p> <p>3.6 Provisions in detailed estimate: contingencies, work charged establishment, centage charges, water supply and sanitary Charges and electrification charges.</p> <p>3.7 Prime cost, Provisional sum, provisional Quantities, Bill of quantities, Spot items or Site items, Day work.</p>
Unit –IV Rate Analysis	<p>4a. Explain the factors that affect the rate analysis of the given item of work.</p> <p>4b. Describe Procedure of rate analysis for the given item of work.</p> <p>4c. Mention task work for given type of work.</p> <p>4d. Prepare rate analysis for the given items of work.</p> <p>4e. Describe the factors affecting the task work for the given situation.</p>	<p>4.1 Rate Analysis : Definition, purpose, importance and factors affecting.</p> <p>4.2 Lead (Standard and Extra), lift, overhead charges, water charges and contractors profit,</p> <p>4.3 Procedure of rate analysis.</p> <p>4.4 Task work- Definition, factors Affecting, types. Task work of different skilled labour for different items.</p> <p>4.5 Categories of labours, their daily wages, types and number of labours for different items of work</p> <p>4.6 Load carrying capacity of different types of vehicles, transportation of materials and their hire -charges.</p> <p>4.7 Preparing rate analysis of different items of work- PCC, RCC work in (column, beam, lintel, slab), brick masonry, stone masonry, Vitrified tile flooring, plastering, , Wood work for doors.</p>
Unit –V Estimate for Civil	<p>5a. Calculate the earthwork quantity for the given civil engineering works.</p>	<p>5.1 Earthwork - Quantities for roads, Bunds and canal by – Mid sectional area method, mean sectional area</p>



Engineering works	5b. Explain the relevant method(s) of calculating the quantity of earthwork of the given work 5c. Prepare detailed estimate for given civil engineering work. 5d. Use the relevant software for preparing the detailed estimate for the given work.	method, Prismoidal formula method and trapezoidal formula method. 5.2 Detailed estimate for septic tank, Community well. 5.3 Use of computer / softwares / programmes for detailed estimate Preparation of Civil Engineering Works works. (Questions on application of software from sub unit 5.3 above shall not be asked in theory exam.)
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Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Fundamentals of estimating and costing.	08	04	04	04	12
II	Approximate Estimates	04	02	00	04	06
III	Detailed Estimate	20	02	08	18	28
IV	Rate Analysis	08	02	04	06	12
V	Estimate for Civil Engineering works	08	00	06	06	12
Total		48	10	22	38	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare detailed estimate of single room of load bearing structure..
- Give seminar on relevant topic.
- Undertake micro-projects.
- Collect current DSR from PWD and prepare report on it.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.



- b. '**L**' in *item No. 4* does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c. About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- e. Guide student(s) in undertaking micro-projects.
- f. Demonstrate students thoroughly before they start estimating..
- g. Encourage students to refer different websites to have deeper understanding of the subject.
- h. Observe continuously and monitor the performance of students in Lab.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course.

In the first two semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here:

- a. Compare the two detailed estimates collected from professionals along with your comments in the form of a report.
- b. Prepare approximate estimate of various types of building such as school building, hospital, auditorium, Hostel, irrigation project, bridge in the immediate vicinity of your area.
- c. Prepare detailed estimate of any load bearing structure using available software.
- d. Prepare detailed estimate of the framed structure using available software.
- e. Prepare rate analysis of Painting work using OBD, Plastic emulsion, Oil paint, luster paint.
- f. Prepare detailed estimate for the proposed new Bituminous Road of 1 km length.
- g. Prepare detailed estimate for the construction of Slab Culvert.
- h. Prepare detailed estimate for the construction of Pipe Culvert.
- i. Prepare estimate for Renovation of an existing building (any five items).
- j. Prepare Rate analysis using CSR/DSR (Current/District Schedule of Rates) Items by PWD Methods.(Any Five items)
- k. Prepare the report on the salient provisions made in IS:1200 with special reference to load bearing structure.

13. SUGGESTED LEARNING RESOURCES :

S. No.	Title of Book	Author	Publication
1	Estimating and Costing in Civil engineering	Datta, B.N.	UBS Publishers Distributors Pvt. Ltd. New Delhi ISBN:9788174767295

S. No.	Title of Book	Author	Publication
2	Estimating construction cost (fifth edition)	Peurifoy, Robert L. Oberlender, Garold	McGraw Hill Education, , New Delhi, 2005, ISBN-10: 0073398012 ISBN-13: 9780073398013
3	Estimating and Costing	Rangwala, S.C.	Charotar Publishing House PVT. LTD., Anand (Gujrat) Pin 388001 Reprint -2011
4	Estimating and Costing	Birdie, G.S.	Dhanpat Rai Publishing Company(P) Ltd. New Delhi 110002 ISBN : 978-93-84378-13-4
5	Civil Engineering Contracts and Estimates	Patil, B.S.	Orient Longman, Mumbai, Ed. 2010 ISBN: 9788173715594, 8173715599
6	Estimating and costing, specification and valuation in civil engineering	Chakraborti, M.	Monojit Chakraborti, Kolkata (2006) ISBN-10: 818530436X ISBN-13: 978-8185304366

14. SOFTWARE/LEARNING WEBSITES

- a. www.ensoftindia.com
- b. www.newtonindia.com
- c. www.mahapwd.com



Program Name : Civil Engineering Program Group
Program Code : CE/CR/CS
Semester : Fifth
Course Title : Design of Steel and RCC Structures
Course Code : 22502

1. RATIONALE

For Civil Engineering technologist to understand the behaviour of various structural components for developing insight for the design concepts and will help the student in quality supervision on site. Design of steel and RCC structures is the core subject for the Civil Engineering. For the design of steel structures, the properties of steel, different steel sections, various grades and strength characteristics of steel and design of connections are required as per IS:800-2007. In the design of RCC structures Limit State Method is to be used as per IS:456-2000 for analysis and design and IS:875-1987 is to be used for Loading Standards.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Use the concepts of Steel and RCC structural design using Limit State Method at the site.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course using Limit State Method are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Use steel table and IS code 800:2007 at work sites.
- Design the connections for the given steel joints.
- Analysis and design of singly reinforced rectangular beams.
- Design of shear reinforcement and development length for beam and slabs.
- Design various slabs for the given edge condition.
- Design of axially loaded short columns and footings.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
4	1	2	7	4	70	28	30*	00	100	40	25#	10	25	10	50	20

(*): Under the theory PA; Out of 30 marks, 10 marks of theory PA are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)



This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

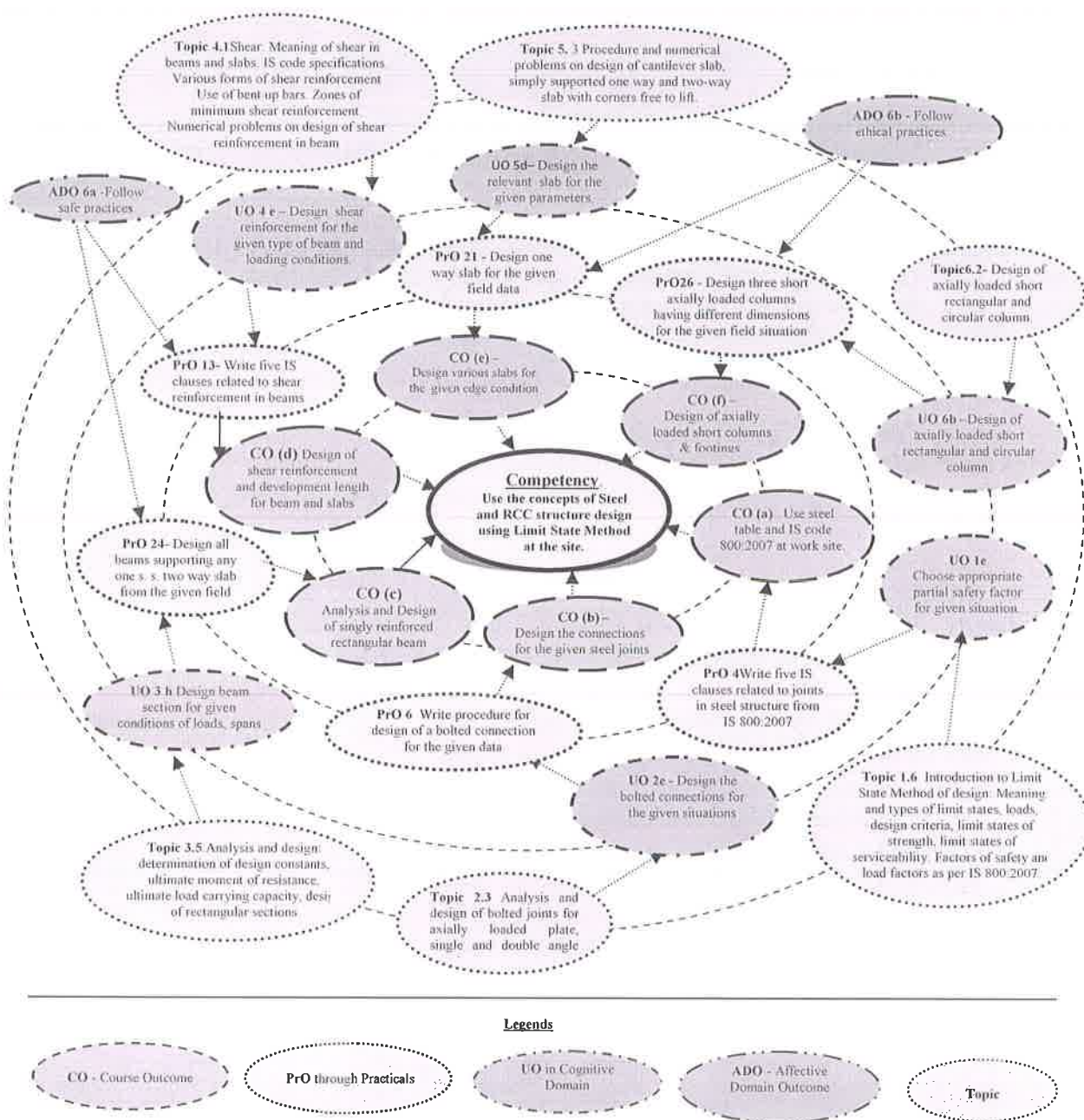


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1.	Draw five standard rolled steel sections showing all details.	1	



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
2.	Write five IS clauses related to load from IS 875:1987.	I	02
3.	Draw five commonly used built up sections.	I	02
4.	Write five IS clauses related to joints in steel structure from IS 800:2007.	I	
5.	Draw types of bolts with their modes of failure.	II	02*
6.	Design a bolted connection for the given data and compare it with design using open source software/IS code.	II	02
7.	Draw types of welds and types of welded joints.	II	02*
8.	Draw modes of failure for bolted connections.	II	02
9.	Write five IS clauses related to partial safety factors, characteristic strengths, characteristic load and design load from IS 456:2000.	III	02
10.	Draw cross section, strain –stress diagram for singly reinforced section giving design parameters and constants.	III	02*
11.	Draw stress block diagram for Under- reinforced, over-reinforced and balanced sections showing all details.	III	02
12.	Write five IS clauses related to shear reinforcement in beams and slabs from IS 456:2000.	IV	02*
13.	Write the procedure to calculate development length of main reinforcement in beams and slabs.	IV	02
14.	Write four IS clauses related to each for slab, beam and column from IS 456:2000.	III,V	02
15.	Draw diagrams showing transfer of loads from one way simply supported slab and two way simply supported slab to the supporting beam as per I. S. 456:2000.	III,V	
16.	Draw the table showing details of deflected shape along with effective length of column as per IS 456:2000.	VI	02
17.	Design of a welded connection for the given data and compare it using open source software/IS code.	II	
18.	Draw reinforcement detailing of dog legged stair.	V	02*
19.	Check the given drawing as per IS 456:2000 specifications with respect to reinforcement detailing. (Working drawing / Blue print should be collected from the suitable site.)	III, IV, V	02
20.	Design one cantilever slab from the given data.	V	02*
21.	Design a one way simply supported slab from the given data.	V	02*
22.	Design a two way simply supported slab from the given data.	V	02*
23.	Design the beam/s each supporting cantilever slab, one way simply supported slab and two way simply supported slab from the given data.	III	02*
24.	Design one axially loaded short column each supporting two given beams (corner column), three beams and four beams from the given field situation from the given data.	VI	02*
25.	Design footing for axially loaded short column designed in Sr. no.24.	VI	02*
26.	Draw the reinforcement details for cantilever slab, one way simply supported slab and two way simply supported slab designed in Sr. no. 20 to 22.	III to VI	02*4



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
27.	Draw the reinforcement details for the beam, column and footing designed in Sr. no. 23 to 25.	III to VI	02*#
28.	Prepare a report on site visit for joints in Steel structures.	II	02
29.	Prepare a report on site visit for reinforcement detailing for various structural elements.	III to VI	02*
Total			32

Note

- 3.1 The term work should consist of manual, A3 size sketchbook and A2 size drawing sheets.
- 3.2 A judicious mix of minimum eight (8) or more practical are to be performed from Sr. No. 1 to 18 and minimum nine (9) or more practical are to be performed from Sr. No. 19 to 29 out of which Sr. Nos. marked with ' (*) ' are compulsory i.e. total minimum seventeen (17) practical or more.
- 3.3 Use A3 size sketchbook for Sr. No. 1,3,5,7,8,10,11,16,17,19.
- 3.4 Collect suitable working drawing /blue print from the site for the data required for the Sr.No.19 to 25 preferably separate drawing for each batch.
- 3.5 For Sr. No. 23 and 24, divide each batch into three groups. Each group will design only one type of beam and one type of column from the given types so that all types of beams and columns will get designed.
- 3.6 For Sr. No. marked with (#), use AutoCAD software for drawing.
- 3.7 A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. All the above listed practical need to be performed compulsorily, so that the student reaches the 'Applying Level' of Blooms's 'Cognitive Domain Taxonomy' as generally required by the industry.
- 3.8 The 'Process' and 'Product' related skills associated with each PrO are to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Interpretation of given data and its presentation.	10
2	Selection of sketches /Process of designing of the given structural components using relevant I.S. Codes /writing of visit report.	30
3	Precision in sketch book, sheets and report and its neatness, cleanliness.	30
4	Individual work and working in groups	20
5	Submission of assigned work in time	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of



practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year and
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. S. No.
1.1	Drawing boards and drawing equipments	1,2,5,7,11,12,17
1.2	Computers	26,27
1.3	Printers	26,27
1.4	Available CAD software.	26,27

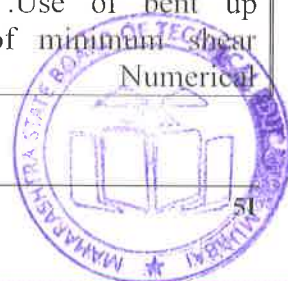
8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs in cognitive domain for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Fundamental of steel structures	1a. Select a relevant steel structure for the given condition. 1b. Use steel table to identify different properties of given steel sections. 1c. Explain the various type(s) of loads (Dead load, live load, impact load, seismic load, snow load etc.) acting on the given steel structures. 1d. Select the relevant factors to calculate seismic forces for given civil structure. 1e. Choose the partial safety factor as per the guidelines laid in IS for the given situation. 1f. Explain the Advantages and disadvantages of steel as construction material in the given situation. 1g. Describe the functions of the given steel structure. 1h. Identify the components of the given steel structure	1.1 Steel as construction material. 1.2 Steel structures: Towers, Roof trusses, Water Tanks, Bridges, Gantry and Crane girders, Columns, Chimney, building frames etc. 1.3 Types, grades and strength of steel sections, Steel Table, IS 808-1989. Stress Strain graph for mild steel. 1.4 Loads acting on steel structures according to IS 875-1987 part I to IV. 1.5 Limit State Method of design: Meaning and types of limit states, loads, design criteria, limit states of strength, limit states of serviceability. 1.6 Factors of safety and load factors as per IS 800:2007.
Unit– II Design of	2a Compute the strength of the given bolted connections	2.1 Type, uses of bolts and joints: Black bolts and High strength



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Steel Connections	2b Design the bolted connections for the given situations. 2c Compute the strength of the given welded connections. 2d Design the welded connections for given situations. 2e State the Specifications for cross-sectional area, pitch, spacing, gauge, end distance, edge distance, and diameter of bolt holes for bolted connections with justification. 2f Explain the advantages and disadvantages of given welded connection.	bolts, modes of failure, 2.2 Specifications of bolt holes for bolted connections. 2.3 Strength of bolt in shear, tension, bearing and efficiency of joint. 2.4 Analysis and design of bolted joints for axially loaded plate, single and double angle members 2.5 Welded connections: Butt and Fillet welds, size of weld, throat thickness 2.6 Analysis and design of fillet welded joint for plate, single and double angle members subjected to axial load.
Unit III- Analysis and Design of Singly Reinforced Sections	3a. Choose partial safety factor as laid in IS provisions for the given situation 3b. Explain the different type(s) of loads acting on the given RCC structure(s). 3c. Describe the procedure used in limit state method of design a RC member for the given data. 3d. Discuss the design parameters including constants for given types of materials. 3e. Calculate ultimate moment of resistance for given type of section. 3f. Infer the stability of the given beam section by applying the various checks. 3g. Design a beam section for given conditions. 3h. Draw reinforcement detailing for a given element as per the IS provisions. 3i. Identify the given section as Under- reinforced, over-reinforced or balanced section.	3.1 RCC: functions of reinforcement, material properties, types of limit states, partial safety factors for material strength, characteristic strengths, characteristic load, design load as per IS 456:2000. 3.2 Types of loads and combinations as per IS:875:2002 3.3 Limit State of collapse (flexure) : assumptions, steel, strain diagram and stress-strain relationship for concrete and block diagram for singly reinforced section, design parameters and constants, ultimate moment of resistance 3.4 Under- reinforced, over-reinforced and balanced sections. 3.5 IS specifications regarding spacing, cover, minimum reinforcement, effective span in beams 3.6 Analysis and design: determination of design constants, ultimate moment of resistance, ultimate load carrying capacity, design of rectangular sections.
Unit –IV Design of Shear reinforcement and Bond	4a. Explain the pattern of shear failure for a given member in structure. 4b. Locate the zones of minimum shear reinforcement with sketch for the given loading	4.1 Shear: Meaning of shear in beams and slabs. IS code specifications. Various forms of shear reinforcement .Use of bent up bars. Zones of minimum shear reinforcement.



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	<p>conditions.</p> <p>4c. Design shears reinforcement for the given conditions.</p> <p>4d. Judge the beam with given reinforcement on the basis of the shear strength.</p> <p>4e. Compute the bond length for the beam with given reinforcement.</p> <p>4f. Identify the zone of minimum shear reinforcement in the given element.</p>	<p>problems on design of shear reinforcement in beam.</p> <p>4.2 Bond: Meaning of bond as per IS code provisions. Meaning and calculation of development length in tension and compression.</p>
Unit –V Design of Slabs	<p>5a. Suggest the relevant type of slab for the given support condition.</p> <p>5b. Suggest relevant corresponding values of design parameters in the given situation.</p> <p>5c. Check the deflection of the given type of slab.</p> <p>5d. Design the given type of slab using the given parameters.</p> <p>5e. Check the development length of the given type of slab.</p>	<p>5.1 Slabs, support conditions, I.S. specifications regarding main steel, distribution steel, spacing and cover for reinforcement, effective span, minimum reinforcement.</p> <p>5.2 Limit state of serviceability for slabs for deflection criteria only.</p> <p>5.3 Design of one way and cantilever slab including development length check only.</p> <p>5.4 Design of two-way slab with four edges discontinuous and provision of torsion reinforcement at corners (As per IS 456:2000, table no 26 case no 9 only). Check for deflection only.</p>
Unit –VI Design of axially loaded short Columns and footing	<p>6a. Identify the type of column in the given situation.</p> <p>6b. Calculate the ultimate load carrying capacity of the column in the given situation.</p> <p>6c. Design the axially loaded short column for the given data.</p> <p>6d. Check the given structural drawing as per the specifications laid in relevant IS code.</p> <p>6e. Design given type of column footing for the given data.</p> <p>6f. Explain the assumptions made in the design of axially loaded short column.</p> <p>6g. Select the given type of RCC footings in the given situation.</p>	<p>6.1 Limit state of collapse in compression, assumptions, effective length, slenderness ratio, short and long columns, and minimum eccentricity.</p> <p>6.2 IS specifications for reinforcement in column.</p> <p>6.3 Load analysis for a column : load on an axially loaded column from beams at a different floor levels in a building</p> <p>6.4 Design of axially loaded short square and rectangular column.</p> <p>6.5 Various RC footings : Isolated and Sloped footings, combined footings, piles</p> <p>6.6 IS specifications for reinforcement in footing</p> <p>6.7 Design of isolated square sloped footing: Flexural design with</p>



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		checks for one-way shear, two-way shear and bond. (Problems on design of footing for bending moment only in theory examination paper)

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Fundamental of steel structures	04	02	04	00	06
II	Design of Steel Connections	10	02	04	08	14
III	Analysis and Design of Singly Reinforced Sections	14	02	04	06	12
IV	Design of Shear Reinforcement and Bond	10	02	02	06	10
V	Design of Slabs	14	02	06	06	14
VI	Design of axially loaded short Columns and footing	12	02	06	06	14
Total		64	12	26	32	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

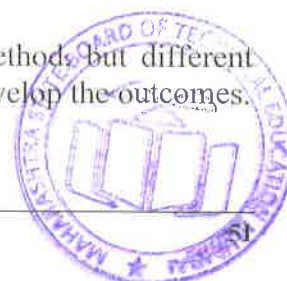
Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare journals based on practical performed in laboratory.
- Give seminar on relevant topic.
- Undertake micro-projects.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.



- c. About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- e. Guide student(s) in undertaking micro-projects.
- f. Demonstrate students thoroughly before they start doing the practice.
- g. Encourage students to refer different websites to have deeper understanding of the subject.
- h. Observe continuously and monitor the performance of students in Lab.
- i. Demonstrate students thoroughly before they start doing the practice.
- j. Encourage students to refer different websites to have deeper understanding of the subject.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty.

- a. Collect the information of various types of connections used in actual practice.
- b. Enlist various software used for the design of steel structures and give details of any one software.
- c. Enlist various software used for the design of RCC structures and give details of any one software.
- d. Procure actual working drawing / blue print of structural design and write report after checking actual reinforcement placed at site.
- e. Collect the details of various types of the formwork used for RCC structures at site.
- f. Collect the details of safety norms followed during RCC construction at site and write a report.
- g. Collect the details of safety norms followed during Steel construction at site and write a report
- h. Visit the site and study the labor management for any one activity related to RCC component and write a report.
- i. Visit the site and study the material management for any one activity related to RCC component and write a report.
- j. Visit the site and check the level for slab, plumb of column and depth of column as per blue print and write detailed procedure of any one.
- k. Identify the various human errors occurred while placing reinforcement and suggest remedial measures.
- l. Enlist the activities during removal of formwork and precautions to be taken.



- m. Enlist all the instruments used on site along with photograph and parallel terminology used by local mason/labour/worker.

13. SUGGESTED LEARNING RESOURCES :

S. No.	Title of Book	Author	Publication
1	Limit State Design of Steel Structures	Shah, V. L. Gore, Veena	Structures Publications, Pune ISBN-13: 1234567170961
2	Limit State Design of Steel Structures	Shiyekar, M. R.	PHI Learning, Delhi ISBN-13: 978-8120347847
3	Design of Steel Structures	Dayarathnam, P.	S. Chand and Company, Delhi. ISBN-13: 978-8121923200
4	Analysis and Design Practices of Steel Structures	Ghosh, Moy, Karuna	PHI Learning, Delhi. ISBN-13: 978-8120349377
5	Design of Steel Structures	Sairam, K.S.	Pearson Publication, Chennai, Delhi. ISBN-13:9332516308
6	Limit State Theory and Design of Reinforced Concrete Structures	Shah, V. L. Karve, S. R.	Structures Publications, Pune. ISBN-13: 9788190371711
7	Fundamentals of Reinforced Concrete	Sinha, N.C. Roy, S.K.	S. Chand & Co., New Delhi. ISBN-13: 978-8121901277
8	Reinforced Concrete Design Principles and Practice	Krishna Raju, N. Pranesh, R.N.	New Age International, Mumbai ISBN-13: 9788122414608
9	Reinforced concrete Design	Pillai, S.U. Menon, Devdas	McGraw Hill Publications, New Delhi, ISBN-13: 978-0070141100
10	Limit State Design of Reinforced Concrete	Varghese, P. C.	PHI Learning Private Limited, Delhi. ISBN-13: 978-8120320390
11	IS:800-2007 Indian Standard code of practice for use of structural steel in general building construction	BIS New Delhi	BIS New Delhi
12	IS:875-1987 Part-1 to 5: Indian Standard Code for Loading Standards	BIS New Delhi	BIS New Delhi
13	IS hand book No. 1 Properties of structural steel rolled section.	BIS New Delhi	BIS New Delhi
14	IS 456:2000 - Plain and Reinforced concrete code of Practice	BIS New Delhi	BIS New Delhi



S. No.	Title of Book	Author	Publication
15	SP16- Design Aids for reinforced concrete to IS 456	BIS New Delhi	BIS New Delhi
16	I.S. 875 (Part 1-5) - 1987 code of practice of design loads for Buildings and structures.	BIS New Delhi	BIS New Delhi
17	SP 24 - Explanatory Handbook on IS 456	BIS New Delhi	BIS New Delhi
18	SP34 : 1987 - Handbook on concrete reinforcement and Detailing.	BIS New Delhi	BIS New Delhi

Others:

- 1 Steel tables

14. SOFTWARE/LEARNING WEBSITES

- a. <https://www.youtube.com/watch?v=mtRR-5fzKo8>
- b. <https://www.youtube.com/watch?v=X8WhkG70tAc>
- c. <https://www.youtube.com/watch?v=zX8HNbHmToM>
- d. <https://www.youtube.com/watch?v=-JNMIMg-CE>
- e. freevideolectures.com › Civil Engineering › IIT Guwahati
- f. www.youtube.com/playlist?list=PLF5B83BDDDBB8FCBE3
- g. nptel.ac.in/noc/individual_course.php?id=noc17-ce21
- h. <http://freevideolectures.com/Course/2686/Design-of-Reinforced-Concrete-Structures>
- i. <https://www.youtube.com/watch?v=hVaB0jGcyB4>
- j. <https://www.youtube.com/watch?v=AfHmpWlcqq4>
- k. <https://www.youtube.com/watch?v=PDJPcQq3PZE>
- l. <https://www.youtube.com/watch?v=GgatFNtQrBo>
- m. <https://www.youtube.com/watch?v=A9JUGWhEW5A>
- n. freevideolectures.com › Civil Engineering › IIT Madras
- o. https://www.youtube.com/watch?v=zwtVO3-_iNQ
- p. <https://www.youtube.com/watch?v=wJWt0dcgafs>
- q. <https://www.youtube.com/watch?v=csK9eNk6S1c>
- r. au.autodesk.com/au-online/classes-on.../class...steel/msf11860





Program Name : Civil Engineering Program Group
Program Code : CE/CR/CS
Semester : Fifth
Course Title : Public Health Engineering
Course Code : 22504

1. RATIONALE

The Environment and Public Health Engineering works for minimizing the impact of Engineering and Technology on the natural resources. Rapidly increasing urbanization, is stretching resources and infrastructure, and threatening environmental quality. To maintain better public health one must have safe quality of drinking water supply, effective methods for disposal of domestic and industrial waste and pollution free environment. The detailed knowledge about various sources of water supply, quality parameters of public water purification and conveyance of water will be useful in planning suitable water supply scheme for town/city. Topics on domestic sewage, conveyance of sewage in sewers analysis and treatment of sewage will be useful for safe disposal of this waste. Emerging trends in sanitation and water supply will provide latest know to the students. Thus the subject will be helpful in bringing up general public health to desired safe level in respect of water supply and disposal of waste.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Execute the efficient water supply and sanitary system.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Identify the sources and characteristics of water and wastewater.
- Estimate the quantity of drinking water and wastewater generated.
- Draw labeled systems of plumbing for building sanitation.
- Draw the flow diagram for process of treatment of water and wastewater.
- Identify various accessories for efficient conveyance and distribution of water.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25#	10	25	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.



Legends: *L*-Lecture; *T* – Tutorial/Teacher Guided Theory Practice; *P* - Practical; *C* – Credit, *ESE* - End Semester Examination; *PA* - Progressive Assessment

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

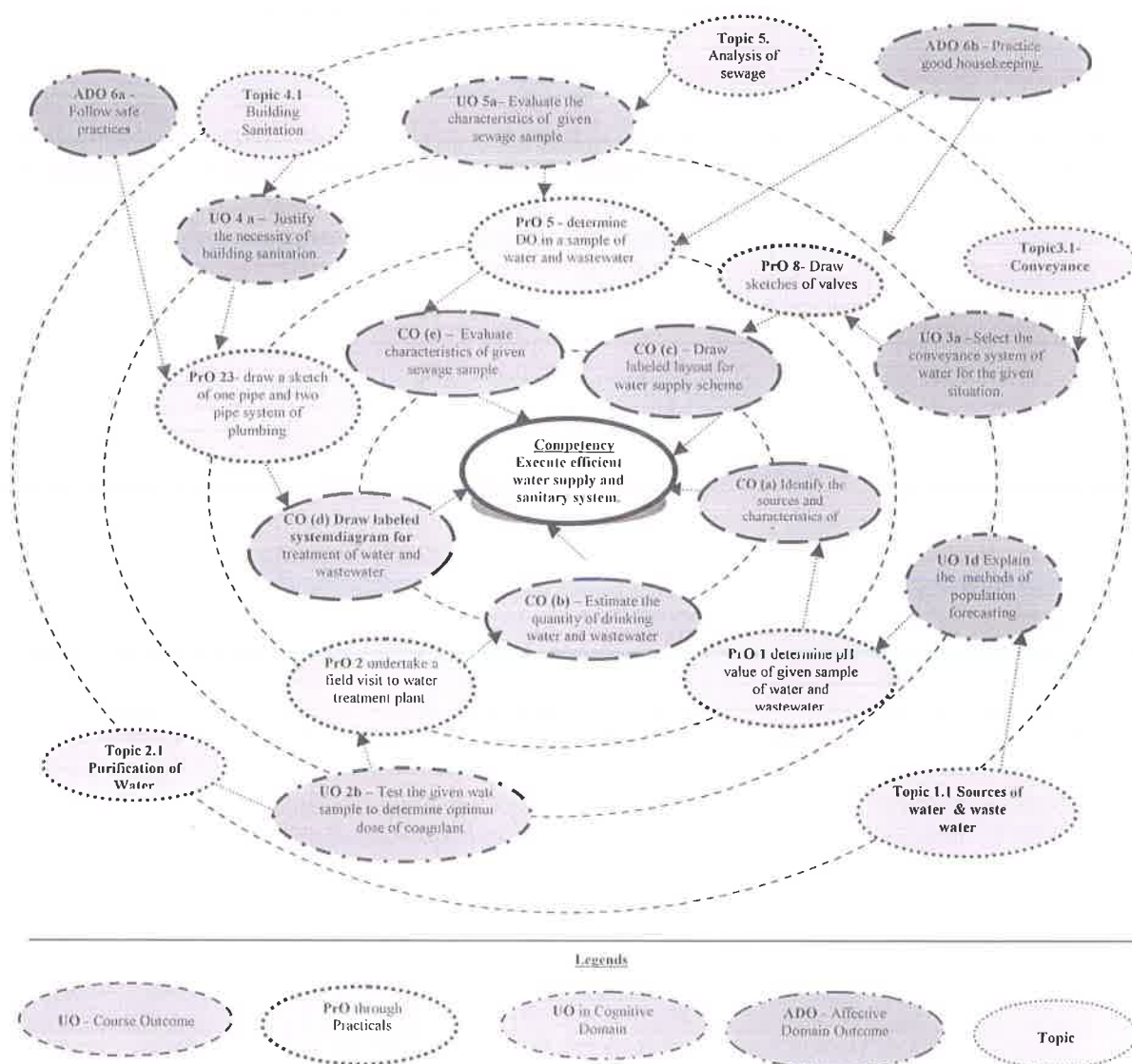


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency:

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Require
1	Determine pH value of given sample of water.	I	02*



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
2	Determine the turbidity of the given sample of water.	I	02*
3	Determine residual chlorine in a given sample of water.	I	02
4	Determine suspended solids dissolved solids and total solids of given sample of water.	I	02
5	Determine the dissolved oxygen in a sample of water.	I	02*
6	Undertake a field visit to water treatment plant.	II	02*
7	Determine the optimum dose of coagulant in the given raw water sample by jar test.	II	02*
8	Draw sketches of various valves used in water supply pipe line	III	02
9	Draw a sketch of one pipe and two pipe system of plumbing	IV	02
10	Determine B.O.D. of given sample of waste water.	V	02
11	Determine pH value of given sample of wastewater.	V	02*
12	Determine suspended solids dissolved solids and total solids of given sample of wastewater.	V	02
13	Determine the dissolved oxygen in the given sample of wastewater.	V	02*
14	Determine C.O.D. of given sample of waste water.	V	02
15	Prepare a report of a field visit to wastewater treatment plant	V	02*
16	Prepare a report of the field visit to bio gas /gobar gas plant in your locality	V	02
Total			32

Note

- A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
a.	Performance of practical in the laboratory / field visit	60
b.	Observation /data collection	10
c.	Results and conclusions	10
d.	Answer to sample questions	10
e.	Submit report in time	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipments.
- Follow ethical Practices.



The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organizing Level' in 2nd year
- 'Characterizing Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

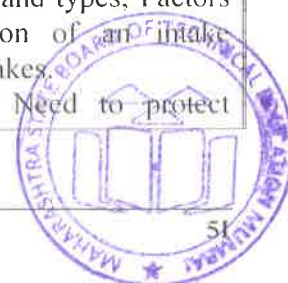
The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. S. No.
1.1	Digital pH meter (4 Digit Display (LED), 0 to 1000 mV, Resolution: 0.01 pH, Manual Temp, Compensation: 0 to 80°C.)	1, 11
1.2	Digital Turbidity Meter.(Range 0 to 200NTU, Resolution 1NTU, Accuracy: $\pm 3\%$ FS, ± 1 Digit, Display $3\frac{1}{2}$ Digit 7-Segment LED Light Source 6V, 0.3Amp Tungsten Lamp, Detector: Photodiode, Sample System: 30 mm Clear Glass Test Tubes, Power 230 V $\pm 10\%$ AC, 50 Hz, Accessories Test tube Set of 5, Operation Manual, Dust Cover	2
1.3	Orthotolodine test kit (free and total chlorine testing for EPA reporting over the range of 0-4 mg/L.)	3
1.4	Electric Oven with digital control (Temperature: 300°C., 25 kg capacity)	4, 12
1.5	Digital DO meter (Range: 0 to 20 ppm, Resolution : 0.1 ppm, Temperature compensation : 0 to 50 °C.)	5, 13
1.6	Jar Test Apparatus (Digital timer: 1 to 99 minutes, material: Stainless steel, Power: Electric supply, Range: 25 to 250 rpm, with 6 glass jars of 1000 mL)	7
1.7	BOD incubator with BOD bottles (Rated Voltage: AC 220V $\pm 10\%$ 50Hz, Power: 2800W, Temperature Controlling Mode: Digital Display, Temperature Controlling Point: 24°C, 93.5°C, Temperature Controlling Precision: $\pm 0.1^\circ\text{C}$)	10
1.8	Digital COD digester (Glassware: 15 Reaction Vessels & Air Condensers, Temperature: 150°C $\pm 1\%$, Capacity: 15 Samples at a time, Sample Size: 20 ml, Range: 0 to 500 ppm without dilution, Timer: 2 hours timer with Buzzer , Power Requirement: 230v 1000w	14

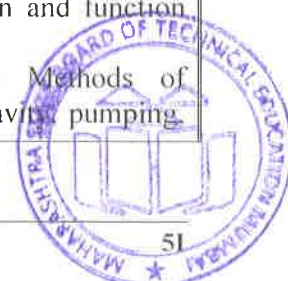
8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Sources, Quantity and Quality of water	1a. Describe various surface and sub surface sources of water in a given situation.	1.1 Sources of water: Surface and Subsurface sources of water, Intake Structures, Definition and types, Factors governing the location of an intake structure, Types of intakes.
	1b. Explain various types of intake structures for the given source of water.	1.2 Quantity of water: Need to protect



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	<p>1c. Draw flow diagram of water supply scheme in the given situation.</p> <p>1d. Explain the methods of forecasting population in the given situation.</p> <p>1e. Undertake physical, chemical and biological tests for the given sample of water.</p> <p>Draw a neat labelled sketch of cross section of "Rapid sand Gravity Filter"</p>	<p>water supplies, flow diagram of water supply scheme, function of units, Demands of water, Factors affecting rate of demand, Variations of water demands, Forecasting of population, Methods of forecasting of population, (Simple problems on forecasting of population), Design period, Estimating of quantity of water supply required for city or town.</p> <p>1.3 Quality of water: Need for analysis of water, Characteristics of water- Physical, Chemical and Biological, Testing of water for Total solids, hardness, chlorides, dissolved Oxygen, pH, Fluoride, Nitrogen and its compounds, Bacteriological tests, E coli, B coli index, MPN, Sampling of water, Water quality standards as per I.S.10500.</p>
UNIT II Purification of water	<p>2a. Explain the term, "Aeration of water" in the given situation.</p> <p>2b. Test the given water sample to determine the optimum dose of coagulant.</p> <p>2c. Describe the process of filtration of water in the given situation.</p> <p>2d. Differentiate between slow sand filter and rapid sand filter in the given situation.</p> <p>2e. Describe different methods of disinfection for the given water sample.</p> <p>2f. Explain advanced treatment methods for the water in the given situation.</p>	<p>2.1 Purification of Water: Screening-Types of screens, Aeration- objects and methods of aeration, Plain sedimentation, Sedimentation with coagulation, principles of coagulation, types of coagulants, Jar Test, process of coagulation, types of sedimentation tanks,</p> <p>2.2 Clariflocculator, Filtration-theory of filtration, classification of filters: slow sand filter, rapid sand filter, pressure filter, construction and working of slow sand filter and rapid sand filter. Disinfection: Objects, methods of disinfection, Chlorination- Application of chlorine, forms of chlorination, types of chlorination practices, residual chlorine and its importance, orthotolidine test, Flow diagram of water treatment plants.</p> <p>2.3 Miscellaneous water Treatments: Water softening, Defluoridation techniques.</p> <p>2.4 Advanced Water Treatments: Electrolysis, Reverse Osmosis.</p>
UNIT III Conveyance and Distribution of water	<p>3a. Select the conveyance system of water for the given area.</p> <p>3b. Select the relevant type of valve for the given pipeline of water supply.</p> <p>3c. Explain the methods of</p>	<p>3.1 Conveyance: Types of Pipes used for conveyance of water, choice of pipe material, Types of joints & Types of valves- their use, location and function on a pipeline.</p> <p>3.2 Distribution of water: Methods of distribution of water- Gravity, pumping.</p>



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	<p>distribution of water in the given situation.</p> <p>3d Use the relevant method for the distribution of water in the given area.</p> <p>3c Draw the layout of water distribution system in the given situation.</p>	<p>and combined system, Service reservoirs - functions and types , Layouts of distribution of water-Dead end system, grid iron system, circular system, radial system ; their suitability, advantages and disadvantages.</p>
UNIT IV Domestic sewage and System of Sewerages	<p>4a. Justify the necessity of Sanitation for the given Building.</p> <p>4b. Describe the various types of traps for the given situation with sketches.</p> <p>4c. Describe relevant system of plumbing in the given situation.</p> <p>4d. Draw layout plan of drainage system for the given building.</p> <p>4e. Describe the testing procedure for the given sewers.</p> <p>4f. Explain the necessity of manhole and drop manhole in the given sewerage system.</p>	<p>4.1 Building Sanitation: Necessity of sanitation, Necessity to treat domestic sewage, Definitions - Sewage, sullage, types of sewage, Definitions of the terms related to Building Sanitation- Water pipe, Rain water pipe, Soil pipe, Sullage pipe, Vent pipe, Building Sanitary fittings-Water closet – Indian and European type, flushing cistern, wash basin, sinks, Urinals.Traps- types, qualities of good trap, Systems of plumbing - one pipe, two pipe, single stack, choice of system Principles regarding design of building drainage, layout plan for building sanitary fittings (drainage plan),inspection and junction chambers, their necessity, location, size and shape, Maintenance of sanitary units.</p> <p>4.2 Systems of Sewerage and Sewer Appurtenances: Types of Sewers, Systems of sewerage, Design of sewers, self cleansing velocity and non scouring velocity, Laying, Testing and maintenance of sewers, Manholes and Drop Manhole-component parts, location, spacing, construction details, Sewer Inlets, Street Inlets.</p>
UNIT V Characteristics and treatment of Sewage	<p>5a. Evaluate the characteristics of given sewage sample.</p> <p>5b. Explain the terms, “BOD and COD” for the given sample of sewage.</p> <p>5c. Examine the quality of treated sewage as per given norms of MPCB.</p> <p>5d. Draw flow diagram for sewage treatment plant for the given data.</p> <p>5e. Select the relevant method of treatment of sewage in</p>	<p>5.1 Analysis of sewage: Characteristics of sewage, B.O.D., C.O.D. and its significance. Aerobic and anaerobic process, Maharashtra Pollution Control Board Norms for the discharge of treated sewage, Objects of sewage treatment and its flow diagram.</p> <p>5.2 Treatment of Sewage: Screening, Grit removal, Skimming, Sedimentation of sewage, Sludge digestion, Trickling filters, Activated sludge process, Disposal of sewage, Oxidation pond, Oxidation ditch, Septic tank (details and</p>



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	the given situation.	design criteria), Recycling and Reuse of domestic waste.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Sources, Quantity and Quality of water	08	04	08	-	12
II	Purification of water	12	04	06	08	18
III	Conveyance and Distribution of water	06	02	04	04	10
IV	Domestic sewage and System of Sewerages	12	02	04	12	18
V	Characteristics and Treatment of Sewage	10	02	04	06	12
Total		48	14	26	30	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare journals based on practical performed in laboratory.
- Give seminar on relevant topic.
- Undertake micro-projects.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).



- d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- e. Guide student(s) in undertaking micro-projects.
- f. Demonstrate students thoroughly before they start doing the practice.
- g. Encourage students to refer different websites to have deeper understanding of the subject.
- h. Observe continuously and monitor the performance of students in Lab.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

- a. Test the water sample from locally available area to determine its characteristics..
- b. Test the waste water sample from locally available area to determine its characteristics
- c. Suggest the remedial measures for the control of pollution of local water source by conduct relevant study and tests.
- d. Visit the site where Utilization and recycling of treated wastewater is being implemented and prepare a detail report on it.
- e. Undertake the Impact study of vehicular pollution on environment.
- f. Undertake a comparative study of Solar water heater project and conventional water heater project for residential building.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Environmental Engineering Vol. I and Vol. II	Garg, S.K.	Khanna Publishers, New Delhi, 2017, ISBN-10: 8174091203; ISBN-13: 978-8174091208 ...
2	Water Supply and Sanitary Engineering	Birdie, G. S. Birdie, J. S.	Dhanpat Rai and Sons, 2011 ISBN: 81874337954,
3	Environmental Pollution Control Engineering	Rao, C.S.	New Age International Pvt Ltd Publishers . 2006, ISBN-13: 978-8122418354
4	Environmental Engineering	Tchobanoglous , George	Mcgraw Hill Publishers, 2013, ISBN 9789351340263

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

- a. www.cpheeo.nic.in



- b. www.mpcb.gov.in.
- c. <http://nptel.ac.in/courses/105106119/>
- d. <http://nptel.ac.in/courses/105104102/>
- e. <http://nptel.ac.in/courses/105106119/33>
- f. www.cpcb.nic.in
- g. <https://mjp.maharashtra.gov.in/>
- h. <https://ocw.mit.edu/courses/civil-and-environmental-engineering/1-85-water-and-wastewater-treatment-engineering-spring-2006/lecture-notes/>
- i. <http://www.nitttrchd.ac.in/sitenew1/nctel/civil.php>
- j. [www.IS 10500\(2012\): Drinking Water](http://www.IS10500(2012).in).
- k. [www.Eldo_PPT-IndianStandards_WWT%20\(1\).pdf](http://www.Eldo_PPT-IndianStandards_WWT%20(1).pdf)





Program Name : Civil Engineering Program Group
Program Code : CE/CR/CS
Semester : Fifth
Course Title : Rural Development (Elective)
Course Code : 22505

1. RATIONALE

Rural development is the process of improving the quality of life and economic well being of people living in rural areas. Rural industrialization in the form of Cottage and Agro-based industries is vital for rural development. The content of this subject includes watershed management, cottage and agro-based industries, rural infrastructure development and study of various government schemes, etc. This will help the student to apply scientific knowledge in the process of sustainable development of villages through optimum utilization of both natural/man-made resources. This course has been designed so that the diploma civil engineer is able to use his knowledge for development of rural areas to make the villages a better place to live in.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Apply the principles of planning in rural development.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Undertake surveys to decide the status of socio-economic significance.
- Identify the need of watershed management in rural areas.
- Suggest relevant government schemes for construction of roads, housing and energy conservation.
- Suggest the relevant cottage and agro based industries for the rural areas.
- Select the relevant schemes of Central/State Government for the rural areas.
- Apply the principles of rural development in rural areas.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20

(*): Under the theory PA; Out of 30 marks, 10 marks of theory PA are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; ESE - End Semester Examination; PA - Progressive Assessment.



5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

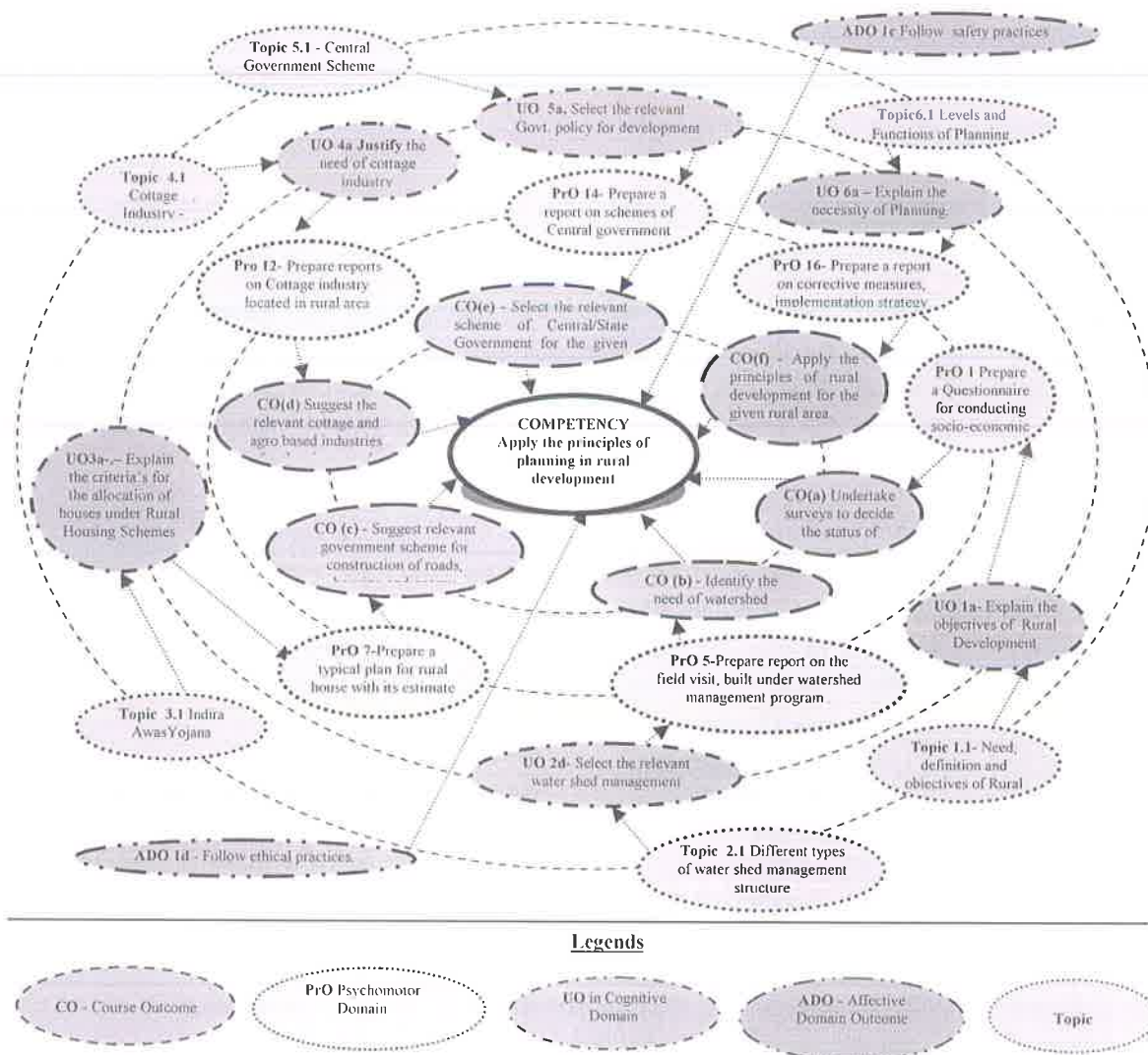


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S.No	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Prepare a Questionnaire for conducting socio-economic survey	I	02*
2	Undertake Socio-economic survey of a small nearby village-Part-I	I	02*
3	Undertake Socio-economic survey of a small nearby village-Part-II	I	02*
4	Analyze the data and prepare a report based on socio-economic survey which includes the list of available natural resources.	I	02*



S.No	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
5	Prepare the report on youth and woman empowerment on the basis of socio-economic survey and suggest a suitable solution with regard to education, training and employment.	I	02
6	Prepare the report on the field visit to the any one structure (K. T. weir, Gabian Structure, Cement Plug,) built under watershed management program.	II	02*
7	Prepare the report on the field visit to the any one structure (Contour Bunding, Farm pond, Underground Bandhara) built under watershed management program.	II	02*
8	Prepare the report on the field visit to the nearby Drip/Sprinkler /Lift Irrigation System with neat labeled sketch/layout along with the details of calculations for capacity, head, discharge and power for pump and pressure calculations for pipe.	II	02*
9	Prepare the typical plan for rural housing for, considering low cost housing/local material for construction.	III	02*
10	Prepare the estimate for the rural house having typical plan as mentioned in above practical no 7	III	02*
11	Suggest a typical cross section for the proposed new village road with justification and detailed note on its construction procedure with required specifications recommended by IRC.	III	02
12	Prepare the report of your recommendations of various schemes of State government regarding village development required to be implemented on the basis of socio-economic survey.	III	02*
13	Prepare the report, including your comments, on construction and working of Gobar gas/ Biogas plant with subsidies available, if any after undertaking the visit to the plant.	III	02
14	Prepare the report, including your comments, on construction and working of solar power panel with subsidies available, if any after undertaking the visit to the site.	III	02
15	Prepare a report on Cottage industry located in nearby rural area (Report should consist of raw material required, process, equipments required and area required) with layout and location plan for it.(on the basis of suitability and scope of that particular village)	IV	02*
16	Prepare a report on schemes of Central Government regarding village development, that are required to be implemented on the basis of socio-economic survey	V	02*
	Total		32

Note

- A suggestive list of **PrOs** is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO of the laboratory/workshop/field work is to be assessed according to a suggested sample given below:



S. No.	Performance Indicators	Weightage in %
a.	Collection and Analysis of data	40
b.	Preparation of report /drawing	30
c.	Interpretation of result and conclusion	10
d.	Answer sample questions	10
e.	Submission of report in time	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year and
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. S. No.
1	NIL	

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs in cognitive domain for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Overview of Rural Development :	1a. Suggest Modifications and improvements required for the development of the given rural area. 1b. Describe the social, economic and political significance of rural development for the given area. 1c. Describe the role of CAPART (Council for advancement of people's action and rural technology) in the development of	1.1 Rural Development :Need, definition, objectives. • Rural development as a phenomenon • Rural development as a strategy 1.2 Significance Of Rural Development • Social significance- Rural problems, social change, resource utilization, infrastructure etc



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	<p>the given type of rural area.</p> <p>1d. Describe the procedure for Socio-Economic survey for the given village.</p> <p>1e. Explain the Role of Civil Engineer in the development of given rural area.</p>	<ul style="list-style-type: none"> Economic significance-- National income, employment, food and fodder, industrial development, internal trade and transport, capital formation, etc. political significance- Political stability, <p>1.3 Rural Development Environment</p> <ul style="list-style-type: none"> Panchayat raj institution CAPART (Council for advancement of people's action and rural technology)- Organizational set up, purposes, objectives, activities. <p>1.4 Socio-Economic survey</p> <p>1.5 Role of Civil Engineer in Rural Development.</p>
Unit– II Water Resource Management and Sanitation	<p>2a. Select the relevant Water shed management structure in the given site condition.</p> <p>2b. Describe the procedure of the construction of farm Pond in the given site condition.</p> <p>2c. Explain the advantages and Disadvantages of Water shed management Structure for the given site condition.</p> <p>2d. Calculate the rain water harvesting potential for the given area.</p> <p>2e. Use the relevant method of Rainwater Harvesting suiting to the given site condition.</p> <p>2f. Draw the Layout of given type of irrigation system(s) showing its component parts for the given site condition.</p> <p>2g. Select the Irrigation System relevant to the given site condition.</p>	<p>2.1 Water shed management Structure (K. T. weir, Gabian Structure, Cement Plug, Contour Bunding, Farm pond, Underground Bandhara.): Uses ,Importance, Advantages and Disadvantages</p> <p>2.2 Rain Water Harvesting and Recharging of sources</p> <p>2.3 Irrigation System- purpose and Type</p> <p>2.4 Layout and component parts of Drip Irrigation, Sprinkler Irrigation and lift Irrigation</p> <p>2.5 Design parameter for laying Drip, Sprinkler and Lift Irrigation System</p> <p>2.6 Rural Water Supply – Sources, Low cost technique of treatment, Protection of Bore hole.</p> <p>2.7 Rural Sanitation- Low cost W.C., Readymade Toilet, Soak Pit , techniques for constructing W. C. requiring less quantity of water.</p>
Unit III- Rural Roads, Housing and Energy	<p>3a Explain the criteria's for the allocation of house under Rural Housing Schemes for the given location.</p> <p>3b Describe the credit-cum-Subsidy scheme for rural housing for the given locality.</p> <p>3c Apply the principles of Rural</p>	<p>3.1 Indira Awas Yojana – Salient features, beneficiary people, Conversion of Unserviceable Houses into Pucca/Semi-Pucca houses.</p> <p>3.2 Credit-cum- Subsidy scheme of rural housing- Salient features, share of Central and State</p>



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	<p>Housing in Habitat Development in the given rural area.</p> <p>3d Summarize the salient features of Pradhan Mantri Gram Sadak Yojna of Govt.of India.</p> <p>3e Set up Rural Building Center for the given purpose in the given situation.</p> <p>3f Calculate the minimum amount of energy, required to cater the need for domestic cooking, heating and lighting in the given rural area.</p> <p>3g Identify the sources of renewable energy for the given site conditions.</p>	<p>Government,</p> <p>3.3 Rural Building Centers-Purpose, technology transfer, skill development, training, eco-friendly materials</p> <p>3.4 Pradhan Mantri Gram Sadak Yojna(PMGSY)- Key elements, concept of rural road connectivity.</p> <p>3.5 Low Cost Housing- Principles, purposes, use of Local Material for construction</p> <p>3.6 Rural Roads- Type, Specifications, Construction Techniques and Road Drainage</p> <p>3.7 Bio mass – Types of fuel such as Firewood, agricultural residues, dung cakes</p> <p>3.8 Renewable energy and Integrated Rural Energy Programme – Objectives, key elements, implementation, financial provisions, sources of renewable energy</p> <p>3.9 Working of Gobar gas and Biogas plant, National project on biogas development-technology, performance and implementation, financial assistance, involvement of Panchayat and local bodies.</p>
Unit-IV Rural Industry and Finance	<p>4a. Justify the need of cottage industry for the rural people in the given rural area.</p> <p>4b. Classify the cottage industry on the basis of given criteria for the given rural area.</p> <p>4c. Classify the agro based industry based on the given criteria.</p> <p>4d. Suggest the criteria with justification for setting the agro based industry for the given rural area.</p> <p>4e. Identify the sources of funds for the development of the given rural area.</p>	<p>4.1 Cottage Industry- Brick Manufacturing, Concrete hollow Block, Artificial Sandstone crushing plant.</p> <p>4.2 Agro based Industry- Dairy, Animal Husbandry, Horticulture, Sericulture, and Fishery</p> <p>4.3 sources of funds for rural development</p> <ul style="list-style-type: none"> Domestic (institutional and non –institutional) foreign institutional and non – institutional)
Unit –V Government Policies Pertaining to	<p>5a. Select the relevant Government policy for the development of the given rural area.</p> <p>5b. Compare the different Government</p>	<p>5.1 Central & State Government Schemes</p> <p>5.1..1 Prime Minister Rural</p> <p>5.1..2 Development Fellows Scheme</p>

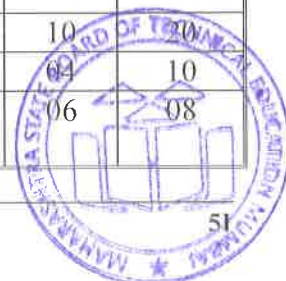


Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Rural Development	<p>schemes of Rural development available for the given area.</p> <p>5c. Explain the salient feature of National Rural Employment Guarantee Act, 2005 for the development of given rural area.</p> <p>5d. Describe the procedure mentioned in Prime Minister Rural Development Fellows Scheme for the given rural area.</p> <p>5e. Execute the Deen Dayal Upadhyaya Grameen Kaushalya Yojana for the development of the given rural area.</p>	<p>5.1.3 National Rural Employment</p> <p>5.1.4 Guarantee Act, 2005, NREGA</p> <p>5.1.5 Swarnjayanti Gram Swarozgar Yojana (SGSY).</p> <p>5.1.6 The Sampurna Grameen Rozgar Yojna.</p> <p>5.1.7 Deen Dayal Upadhyaya</p> <p>5.1.8 Grameen Kaushalya Yojana.</p>
Unit – VI Planning for Rural Development	<p>6a. Justify the necessity of planning for the development of the given rural area.</p> <p>6b. Execute the relevant plan at the specified level of the given rural area.</p> <p>6c. Describe the functions of planning at micro, meso and macro levels for the given rural area..</p> <p>6d. Describe the process of micro level planning w.r.t.agriculture.</p> <p>6e. Describe the methodology used for executing the block and district level planning for the given rural area.</p> <p>6f. Identify the components of an ideal development project for the given rural area.</p>	<p>6.1 Plan and planning for rural development.</p> <p>6.2 Levels and Functions of Planning.</p> <p>6.3.1 Micro-level Planning</p> <p>6.3.2 meso-level Planning</p> <p>6.3.3 macro-level Planning</p> <p>6.3 Decentralization policy of Planning.</p> <p>6.4 Block and District Level Planning.</p>

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Overview of Rural Development	04	02	04	-	06
2	Water Resource Management and Sanitation	10	02	04	10	16
3	Rural Roads, Housing and Energy	12	02	08	10	20
4	Rural Industry and Finance	08	02	04	04	10
5	Government Policies Pertaining to Rural Development	06	02	-	06	08



Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
6	Planning for Rural Development	08	-	04	06	10
Total		48	10	24	36	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare journals based on practical performed in laboratory.
- Give seminar on relevant topic.
- Undertake micro-projects.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

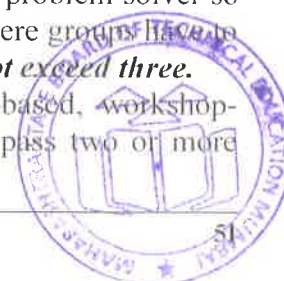
These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Guide student(s) in undertaking micro-projects.
- Demonstrate students thoroughly before they start doing the practice.
- Encourage students to refer different websites to have deeper understanding of the subject.
- Observe continuously and monitor the performance of students in class and Lab.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more



COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

- Prepare a report on implementation of Prime Minister Rural Development Fellows Scheme for the nearby Village after undertaking the visit to that village.
- Collect the detailed information on Pradhan Mantri Gram Sadak Yojana (PMGSY) that has been executed successfully for the given rural area and present the same in the form of the report.
- Summarize the salient features of the National Rural Employment Guarantee Act, 2005 (NREGA) that has been executed successfully for the given rural area and present the same in the form of the report.
- Prepare the report on the executed scheme under the banner of “Swarnjayanti Gram Swarozgar Yojana (SGSY)” to assist the poor families living below the poverty line in the given rural areas for taking up self employment.
- Prepare the report on the executed scheme under the banner of, “The Sampoorna Grameen Rozgar Yojna” to provide additional wage employment in the given rural areas with its impact on food security, improvement in nutritional levels.
- Analyze the E-Book released by the Ministry of Rural Development downloaded through internet with special reference to its initiatives and achievements.
- Collect the information of, “Deen Dayal Upadhyaya Grameen Kaushalya Yojana” and prepare a report on it with reference to the nearby village or rural settlement.
- Visit to - Ralegan Siddhi, Hiware Bazar, Chitrakut, Vanrai and prepare a report on it.

13. SUGGESTED LEARNING RESOURCES :

S. No.	Title of Book	Author	Publication
1	Rural Development in India: Past, Present and Future : a Challenge in the Crisis	Desai,Vasant	Himalaya Publishing House, Delhi ISBN 8183181929 ISBN 9788183181921
2	Rural Development Strategy	Rastogi , A.K.	Wide Vision, Jaipur ISBN -81-8068-000-2
3	Rural Development Principles, Policies and Management	Singh, Katar	Sage Publications India Pvt Ltd ISBN- 978-81-7829-926-6 (PB)
4	Dynamics Of Rural Development	Gaur, Keshav Dev	Mittal Publications, 1992, Delhi ISBN:81-7099-396-2 ISBN-13:978-8170993964
5	Document Published by Ministry of Rural development	Govt. of India	Ministry of Rural development,

14. SOFTWARE/LEARNING WEBSITES

- <http://rural.nic.in/>
- <http://www.panchayat.gov.in/>
- <https://www.india.gov.in/topics/rural>





Program Name : Civil Engineering Program Group**Program Code : CE/CR/CS****Semester : Fifth****Course Title : Energy Conservation and Green Building (Elective)****Course Code : 22506****1. RATIONALE**

Today's homebuyers are increasingly interested in green building as it improve the way homes use energy, water, and materials, to reduce negative impacts on human health and the overall environment-both during construction and over its lifetime. Building heating and cooling are the most energy-intensive activities, followed by electricity use for lighting and appliances. Rising standards of living result in more energy services required for heating, cooling, lighting and communicating. Energy being in limited quantum as on date is a very scarce resource nowadays and need to be used optimally. Higher levels of energy efficiency reduce carbon emissions from the home's own energy systems. Therefore, it becomes necessary to be energy-conscious and make every effort for the conservation of energy. The environmental management and audit is necessary to study the impact of various industries on natural resources. Green building use the resources optimally, reduce waste and reduce the cost of life cycle and provide healthy indoor environment for its occupants through restoring/improving the natural environment. Therefore this course will enable the students to face these challenges of today's era in most effective way to build the structures as green one to improve the quality of environment significantly.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Implement concept of energy conservation in construction practises.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences, and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above-mentioned competency:

- Identify various sources of environmental pollution.
- Implement the different steps in environmental impact assessment.
- Relate the construction of green building with the prevailing energy conservation policy and regulations.
- Construct the building using the principles of Green building and the relevant materials.
- Select the relevant rating system for assessment of given Green building

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20



(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

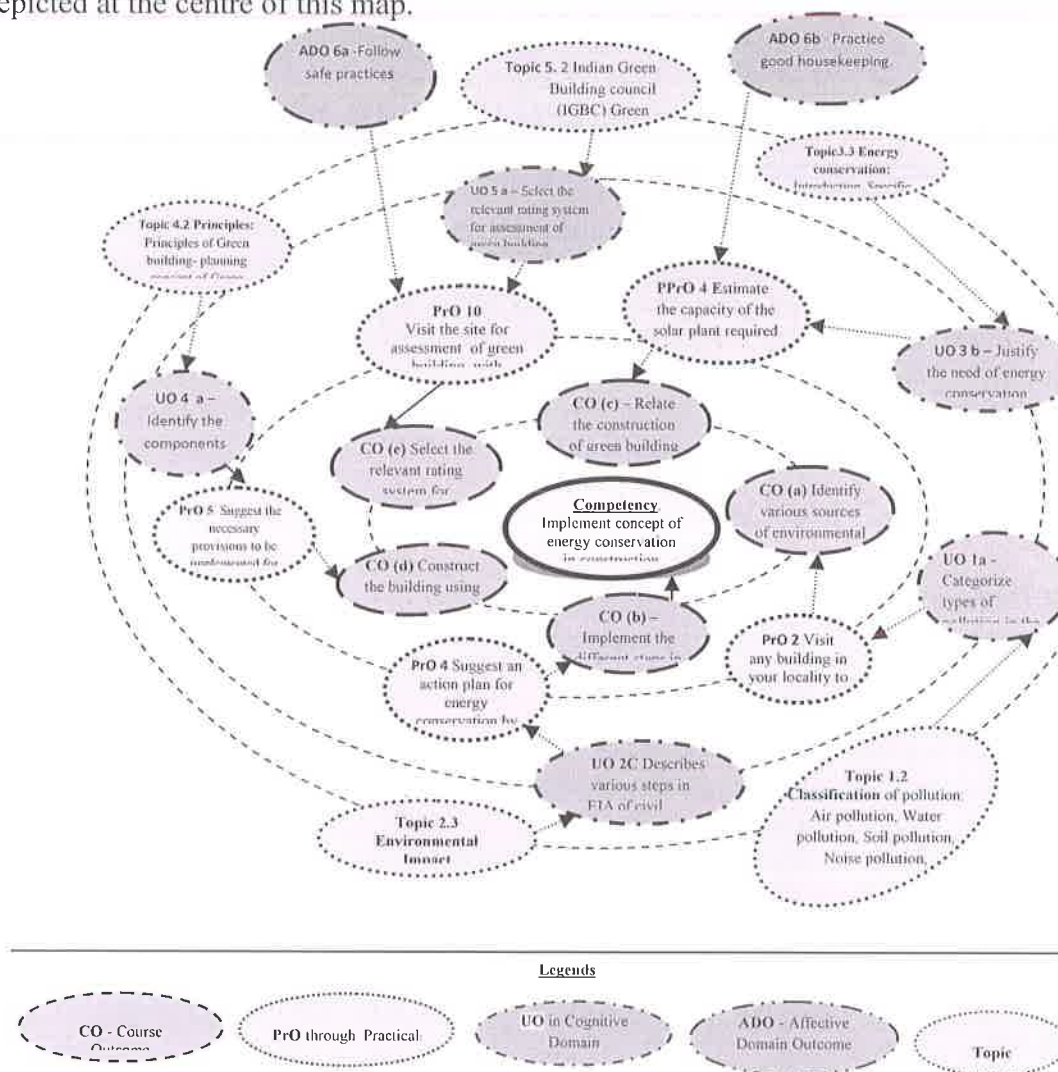


Figure 1 - Course Map

6. SUGGESTED PRACTICALS / EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Prepare a report on noise levels in various area of your city by	1	02*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
	collecting the relevant data from the concern department with your comments.		
2	Visit any building in your locality to identify the relevant legal provisions followed for control of pollution and submit your observations-cum-findings in the form of a report.	I	02*
3	Inspect your institute building and submit an action plan for improving the indoor and outdoor environmental quality	II	02*
4	Estimate the capacity of the solar plant required for your institute building on the basis of the total electricity consumption data available from concern department.	II	02*
5	Identify the impact of number of trees , green belt on the energy level of the building. (By physical verification)	III	02*
6	Prepare an action plan for energy conservation by inspecting an existing structure to explore its potential in it.	III	02*
7	Conduct the energy audit of your institute building using any rating system.	III	02
8	Visit to the nearby wind mill and prepare a report on your observations w.r.t. generation of energy with relevant sketches wherever required.	III	02
9	Visit to the nearby Hydroelectric power plant and prepare a report on your observations w.r.t. generation of energy with relevant sketches wherever required.	III	02
10	Visit to the nearby solar energy plant and prepare a report on your observations w.r.t. generation of energy with relevant sketches wherever required.	III	02*
11	Inspect any conventional building in your area to suggest the action plan for converting it into green building with necessary legal provisions to be followed.	IV	02*
12	Visit the site of green building to identify the components of HVAC unit with space calculation and submit the visit report.	IV	02
13	Visit the site for assessment of green building with relevant rating system and submit your findings in the form of a report. (Part 1)	V	02*
14	Visit the site for assessment of green building with relevant rating system and submit your findings in the form of a report. (Part 2)	V	02*
15	Visit the site for assessment of green building with relevant rating system and submit your findings in the form of a report. (Part 3)	V	02*
16	Visit a site for suggesting necessary modifications required for improving green rating and energy conservation in the given building in Local area	V	02*
	Total		32

Note

i. A suggestive list of **PrOs** is given in the above table. More such **PrOs** can be added to attain the **COs** and competency. A judicious mix of minimum 12 or more practical



LOs/tutorials need to be performed, out of which, the practicals marked as '' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.*

ii. Hence, the 'Process' and 'Product' related skills associated with each PrO of the laboratory/workshop/field work are to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
a.	Preparation of experimental set up	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical Practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. S. No.
1	All practicals are based on Field visits, survey, and report writing. No specific equipments are required.	

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
------	--	-----------------------

Unit – I Environmental Pollution	1a.Categorize types of pollution in the given situation. 1b.Explain the term, “air pollution” in the given context. 1c.Justify the need to control environmental pollution of the given area. 1d.Describe the relevant process of reducing noise pollution in the given situation. 1e.Use the different legal provisions pertaining to environmental and pollution in the given situation.	1.1 Introduction: Definition of Environment and environmental pollution, Ecology, control of environmental pollution. 1.2 Classification of pollution: Air pollution, Water pollution, Soil pollution, Noise pollution, Environmental laws for controlling pollution.
Unit – II Environmental Audit and Environmental Impact Assessment (EIA)	2a.Justify the necessity of Environmental audit for the given purposes. 2b.Set the norms for Environmental audit of the given building. 2c.Describes various steps in EIA of the given civil engineering projects. 2d.Relate the findings of EIAfor reducing the Pollution in the given situation.	2.1 Environmental Audit : Meaning, Necessity, Norms 2.2 Types: Objective-based types: Liabilities audit, Management audit, Activities audit Client-driven types: Regulatory external audit, Independent external audit, Internal environmental audit, Third party audit 2.3 Environmental Impact Assessment(EIA): Introduction, EIA regulations, Steps in environmental impact assessment process, Benefits of EIA, Limitations of EIA, Environmental clearance for the civil engineering projects.
Unit– III Energy and Energy conservation	3a.Use the given source of renewable and Non-renewable energy for energy conservation. 3b.Justify the need of energy conservation in the given civil project. 3c.Describe present practices adopted in energy conservation in the country. 3d.Justify the role of MEDA in energy conservation in the given city/town. 3e. Implement the relevant provisions of Energy conservation act 2001 for the purpose of energy conservation in the given project.	3.1 Renewable Energy Resources : Solar Energy, wind Energy, Ocean Energy, Hydro Energy, Biomass Energy 3.2 Non-renewable Energy Resources: Coal, Petroleum, Natural Gas, Nuclear Energy, Chemical Sources of Energy, Fuel Cells, Hydrogen, Biofuels 3.3 Energy conservation: Introduction, Specific objectives, present scenario, Need of energy conservation, LEED India Rating System and Energy Efficiency. 3.4 Functions of Government organization working for Energy conservation and Audit(ECA)- •National Productivity council(NPC) •Ministry of New and Renewable Energy (MNRE)



		<ul style="list-style-type: none"> • Bureau of Energy efficiency (BEE) • Maharashtra Energy Development Agency (MEDA) 3.5 Salient features of Energy Conservation Act – 2001
Unit– IV Green Building	4a. Identify the components of the given green building. 4b. Explain the principles of green building used in the given building. 4c. Improve the quality of environment in the given civil structure. 4d. Suggest the strategies for design of the given building to have green building construction. 4e. Identify the relevant Materials required for the given building to have green building construction.	4.1 Introduction: Definition of Green building, Benefits of Green building, 4.2 Principles: Principles of Green building- planning concept of Green Building 4.3 Features: Salient features of Green Building, Environmental design (ED) strategies for building construction 4.4 Process: Improvement in environmental quality in civil structure 4.5 Materials: Green building materials and products- Bamboo, Rice husk ash concrete, plastic bricks, Bagasse particle board, Insulated concrete forms. reuse of waste material-Plastic, rubber, Newspaper wood, Non toxic paint, Green roofing,
Unit– V Rating System for Green Building	5a. Select the relevant rating system for assessment of given green building 5b. Compare the different rating systems such as GRIHA, IGBC, EDGE, BEE adopted in the country. 5c. Explain salient provisions used in IGBC green rating system for the given building. 5d. Explain the role of HVAC unit in the given type of green building.	5.1 Leadership in Energy and Environmental Design (LEED) criteria, 5.2 Indian Green Building council (IGBC) Green rating, 5.3 Green Rating for Integrated Habitat Assessment. (GRIHA) criteria, 5.4 HVAC unit in green Building

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

9.SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Environmental Pollution	4	--	4	4	08
II	Environmental Audit and Environmental Impact Assessment	8	2	4	6	12

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
	(EIA)					
III	Energy and Energy conservation	10	4	6	6	16
IV	Green Building	14	2	8	6	16
V	Rating System for Green Building	12	2	4	12	18
Total		48	10	26	34	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Identify renewable and non renewable energy sources
- Identify the sources of pollution in your area
- Visit to construction site to identify energy resources
- Make a model of solar energy plant.
- Search software/freeware for the course content and write the report stating their applications.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Guide student(s) in undertaking micro-projects.
- Procure various materials required for practical exercises.
- Arrange visit to nearby industries and workshops for understanding various construction materials.
- Use video/animation films to explain various processes like Manufacturing of construction materials, concrete mixing, and base preparation for painting, mortar laying, carpentry work, false ceiling.
- Use different instructional strategies in classroom teaching.



- j. Demonstrate different samples of various construction materials like Stone, aggregate of different sizes, timber, lime, bitumen, Bricks, tiles, precast concrete products, Water proofing material, Termite proofing material, Thermal insulating material, plaster of Paris, paints, distemper, and varnishes.
- k. Display various technical brochures of recent building materials.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

- a. Prepare a report by taking case study to classify the terms and the construction methodologies between Traditional building and Green building.
- b. Collect the relevant information of recent technologies in green building construction and prepare a report on it.
- c. Make a model of hydroelectric power plant and prepare a report.
- d. Prepare a questionnaires for environmental audit
- e. Prepare questionnaires for assessment of environmental impact

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	Sustainable construction: Green Building design and Delivery.	Kibert, C.J.	John Wiley Hoboken, New Jersey, Nov. 2007, ISBN: 978-0-470-11421-6.
2.	Non conventional Energy Resources–	Chauhan, D S Sreevasthava, S K	New Age International Publishers, New Delhi 2014 ISBN13 : 9788122433999
3.	Alternative Building Materials and Technologies –	Jagadeesh, K S, Reddy Venkatta Rama Nanjunda Rao, K S	New Age International Publishers, Delhi, 2008 ISBN 8122420370, 9788122420371
4.	Handbook of Green Building Design and Construction	Sam Kubba	Butterworth-Heinemann, 2012 eBook ISBN: 9780123851291



14. SUGGESTED SOFTWARE/LEARNING WEBSITES

- a. www.moef.nic.in/environmental_clearancegeneral<http://www.sustainable.doe.gov>
- b. <https://www.mahaurja.com/>
- c. <https://mnre.gov.in/>
- d. https://www.mahaurja.com/meda/energy_conservation/energy_conservation_program
- e. <http://web.ccsu.edu/faculty/kyem/GEOG473/10TheWeek/IMPACT%20ASSESSMENT.htm>



Program Name : Civil Engineering Program Group
Program Code : CE/CR/CS
Semester : Fifth
Course Title : Traffic Engineering (Elective)
Course Code : 22507

1. RATIONALE

Traffic engineering is an important aspect of all modes of transportation. Due to the abundant growth in population and infrastructure development, there is urgent need to pay the immediate attention to the certain issues like designing traffic control device installations and modifications, including traffic signals, signs, and pavement markings. Also it is important for safety of vehicle users as well as pedestrians. This course is expected to develop knowledge of performing various traffic surveys, analyze and interpret the data and provide the solutions in the form of traffic controlling devices. The civil engineering diploma holders have to do the related construction and maintenance activities of the structures made for guiding the traffic.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Execute the working and control of traffic engineering elements.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Analyze the road traffic characteristics.
- Undertake various types of road traffic studies.
- Use the relevant road traffic signs and markings.
- Select the relevant road signals for the given traffic islands
- Maintain the road environment.
- Suggest preventive measures to avoid accidents by analyzing the traffic conditions at site.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20

(*): Under the theory PA; Out of 30 marks, 10 marks of theory PA are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.



Legends: *L*-Lecture; *T* – Tutorial/Teacher Guided Theory Practice; *P* - Practical; *C* – Credit, *ESE* - End Semester Examination; *PA* - Progressive Assessment.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

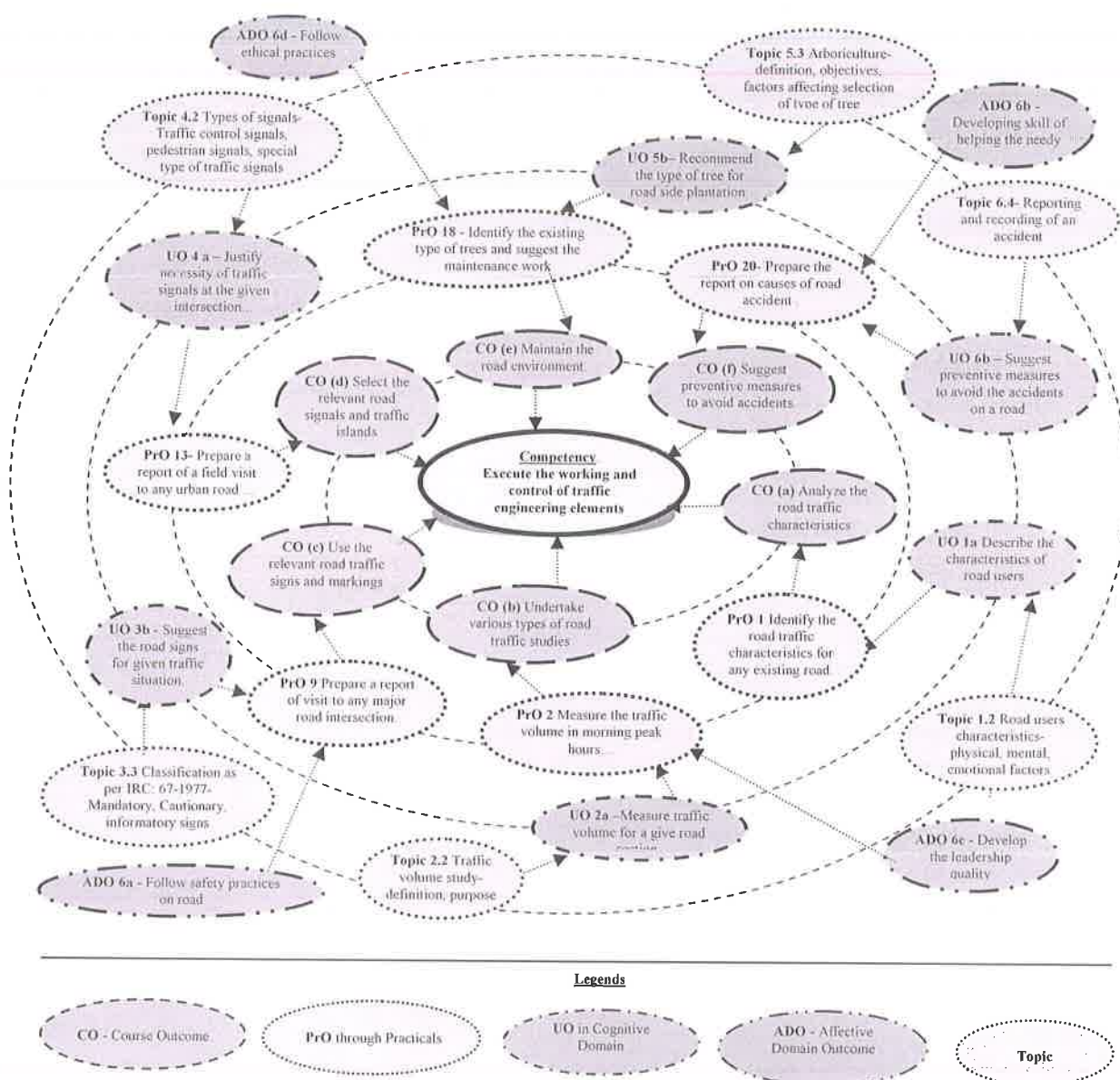


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1.	Identify the road traffic characteristics for any existing road.	I	02
2.	Measure the traffic volume in morning peak hours to analyze traffic composition on road way.	II	02*
3.	Measure the traffic volume in evening peak hours to analyze traffic composition on road way.	II	02
4.	Measure the traffic volume in non peak hours to analyze traffic composition on road way.	II	02
5.	Measure the traffic volume in morning peak hours to analyze traffic composition at Intersection.	II	02*
6.	Measure the traffic volume in evening peak hours to analyze traffic composition at Intersection.	II	02
7.	Measure the traffic volume in non peak hours to analyze traffic composition at Intersection.	II	02*
8.	Prepare a report of trip generation and trip attraction between two zones on the basis of origin-destination study within area of your town/city.	II	02*
9.	Measure the spot speed on corridor of road way to analyze the percentile speed graphically.	II	02*
10.	Prepare a report of a field visit to any major road intersection in your locality to identify the type, working of traffic signals along with your recommendations if any.	III	02*
11.	Prepare a report of a field visit to any minor road intersection in your locality to identify the type, working of traffic signals along with your recommendations if any.	III	02
12.	Suggest the relevant vehicle parking system for your campus along with your recommendations if any in the form of a report.	III	02*
13.	Prepare a report of a field visit to any urban road way to identify the road signs and corresponding markings on road.	III	02
14.	Prepare a report of a field visit to any urban road to identify the traffic island along with its sketch.	III	02
15.	Prepare a report of a field visit to any road intersection in your locality to identify its type along with its sketch.	IV	02*
16.	Identify the existing street lighting system of any two types of roads.	IV	02
17.	Locate the points of conflicts in the diagram of a busy intersection on a major urban road in your locality.	IV	02
18.	Identify the existing type of trees to suggest any relevant maintenance required.	V	02
19.	Draw the collision diagram for any case study of road accident.	VI	02*
20.	Prepare the report on the causes of accidents and preventive measures suggested by you for the situation in practical no 18.	VI	02*
Total			32

Note

- i. A suggestive list of **PrOs** is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to



be performed, out of which, the practicals marked as '' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.*

ii. The 'Process' and 'Product' related skills associated with each PrO are to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
a.	Observation	40
b.	Following safety measures during work	10
c.	Active participation in team work	10
d.	Interpretation of observations and suggestions given	30
e.	Report submission in time	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices on road.
- Developing skill of helping the needy.
- Develop the leadership quality.
- Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year and
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. S. No.
1.1	Computer system (Any computer system with basic configuration)	All
1.2	Drawing board with accessories	All
1.3	LCD Projector with accessories	All
1.4	Measuring tape.	13,14, 15
1.5	Line dori, white wash, brush	13,14, 15

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs in cognitive domain for achieving the COs to attain the identified competency. More UOs could be added.



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Fundamentals of Traffic Engineering.	1a. Describe the characteristics of road users in the given situation.. 1b. Describe the vehicular characteristics for the given situation. 1c. Calculate reaction time of driver in the given situation. 1d. Explain the factors affecting the reaction time for the given situation.	1.1 Traffic engineering- Definition, objects, scope 1.2 Road user's characteristics-physical, mental, emotional factors. 1.3 Vehicular characteristics-width, length, height, weight, speed, efficiency of breaks. 1.4 Road characteristics-gradient, curve of a road, design speed, friction between road and tyre surface. 1.5 Reaction time-factors affecting reaction time. PIEV Theory.
Unit– II Traffic Studies	2a Measure the traffic volume for the given section of road. 2b Analyze origin-destination studies data collected for the given road. 2c Analyze spot speed study data collected for the given road. 2d Design and develop the parking system for the given situation. 2e Suggest the improvement in road geometrics for the given road based on traffic volume count with justification.	2.1 Traffic Studies –types, purpose, Information required for traffic studies. 2.2 Traffic volume study-definition, purpose. 2.3 Methods of collection of traffic volume count data-manual, automatic recorders, moving car method 2.4 Traffic volume count data-representation and analysis of data. 2.5 Necessity of Origin and Destination study and its methods. 2.6 Speed studies-spot speed studies, and its presentation 2.7 Need and method of parking study.
Unit III- Road Signs and Traffic Markings	3a. Interpret the traffic signs at the given road intersection or road. 3b. Suggest the road signs for given traffic situation with justification. 3c. Explain the necessity of pavement markings for given road and road intersection. 3d. Draw the relevant markings on the given pavement.	3.1 Traffic control devices –definition, necessity, types. 3.2 Road signs-definition, objects of road signs. 3.3 Classification as per IRC: 67-1977- Mandatory or Regulatory, Cautionary or warning, informatory signs, Location of cautionary or warning sign in urban and non-urban areas, Points to be considered while designing the road signs. Points to be considered while erecting the road signs. 3.4 Traffic markings- definition 3.5 Classification of traffic markings- carriage way, kerb, object marking and reflector markers



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit-IV Traffic Signals and Traffic Islands.	4a Justify the necessity of given traffic signal at the inter section of a road. 4b Explain the principle of coordinated signals on the given road section. 4c Categorize the existing traffic island at the given road intersection. 4d Suggest the relevant measures to guide the traffic in the given situation with justification..	4.1 Traffic signals- Definition, 4.2 Types of signals-Traffic control signals, pedestrian signals, special type of traffic signals, 4.3 Types of traffic control signals.-Fixed time, manually operated, traffic actuated signals 4.4 Location of signals 4.5 Compute signal time by fix time cycle, trail cycle, approximate, Webster's and IRC method and sketch timing diagram for each face. 4.6 Traffic islands –Definition, advantages and disadvantages of providing islands. 4.7 Types of traffic islands-rotary or central, channelizing or Refuge Island. 4.8 Road intersections or junctions- Definition, Types of road intersection. 4.9 Intersection at grade- Types, basic requirements of good intersection at grade. 4.10 Grade separated intersection- advantages and disadvantages, types- over pass or flyovers-Cloverleaf pattern, Trumpet type, underpass 4.11 Segregation of traffic-Definition, purpose, types.
Unit –V Road Environment and Arboriculture	5a. Suggest the street lighting system for the given road section. 5b. Recommend the relevant type of trees for road side plantation. 5c. Justify the need of protecting the road side plantation. 5d. Describe the methods of protecting the road side plantation.	5.1 Street lighting –definition, sources necessity, types-luminaire, foot candle, lumen, factors affecting their utilization and maintenance. 5.2 Factors affecting visibility at night. 5.3 Arboriculture- definition, objectives, factors affecting selection of type of trees. 5.4 Maintenance of trees-protection and care of road side trees
Unit –VI Road Accident Studies	6a. Analyze the causes of accident occurred on the given road section. 6b. Suggest preventive measures to avoid the accidents on the given road section. 6c. Create awareness about the traffic rules and laws at selected location.	6.1 Road accidents-Definition, types- Collision and non-collision accidents 6.2 Causes of accidents 6.3 Measures to prevent road accidents 6.4 Reporting and recording of an accident 6.5 Collision and condition diagram 6.6 Considerations regarding road safety 6.7 Legislation and law enforcement, education and propaganda

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Fundamentals of Traffic Engineering	02	04	--	--	04
II	Traffic Studies	08	02	04	06	12
III	Road Signs and Traffic Markings	12	02	08	06	16
IV	Traffic Signals and Traffic Islands.	12	02	08	06	16
V	Road Environment and Arboriculture	06	--	08	--	08
VI	Road Accident Studies	08	--	08	06	14
Total		48	10	36	24	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare journals based on practical performed in laboratory.
- Group discussion on traffic jams and related probable solutions in the city.
- Undertake micro-projects.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Guide student(s) in undertaking micro-projects.
- Demonstrate the particular situation before undertaking the task in practice.



- g. Train the students to help competent authority for guiding the traffic movements at an intersection.
- h. Show video clips of nearby road with traffic movements and discuss the shortcomings in the road design
- i. Show picture clips/photographs of Road accidents and discuss the features of road system design which could have prevented such accidents.
- j. Arrange expert lectures by traffic system designers.
- k. Arrange the brain storming sessions for suggesting the viable solution for a specific traffic problem.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

- a. Prepare a model of traffic controlling devices.
- b. Make posters showing traffic safety and awareness.
- c. Perform traffic survey of busy road junction of city in groups and to suggest measures for improvement.
- d. Prepare a report on advanced road marking machinery and materials.
- e. Undertake the process of planting, protecting and maintaining the trees along the road.
- f. Prepare the charts showing different types of road signs.

13. SUGGESTED LEARNING RESOURCES :

S. No.	Title of Book	Author	Publication
1	Transportation Engineering	Arora, N. L.	Khanna Publishers, Delhi, 1996, ISBN: 81-7319-0933,
2	Traffic Engineering and Transport Planning	Kadiyali, L.R.	Khanna Publishers, Delhi, 2001, ISBN:10: 8185240779;
3	Transportation Engineering Vol. I & II	Vazirani, V N Chaondola, S P	Khanna Publishers. Delhi, 2016 ISBN: 9780128038185; 9780128038895
4	Traffic planning and design	Saxsena, S C	Dhanpat Rai & Sons Delhi, 2016 ISBN-10: 8123915500
5	Indian Highways- IRC Journal	Journal-monthly issue	IRC (Indian Road Congress), India, 1973, ISSN: 0376-7256

14. SOFTWARE/LEARNING WEBSITES

- a. <http://www.sanfoundry.com/highway-engineering-questions-answers-traffic-engineering/>
- b. <https://www.youtube.com/watch?v=G7qU7HOw9QA>
- c. <http://freevideolectures.com/Course/91/Introduction-to-Transportation-Engineering/4>
- d. <https://www.slideshare.net/AtifKhan178/road-arboriculture>
- e. <https://www.youtube.com/playlist?list=PLCC59953860B62145>
- f. <http://nptel.ac.in/downloads/105101008/>
- g. http://nptel.ac.in/courses/105101008/downloads/cete_29.pdf
- h. http://nptel.ac.in/courses/105101008/downloads/cete_38.pdf



Program Name : Civil Engineering Program Group
Program Code : CE/CR/CS
Semester : Fifth
Course Title : Precast and Pre-stressed Concrete (Elective)
Course Code : 22508

1. RATIONALE

Precast and Pre-stressed Concrete construction technology is widely used across the globe for its inherent advantages. It has been adopted in India from past many years, but was mostly limited to civil structures such as tunnels, bridges, flyovers and underpasses. Today, with critical housing shortages, rising labour and input costs and an increased emphasis on quality and timely delivery, more and more developers are opting for innovative construction practices like precast and pre-stressed concrete. Hence it is essential to make upcoming engineering community aware about this. This course is designed to provide basic knowledge of precast and pre-stressed elements, their design aspects, pre-stressing techniques, methods and basic design principles.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- a) **Execute effectively construction work involving precast and pre-stressed concrete**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student will be able to demonstrate the following **industry oriented** COs associated with the above mentioned competency:

- Select the relevant precast concrete element for a given type of construction.
- Use the relevant components for the prefabricated structure.
- Justify the relevance of pre-stressed element in a given situation.
- Select the relevant methods / systems for given construction work.
- Evaluate losses in a given pre-stressed concrete construction.
- Propose a suitable cable profile for the given pre-stressed concrete member.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory							Practical					
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)



This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes details in subsequent sections to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

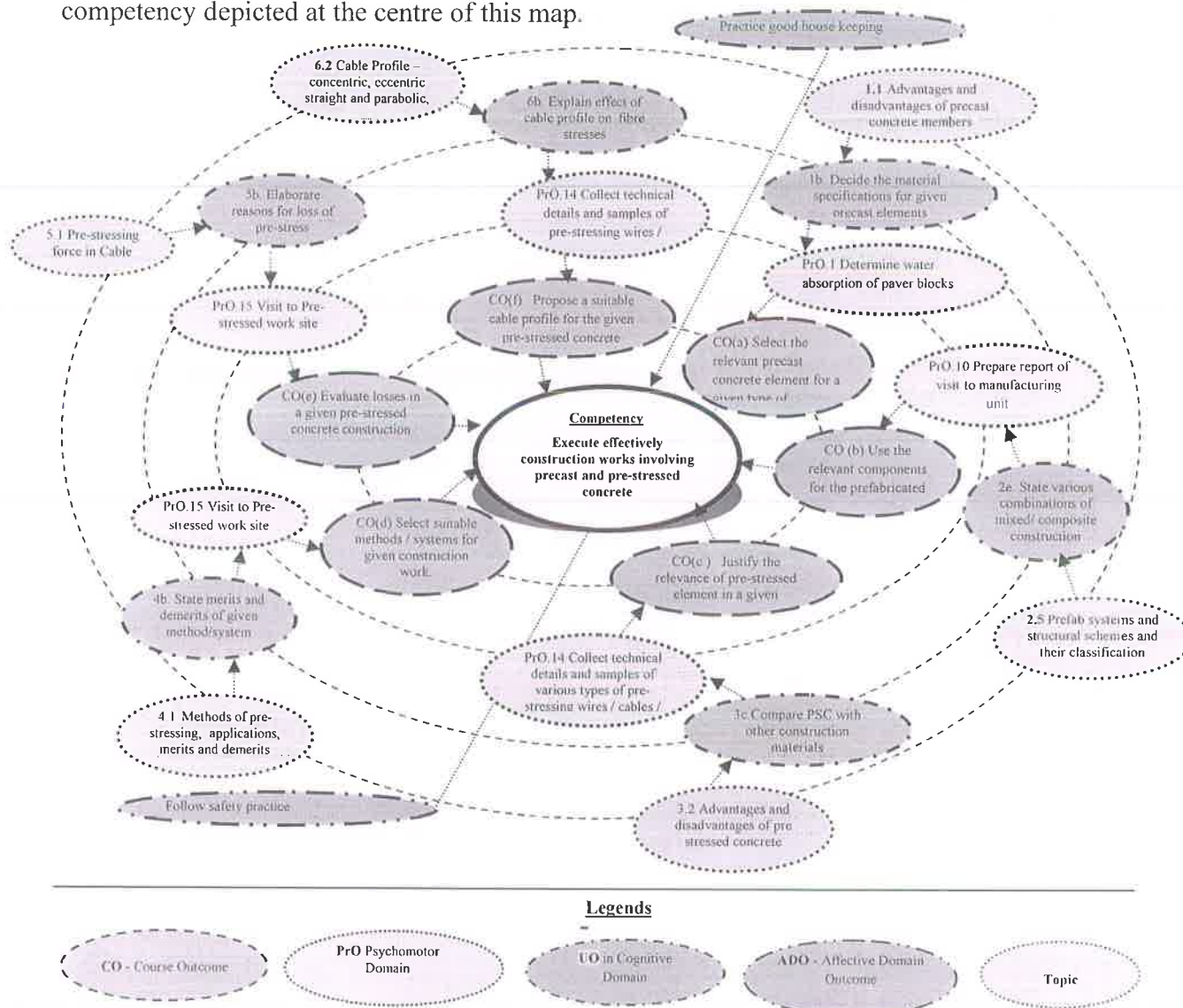


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs) Ten compulsory* + any other two	Unit No.	Approx. Hrs. required
1	Determine water absorption of paver blocks of three different shapes of three different make and size.	I	02*
2	Determine water absorption of solid / hollow building blocks of three different sizes of three different make and size.	I	02*
3	Inspect any three elements (e.g. manhole covers, paver blocks, hollow blocks, solid blocks, curb stones etc) for dimension checking.	I	04*

S. No.	Practical Outcomes (PrOs) Ten compulsory* + any other two	Unit No.	Approx. Hrs. required
4	Prepare report of field visit to a manufacturing unit (of precast elements such as fencing pole, transmission pole, electric pole) with reference to the points such as manufacturing process, curing, stacking, handling, in-house inspection and testing.	I	04*
5	Determine compressive strength of given solid precast blocks	I	02*
6	Determine compressive strength of given hollow precast blocks	I	02*
7	Determine compressive strength of given paver blocks	I	02*
8	Perform load test on given manhole cover as per IS 12592:2002 Annex C	I	02
9	Observe Pressure Testing of given precast pre-stressed pipes	I	04
10	Prepare report of field visit to manufacturing unit (of precast elements such as lintel, chajja, door frame, wall panels, stair steps) with reference to the points such as manufacturing process, curing, stacking, handling, in-house inspection and testing.	II	04*
11	Determine flexural strength on given wall panels on site	II	04
12	Test in-situ the given prefabricated wall panel to judge its resistance against impact.	II	04
13	Test in-situ the given prefabricated wall panel to judge its resistance against flexure (holding the panel simply supported and applying impact force at centre till collapse)	II	02
14	Determine flexural strength of the given precast joists	II	02
15	Prepare the report, collect the samples of various types of pre-stressing wires / cables / strands along with their technical specifications/brochure.	III	02*
16	Prepare report of field visit to bridge site regarding pre-stressed member with reference to the points such as shape, dimensions, cable/ tendon, anchor block, method of pre-stressing, transfer of pre-stress, equipment used, etc.	III to VI	04*
Total			32

Note

- A suggestive list of **PrOs** is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practicals need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S.No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and Recording	10
5	Interpretation of result and Conclusion	20
6	Answer to sample questions	10



S.No.	Performance Indicators	Weightage in %
7	Submission of report in time	10
	Total	100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year.
- 'Organising Level' in 2nd year.
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipments with broad specifications mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipments by administrators.

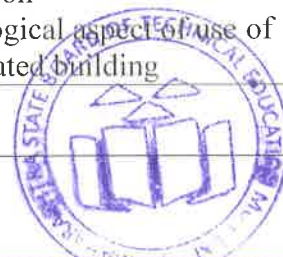
S. No.	Equipment Name with Broad Specifications	Exp. No.
1	Hot air electric oven having temperature range 5 ⁰ C to 250 ⁰ C, removable 2-3 stainless steel shelves, thermostat, digital temp controller, with mineral wool insulation, door walls with silicon rubber gasket and lock	1,2
2	Digital display balance of capacity 10 kg having LC 10 gm and of capacity 30 kg having LC 10 gm	1,2
3	Test frame for load test for manhole covers	9
4	Universal Testing Machine: Capacity – 1000 kN. Type: Mechanical type / digital, electrically Operated with accessories such as (1) Tensile test attachment for wire specimen, (2) Compression test attachment, (3) Transverse test attachment with bending Punch, along with service tools and operation manual	10, 13
5	Compression Testing Machine: Digital display manual control compression testing; machine; Max. Capacity (KN): 2000 ; Measuring range: 4%-100% of FS; Max. distance between two platen (mm): 330; Compression plate size (mm): 220×220; Max. piston stroke (mm): 0-20; Max. piston speed (mm/min): Approx. 30; Column clearance 300×200; Oil pump motor power (KW): 1.5	6, 7, 8



8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs in cognitive domain for achieving the COs to attain the identified competency.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Precast concrete Elements	1a. Explain the concepts of precast concrete in the given situation. 1b. Select the material of relevant specifications for the given pre-cast elements. 1c. Describe the design considerations and IS provisions for given pre-cast element. 1d. Classify the joints of the given pre-cast elements. 1e. Recommend the precast element in the given situation on the basis of different test carried on it. 1f. Justify the need of different tests to decide the relevance of precast element in the given situation.	1.1. Advantages and disadvantages of precast concrete members, 1.2. Materials used- PCC, RCC, PSC, SCC, Ferro-cement, Aerated and Foam concrete 1.3. Non-structural Precast elements - Paver blocks, Fencing Poles, Transmission Poles, Manhole Covers, Hollow and Solid Blocks, Door & Window frames, curb stones. 1.4. Structural Precast elements – tunnel linings, Canal lining, Box culvert, bridge panels, foundation, sheet piles 1.5. Materials required, IS specifications, casting tolerances, fabricating systems, design considerations, joints, testing, storage and transportation, equipment ; for elements mentioned above 1.6. Testing of Precast components
Unit – II Prefabricated building	2a. Describe the various elements for a Prefabricated building 2b. Describe modular co-ordination design considerations with IS provisions for prefabricated elements. 2c. Explain the requirements of structural joints of the given pre-fabricated element. 2d. Describe the procedure of the storage, transportation and erection for a given precast element. 2e. Suggest the various combinations for mixed / composite construction. 2f. Recommend the relevant equipment required for the construction of given Prefabricated element with justification. 2g. Depict the effect of	2.1 Precast Structural Building components such as slab panels, beams, columns, footings, walls, lintels and chajjas, staircase elements, 2.2 Prefabricated building using precast load bearing and non load bearing wall panels, floor systems, 2.3 Material characteristics, Plans & Standard specifications 2.4 Modules, modular co-ordination, modular grid, finishes 2.5 Casting tolerances for above elements 2.6 Prefab systems and structural schemes and their classification 2.7 Design considerations and requirements 2.8 Joints – requirements of structural joints and their design considerations for above elements 2.9 Manufacturing, storage, curing, transportation and erection of above elements, equipment needed 2.10 Introduction to Mixed and composite construction 2.11 Ecological aspect of use of Prefabricated building



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	Prefabricated building on the surrounding environment of the given building.	
Unit– III Introduction to Pre-stressed Concrete	3a. Explain the principle of pre-stressing the given element. 3b. Describe the applications of pre-stressed concrete elements in the given situation. 3c. Distinguish the PSC with other construction materials in given situation. 3d. Justify the need of high strength material for PSC. 3e. Select relevant type of pre-stressing steel for given member.	3.1 Principle of pre-stressed concrete and basic terminology. 3.2 Applications of pre-stressed concrete 3.3 Advantages and disadvantages of pre-stressed concrete 3.4 Materials used and their properties, Necessity of high-grade materials 3.5 Types of Pre-stressing steel -Wire, Cable, tendon, Merits-demerits and applications
Unit– IV Methods and systems of pre-stressing	4a. Select the relevant method of pre-stressing for given structural element. 4b. Illustrate the merits and demerits for given method/system of pre-stressing. 4c. Explain Hoyer system of pre-tensioning with diagram. 4d. Explain relevant system of post-tensioning based on the given criteria with diagram.	4.1 Methods of pre-stressing – Internal and External pre-stressing, Pre and Post tensioning- applications, merits and demerits 4.2 Systems for pre tensioning – process, applications, merits and demerits - Hoyer system 4.3 Systems for post-tensioning - process, applications, merits and demerits - Freyssinet system, Magnel Blaton system, Gifford Udall system. 4.4 Cover requirement for tendons
Unit– V Losses of pre-stress	5a. Identify the reasons for loss of pre-stress in the given element. 5b. Describe the situations in which the given elements exhibit the loss of pre-stress. 5c. Calculate the loss of pre-stress during anchoring in the given situation. 5d. Calculate the loss of pre-stress occurring in the	5.1. Pre-stressing force in Cable, Meaning of Loss of Pre-stress 5.2. Loss of pre-stress during the tensioning process - loss due to friction, length effect, wobbling effect and curvature effect. (Simple Numerical problems to determine loss of pre-stress) 5.3. Loss of pre-stress at the anchoring stage, 5.4. Loss of pre-stress occurring subsequently: losses due to shrinkage of concrete, creep of concrete, elastic shortening, and creep in steel. (Simple



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	given situation. 5e. Compile the IS recommendations for percentage loss in the given pre-stressing method.	Numerical problems to determine loss of pre-stress) 5.5. IS recommendations for % loss in case of Pre and Post tensioning
Unit– VI Analysis and design of Pre-stressed rectangular beam section	6a. Explain the assumptions made in the analysis of pre-stressed concrete beams 6b. Outline the cable profiles in the given situation. 6c. Predict the effect of the given cable profile on fiber stresses. 6d. Calculate maximum stresses induced in given beam 6e. Describe the steps adopted in the design of given pre-stressed beam element.	6.1 Basic assumptions in analysis of pre-stressed concrete beams. 6.2 Cable Profile in simply supported rectangular beam section – concentric, eccentric straight and parabolic, 6.3 Effect of cable profile on maximum stresses at mid span and at support. 6.4 Numerical problems on determination of maximum stresses at mid spans with linear (concentric and eccentric) cable profiles only. 6.5 Simple steps involved in Design of simply supported rectangular beam section (No numerical Problems)

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

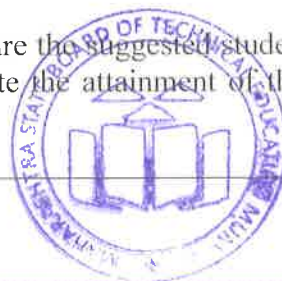
Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Precast concrete Elements	08	02	04	06	12
II	Prefabricated building	10	02	06	08	16
III	Introduction to Pre-stressed Concrete	06	02	02	04	08
IV	Methods and systems of pre-stressing	06	00	04	04	08
V	Losses of pre-stress	08	02	04	06	12
VI	Analysis and design of Pre-stressed rectangular beam section	10	02	04	08	14
Total		48	10	24	36	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various



outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- a. Undertake micro-projects.
- b. Prepare journals based on practical performed in laboratory.
- c. Poster presentation on any one topic.
- d. Prepare short film related to manufacturing process of precast units.
- e. Prepare short film related to pre-stressing process adopted on site.
- f. Market survey specific to properties of various type of materials used in Precast and Pre-stressed concrete.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- a. Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- b. '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c. About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- a. Guide student(s) in undertaking micro-projects.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

- a. Collect pictorial information about pre-stressing jobs
- b. Collect data of pre-stressed components manufactured in your vicinity.
- c. Write a detailed report of visit to any one prefabricated unit.
- d. Collect data for materials required for precast elements, with their suppliers, sale price etc.
- e. Prepare a power point presentation on systems of pre-stressing
- f. Present a seminar on testing of precast units.
- g. Collect samples of at least five precast elements from your area.
- h. Prepare a report on comparison of cast in situ and precast elements with respect to time required, quality and cost.



13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Pre Cast and Pre Stress Technology: Process, Method and Future Technology	Marzuki , Nor Ashikin	Createspace Independent Pub ISBN 10: 1499353391 ISBN 13: 978-1499353396
2	Handbook on Precast Concrete buildings	--	Indian Concrete Institute
3	Precast Concrete Structures	Elliott, Kim S.	CRC Press, New York, 2011 ISBN- 13: 9781498723992
4	Design Of Pre-stressed Concrete Structures	Lin, T.Y.	John Wiley and Sons, New York, 2014 ISBN- 8: 0471018988
5	Pre-stressed Concrete	Krishna Raju, N.	Tata McGraw Hill, New Delhi, 2012 ISBN 10: 1259003361 ISBN 13: 9781259003363
6	Pre-stressed Concrete Structures	Nagarajan, Pravin	Pearson Education India ISBN 9332517614, 9789332517615
7	IS 12592: 2002 Precast Concrete Manhole Cover and Frame	BIS, New Delhi	BIS, New Delhi
8	IS 15658: Precast concrete blocks for paving - Code of Practice	BIS, New Delhi	BIS, New Delhi
9	IS 15916: 2011 Building Design and Erection Using Prefabricated Concrete - Code of Practice	BIS, New Delhi	BIS, New Delhi
10	IS 15917: 2011 Building Design and Erection Using Mixed/Composite Construction - Code of Practice	BIS, New Delhi	BIS, New Delhi
11	IS 458 - 2003 Precast Concrete Pipes (with and without reinforcement) — Specification	BIS, New Delhi	BIS, New Delhi

14. SOFTWARE/LEARNING WEBSITES

- <http://www.asnu.com.au>
- www.youtube.com for videos regarding precast and prestressing procedures.
- www.nptel.ac.in
- www.discoveryforengineers.com
- Website of Precast Concrete Engineers Society (PSEI)
- Website of Masterbuilder (Precast Concrete Structures-Design aspects and its implementation in India)





Maharashtra State Board of Technical Education, Mumbai

Teaching and Examination Scheme for Post S.S.C. Diploma Courses

Program Name : Computer Engineering Groups

Program Code : CO/CM/CW

With Effect From Academic Year: 2017 - 18

Duration of Program : 6 Semesters

Duration : 16 Weeks

Semester : Fifth

Scheme : I

S. N.	Course Title	Course Abbreviation	Course Code	Teaching Scheme			Credit (L+T+P)	Examination Scheme													Grand Total		
				L	T	P		Theory								Practical							
								Exam Duration in Hrs.	ESE		PA		Total		ESE		PA		Total				
									Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks			
1	Environmental Studies	EST	22447	3	-	-	3	90 Min	70*#	28	30*	00	100	40	--	--	--	--	--	--	100		
2	Operating Systems	OSY	22516	3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150		
3	Advanced Java Programming	AJP	22517	3	1	2	6	90 Min	70*#	28	30*	00	100	40	25#	10	25	10	50	20	150		
4	Software Testing	STE	22518	3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150		
Elective (Any One)																							
4	Client Side Scripting Language	CSS	22519	3	-	2	5	3	70	28	30*	00	100	40	25#	10	25	10	50	20	150		
	Advanced Computer Network	ACN	22520	3	-	2	5	3	70	28	30*	00	100	40	25#	10	25	10	50	20	150		
	Advanced Database Management Systems	ADM	22521	3	-	2	5	3	70	28	30*	00	100	40	25#	10	25	10	50	20	150		
5	Industrial Training	ITR	22057	-	-	6	6	--	--	--	--	--	--	--	75#	30	75	30	150	60	150		
6	Capstone Project Planning	CPP	22058	-	-	2	2	--	--	--	--	--	--	--	25@	10	25	10	50	20	50		
Total				15	1	16	32	--	350	--	150	--	500	--	200	--	200	--	400	--	900		

Student Contact Hours Per Week: **32 Hrs.**

Medium of Instruction: **English**

Theory and practical periods of 60 minutes each.

Total Marks : 900

Abbreviations: ESE- End Semester Exam, PA- Progressive Assessment, L - Lectures, T - Tutorial, P - Practical

@ Internal Assessment, # External Assessment, *# On Line Examination, ^ Computer Based Assessment

* Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain LOs required for the attainment of the COs.

~ For the courses having ONLY Practical Examination, the PA marks Practical Part - with 60% weightage and Micro-Project Part with 40% weightage

➤ **If Candidate not securing minimum marks for passing in the "PA" part of practical of any course of any semester then the candidate shall be declared as "Detained" for that semester.**

➤ **Evaluation of Industrial Training and its reports is to done after completion of Industrial Training. Credits of Industrial Training will not affect the framing of time table.**



Program Name : All Branches of Diploma in Engineering and Technology.
Program Code : CE/CR/CS/CH/CM/CO/IF/CW/DE/EJ/EN/EQ/ET/EX/IE/
 MU/EE/EP/EU/IS/IC/AE/FG/ME/PG/PT/DC/TX/TC
Semester : Fifth
Course Title : Capstone Project – Planning
Course Code : 22058

1. RATIONALE

According to the requirement of National Board of Accreditation (NBA), 'learning to learn' is an important Graduate Attribute (GA No.11). It is required to develop this skill in the students so that they continue to acquire on their own new knowledge and skills from different 'on the job experiences' during their career in industry. An educational 'project' just does that and may be defined as *'a purposeful student activity, planned, designed and performed by a student or group of students to solve/ complete the identified problem/task, which require students to integrate the various skills acquired over a period to accomplish higher level cognitive and affective domain outcomes and sometimes the psychomotor domain outcomes as well'*. Projects mainly serve this purpose of developing learning-to-learn skills with an aim to develop the following attributes in the students:

- a) Initiative, confidence and ability to tackle new problems
- b) Spirit of enquiry
- c) Creativity and innovativeness
- d) Planning and decision making skills
- e) Ability to work in a team and to lead a team
- f) Ability of self directed learning which is required for lifelong learning
- g) Persistence (habit of not giving up quickly and trying different solutions in case of momentary failures, till success is achieved)
- h) Resourcefulness
- i) Habit of keeping proper records of events and to present a formal comprehensive report of their work.

2. COMPETENCY

The course should be taught and implemented with the aim to develop the required course outcomes (COs) so that students will acquire following competency needed by the industry:

- **Plan innovative/creative solutions independently and/or collaboratively to integrate various competencies acquired during the semesters to solve/complete the identified problems/task/shortcomings faced by industry/user related to the concerned occupation.**

3. COURSE OUTCOMES (COs)

The following could be some of the major course outcomes depending upon the nature of the projects undertaken. However, in case of some projects few of the following course outcomes may not be applicable.

- a) Write the problem/task specification in existing systems related to the occupation.
- b) Select, collect and use required information/knowledge to solve the problem/complete the task.
- c) Logically choose relevant possible solution(s).
- d) Consider the ethical issues related to the project (if there are any).
- e) Assess the impact of the project on society (if there is any).
- f) Prepare 'project proposals' with action plan and time duration scientifically before beginning of project.



- g) Communicate effectively and confidently as a member and leader of team.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
–	–	2	2	–	–	–	–	–	–	25@	10	25	10	50	20	

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment

5. Capstones Project

One of the dictionary meaning is the ‘crown’ or the stone placed on top of the building structure like ‘kalash on top of Temples and Mosques’ or ‘Cross on top of churches’. Capstone projects are culminating experiences in which students synthesize the competencies acquired over whole programme. In some cases they also integrate cross-disciplinary knowledge. Thus Capstone projects prepare students for entry into a career and can be described as a ‘rite of passage’ or ‘minimal threshold’ through which participants change their status from student to graduate. A capstone project therefore should serve as a synthesis — reflection and integration— to bridge the real-world preparatory experience to real life. Thus capstone project should have emphasis on integration, experiential learning, and real-world problem solving and hence these projects are very important for students. To develop the highly essential industry oriented skills and competencies in the students, the capstone projects are offered in the last two semesters to serve for following purposes:

- Integrate the competencies acquired by the students in the previous and current semesters.
- Provide opportunities for interdisciplinary work in tackling problems likely to be faced by them in industry which are exciting and challenging.

6. Capstone Project Planning

Students are supposed to find out a suitable project and prepare a detailed plan in fifth semester so that it can be executed smoothly in sixth semester. The main characteristic of any project whether small or big is that it requires simultaneous application of various types of skills in the different domains of learning. Moreover, project normally do not have a predefined single solution, in other words for the same problem different students may come up with different but acceptable solutions. Further, in the process of arriving at a particular solution, the student must be required to make a number of decisions after scrutiny of the information s/he has accumulated from experiments, analysis, survey and other sources.

The projects will have a detailed project proposal, which must be executed or implemented within the time allocated, simultaneously maintaining a logbook periodically monitored by the teacher. A detailed project report is to be prepared as project progresses, which has to be submitted after the project is over. For self assessment and reflection students have to also prepare a portfolio of learning.

During the guidance and supervision of the project work, teachers’ should ensure that students acquire following *learning outcomes* (depending upon the nature of the project work some of these learning outcomes may not be applicable):

- Show the attitude of enquiry.
- Identify the problems in the area related to their programme.
- Identify the information suggesting the cause of the problem and possible solutions.
- Assess the feasibility of different solutions and the financial implications.



- e) Collect relevant data from different sources (books/internet/market/suppliers/experts etc. through surveys/interviews).
- f) Prepare required drawings and detailed plan for execution of the work.
- g) Work persistently and participate effectively in group work to achieve the targets.
- h) Work independently for the individual responsibility undertaken.
- i) Ask for help from others including guide, when required.
- j) Prepare portfolio to reflect (*chintan-manan*) on experiences during project work.
- k) Prepare seminar presentations to present findings/features of the project.
- l) Confidently answer the questions asked about the project.
- m) Acknowledge the help rendered by others in success of the project.

If students are able to acquire these *learning outcomes*, then they would be able to acquire the COs as discussed in section 3.

7. Scopes of Projects

Scope of the project work should be decided based on following criteria:

- a) **Relation to diploma programme curriculum:** When students intend to select topics for the project work they need to choose a project which relates well to their curriculum (It may be beyond curriculum, but it should relate to it) and requires implementation of theories already learnt and skills already possessed by them from the previous semesters.
- b) **Abilities possessed by the group of students:** Projects should be chosen so that it can be completed mainly using students' problem solving capabilities and depth of learning. It is natural that highly motivated students or high achievers may come out with projects which are more complex and challenging. Teachers should guide students to choose challenging projects according to the students' ability.
- c) **Resources Available:** Students and Guides should keep in mind the availability of resources while deciding the topic and the scope of the project. Some of the important resources which need consideration are:
 - i. Time available
 - ii. Raw Material/Components required
 - iii. Manufacturing/Fabrication equipment and tools required
 - iv. Testing/Measuring equipment and instruments required
 - v. Access to Journals (Library/Digital)
 - vi. Expertise for theoretical guidance (available in polytechnic, nearby institutes or nearby industries)
 - vii. Expertise and technology required for fabrication (if required)
 - viii. Software required.

An important aspect to be considered is to decide who will choose a project. The best practice is that teacher should guide students about the above factors to be considered for choosing the project and based on these factors students should do the ground work and identify the possible projects and teachers should work as only facilitator and Guide in final selection of the project title and its scope.

d) Suggested Type of Capstone Projects

In general, the projects that the students can take up could be of the following types;

- i. Feasibility studies.
- ii. Design projects
- iii. Market surveys about raw material, components or finished products.
- iv. Prototype (design, make, test and evaluate).
- v. Advanced experimental work requiring the development of existing equipment to be used and developed.
- vi. Field works: This could include surveys, using equipment, charting data and information from visual observation.



- vii. Comparative Studies: Theoretical study of two systems/mechanisms/ processes in detail and comparing them on the basis of cost/energy conservation/impact on environment/technology used etc.
- viii. Application of Emerging technology: Theoretical study of some emerging technology and feasibility of its application in some real life situation in detail.
- ix. Fabrication of some equipment/machine etc.
- x. Construction of some structure.
- xi. Development of software or use of software for solving some broad-based problem.

8. GUIDELINES FOR UNDERTAKING A PROJECT

The selection of the *Capstone Project title* must have emphasis to the Elective courses/ Elective Group taken for the study and exam for 5th and 6th semester. The students will then work on the identified problem/task through a rigorous process of understanding and analyzing the problem, conducting a literature search, deriving, discussing (monitored by the guide every fortnight) and designing the *Semester V 'Project Proposal'* with the following sub-titles:

- a) Rationale (one page)
- b) Introduction
- c) Literature Survey
- d) Problem Definition
- e) Proposed Methodology of solving Identified problem
- f) In-case some prototype has to be fabricated then its tentative design and procedure for making it should be part of the proposal.
- g) Resources and consumables required.
- h) Action Plan (sequential list of activities with probable dates of completion)

As soon as the 'Project Proposal' is approved by the teacher, the student will begin to maintain a dated '*Project Logbook*' for the whole semester. This is a sort of a 'weekly diary' indicating all the activities conducted by the student every week in the semester to complete the project. This '*project logbook*' should be got signed by the teacher at regular intervals for progressive assessment to match the project proposal. If this is maintained sincerely and truthfully by the student, it will be very helpful in compiling the 'Project Report' at the end of the semester by him/her.

9. PORTFOLIO FOR SELF-DIRECTED LEARNING

To ensure that students acquire these outcomes, students should also be guided to prepare a '*Portfolio*', so that they may reflect on their weaknesses/mistakes and learn from them. *Students should also be encouraged to discuss with their guide and record not only technical problems but also problems related to group work, planning, execution, leadership in the team etc., so that students can also identify their weaknesses in affective domain and take remedial actions to overcome the same.* If they wish, the students can also show their portfolio to their teachers (whom they trust) for obtaining teachers' comments on their reflection for pointing out their mistakes so that they can improve their performance.

'*Portfolio*' is the record of the reflection (thinking or *chintan-manan*) on experiences to which students undergo during the different stages of the project. In a portfolio, students record their critical experiences and reflect (think or do *chintan-manan*) on them in writing. This process of reflecting on the experiences make them learn from their mistakes and build on their strengths. To help students in reflection, a Portfolio format with reflective prompts (simple thought provoking questions) for different stages of the project is given as annexure B.

12.1 Purposes of Portfolio Preparation



Reflection by self is important since group work is so complex that it is difficult for teachers to appreciate the real problems amongst the students. In a portfolio, prompts (simple thought provoking questions) are given to trigger reflection on different aspects of project work. Prompts help the students to ask questions from themselves regarding different aspects of the project work and interpersonal relationships. Process of answering these questions forces students to think about behavioral problems and possible remedies/solution to deal with those problems. Portfolio preparation therefore helps in reflection on building the strengths and elimination of the weaknesses of the students pertaining to following qualities which the industry also need.

- a) Plan properly for execution of given work.
- b) Take appropriate decisions.
- c) Arrange resources.
- d) Work as member and leader of team.
- e) Communicate properly.
- f) Resolve the conflicts.
- g) Manage the time well.
- h) Have concern for ethical, societal and environmental issues.
- i) Learn-to-learn from experiences.

It may be seen that these qualities are not directly related with the theoretical subject knowledge and can be developed only through real life experiences. Project work is one such type of experience where opportunity is available to develop all these qualities.

However, even during project work, emphasis of most of the students and teachers remains on development of the technical knowledge and skills while development of above qualities is neglected. Students can develop these qualities if they reflect (do thinking or *Chintan-Manan*) on their experiences from the point of view of these qualities and find out their own weaknesses and strengths. Because if somebody wants to improve his/her abilities then first step for that person is to have self awareness about his/her weaknesses and strengths.

Though portfolio preparation requires considerable time, it is essential, if we want to learn from the experiences and develop these qualities. Writing down reflections helps in better reflection as it is well known that when a person starts writing something he/she becomes more cautious about his/her view and evaluate those views before writing. Thus process of writing improves the quality of reflection or thinking. Moreover, if reflections on different stages of work are written down, over a period of time a large amount of reflection can be generated, and if this reflection is looked back, it may help in identifying some pattern of behaviour in individual which may be improved or rectified latter on as per requirement.

12.2 Guidelines for Portfolio Preparation and assessment

The main purpose of portfolio preparation is learning based on self-assessment and ***portfolio is not to be used for assessment in traditional sense.***

- a) Each student has to prepare his/her portfolio separately. However, he/she can discuss with the group members about certain issues on which he/she wants to write in the portfolio.
- b) For fifth semester and sixth semester, there will be only one portfolio but it will have two separate parts, first part for project planning (having two sections A and B) second part for project execution. (having two sections C and D)
- c) Whatever is written inside the ***portfolio is never to be used for assessment***, because if teachers start giving marks based on whatever is written in the portfolio, then students would hesitate in true self-assessment and would not openly describe their own mistakes or shortcomings.



- d) Some marks are allocated for portfolio, these marks are to be given based on how sincerely portfolio has been prepared and not based on what strengths and weaknesses of the students are mentioned in the portfolio.
- e) Portfolio has to be returned back to the students after assessing it (assessment is only to see that whether portfolio is completed properly or not) by teachers. Because student is the real owner of the portfolio.
- f) Students mainly learn during portfolio preparation, but they can further learn if they read it after a gap. And hence they are supposed to keep the portfolios with them even after completion of the diploma because it is record of their own experiences (it is like diary some people write about their personal experiences), because they can read it again after some time and can revise their learning (about their own qualities)

Even after completion of Diploma programme, students can continue to prepare portfolio related to different experiences in their professional and personal life and by refereeing back to old portfolios after a gap of some years, they can learn that how their personality has evolved over the years. They can also see a pattern of behaviour in their own personality which may be source of their weaknesses or strengths and they can take remedial measures based on this study of their portfolios.

Note

Since some sections of the portfolio are related with interpersonal relationships and student may find it difficult to write these experiences in English. Language should not be the barrier in reflection and hence students should be allowed to prepare the portfolio in their preferred language such as *Marathi* or *Hindi* if they find it difficult to write in English.

The amount and type of mistakes identified by students would not affect the marks received by the students. The total 7 Marks allocated for portfolio (4 marks for PA and 3 for ESE) are only for proper completion of the portfolio.

10. PROJECT REPORT

At the end of fifth Semester, the student will prepare a Semester V 'Project Report' with the following sub-titles:

- Certificate (in the Format given in this document as annexure A)
- Acknowledgements
- Abstract (in one paragraph not more than 150 words)
- Content Page
- Chapter-1 Introduction and background of the Industry or User based Problem
- Chapter-2 Literature Survey for Problem Identification and Specification,
- Chapter-3 Proposed Detailed Methodology of solving the identified problem with action plan
- References and Bibliography

Note: The report should contain relevant diagrams and figures, charts.

11. ASSESSMENT OF CAPSTONE PROJECT – PLANNING

Like other courses, assessment of Project work also has two components, first is progressive assessment, while another is end of the term assessment. The mentor faculty will undertake the progressive assessment to develop the COs in the students. They can give oral informal feedback about their performance and their interpersonal behaviour while guiding them on their project work every week. The following characteristics/ qualities informally or formally should be considered during different phases of the project work which will be assessed thrice as discussed in sub-section.

(A) Initial Phase

- i. **Definition of the Problem**
 - a) Accuracy or specificity



- b) Appropriateness with reference to desired course outcomes.
- ii. **Methodology of Conduction the Project**
 - a) Appropriateness
 - b) Flexibility
 - c) Clarity
- iii. **General Behaviour**
 - a) Initiative
 - b) Resourcefulness
 - c) Reasoning ability
 - d) Imagination/creativity
 - e) Self-reliance

(B) Intermediate Phase

- i. **Performance of Student**
 - a) Ability to follow correct procedure
 - b) Manipulative skills
 - c) Ability to collect relevant information
 - d) Ability to observe, record & interpret
 - e) Ingenuity in the use of material and equipment
 - f) Target achievement
- ii. **General Behaviour**
 - a) Persistence
 - b) Interest
 - c) Commitment
 - d) Confidence
 - e) Problem solving ability
 - f) Decision making ability
 - g) Initiative to act
 - h) Team spirit.
 - i) Sharing of material etc.
 - j) Participation in discussion
 - k) Completion of individual responsibilities

(C) Final Phase

- i. **Quality of Product**
 - a) Dimensions
 - b) Shape
 - c) Tolerance limits
 - d) Cost effectiveness
 - e) Marketability
 - f) Modernity
- ii. **Quality of Report**
 - a) Clarity in presentation and organization
 - b) Styles and language
 - c) Quality of diagrams, drawings and graphs
 - d) Accuracy of conclusion drawn
 - e) Citing of cross references
 - f) Suggestion for further research/project work
- iii. **Quality of presentation**
 - a) Understanding of concepts, design, methodology, results, implications etc
 - b) Communication skills
 - c) Ability to draw conclusions and generalization



12. PROGRESSIVE ASSESSMENT (PA) GUIDELINES

15 Marks are allocated for the formal progressive assessment. However, following points need consideration during the three times of formal progressive assessment of the students at the end of 4th, 12th and 14th week.

- Fortnightly monitoring** by the mentoring teachers is necessary and marks given progressively (even the gradual chapter preparation) so that that students will not copy earlier reports or get things done or reports from the market. The **students should not be awarded marks** if they have not done on their own.
- For progressive assessment at the end of 14th week, students should be asked to give the power point presentation before group of teachers and junior students (so that junior students may also get awareness about the capstone project work they have to carry out in future).
- Although marks for *portfolio preparation* is to be given at the end of 14th week, students should be asked to bring their partly prepared portfolio (relevant sections prepared) also during their assessment at the end of 4th week and 12th week.
- Marks for portfolio preparation should be based only on proper preparation of portfolio by writing answers to most of the prompts (self-questions to students) in the portfolio. These marks should not be based on the mistakes indicated by students in their working (while answering the prompts) and corrective actions taken by them.
- The students would be awarded marks for their efforts (In some cases it may happen that due to some reasons such as unavailability of some material or component or some other resources, students may not be able to complete the project, but they have tried their best, in such cases students would be given appropriate marks if they have done enough efforts.)
- Originality of the report** (written in own words) would be given more importance rather than use of glossy paper or multi-colour printing.

12.1 Progressive Assessment (PA) Criteria

Allocation Criteria of the **25 marks** are for the Progressive Assessment (PA).

S. No.	Criteria	Marks
First Progressive Assessment at the end of 4th week		
1	Problem Identification/Project Title (Innovation /Utility of the Project for industry/ User/Academia) marks to be also given based on (i) Accuracy or specificity of the scope and (ii) Appropriateness of the work with reference to desired course outcomes.	02
2	Industrial Survey and Literature Review: marks to be given based on extent/volume and quality of the survey of Industry / Society / Institutes/Literature/Internet for Problem Identification and possible solutions	02
3	General Behaviour: initiative, resourcefulness, reasoning ability, imagination/creativity, self-reliance to be assessed Note: Oral feedback on general behaviour may also be given whenever relevant/ required during day to day guidance and supervision. Only written feed-back/suggestions	00
Second Progressive Assessment at the end of 12th week		
4	Project Proposal: Marks to be given also based on appropriateness, flexibility, detail and clarity in methods/planning. (In case of working models, detailed design and planning of fabrication/assembly of the prototype has to be also assessed). This proposal should include whole project including work to be done in sixth semester	03



S. No.	Criteria	Marks
5	Execution of Plan in fifth semester (Since project is to be fully completed in sixth semester, the part of the project which is planned to be completed in fifth semester is only to be evaluated: marks to be also given based on ability to collect relevant information, ability to follow correct procedure, manipulative skills, ability to observe, record & interpret, ingenuity in the use of material and equipment, target achievement) In case of working models, quality of workman ship (including accuracy in dimensions, shape, tolerance limits), appropriateness of raw materials/components/ technology being used, functioning of the prototype, cost effectiveness, marketability, modernity etc. has to be also assessed.	02
6	Log book (for work done in fifth semester, detailed and regular entry would be basis of marks)	02
7	General Behaviour (persistence, interest, confidence, problem solving ability, decision making ability, initiative to act, team spirit, sharing of material etc., participation in discussions, completion of individual responsibilities, leadership) Note: Oral feedback on general behaviour should also be given whenever relevant/ required during day to day guidance and supervision. Only written feed-back./suggestions	00
Third Progressive Assessment at the end of 14th week		
8	Portfolio for Self learning and reflection (marks based on amount of reflection and completion of the portfolio for work done in fifth semester)	04
9	Final Report writing including documentation. (marks based on: clarity in presentation and organization; styles and language; quality of diagrams, drawings and graphs; accuracy of conclusion drawn; citing of cross references; suggestion for further research/project work) Report has to be prepared for work done in fifth semester and planning for sixth semester work.	06
10	Presentation (presentation skills including communication skills to be assessed by observing quality of presentations and asking questions during presentation and viva/voce) Report has to be prepared for work done in fifth semester and plan for sixth semester.	02
11	Defence (ability to defend the methods/materials used and technical knowledge, and involvement of individual to be assessed by asking questions during presentation and viva/voce)	02
Total		25

13. END-SEMESTER-EXAMINATION (ESE) ASSESMENT GUIDELINES

The **remaining 25 marks** are for the end-semester-examination (ESE). And marks would be given according to following criteria. Moreover, the suggested evaluation scheme can be changed slightly by the external faculty according to nature of problem / project following University guidelines..

- For each project, the one or two students from the concerned group of students should be asked to present the power point presentation before the external and internal (for about 10 minutes) and then external should ask the questions from each member of the group separately to ascertain the contribution made by each student.
- The students would be awarded marks for their efforts (In some cases it may happen that due to some reasons such as unavailability of some material or component or some other resources, students may not be able to complete the project, but they have tried their best, in such cases students would be given appropriate marks commensurate with their efforts.)



- c) The students would not be awarded marks if they have completed the project by getting done the work from market or some professionals (taking help and guidance is different as compared to getting the work or maximum part of the work completed from others on payment basis).
- d) Originality of the report (written in own words, even if there are grammatical and spelling mistakes) would be given more importance rather than quality of printing and use of glossy paper (and preparing report by copy pasting from other reports).

Note: It is very common that people are not able to complete the project in time despite best of their efforts. (Please recall that how many times people are able to complete in time, personal projects such as building own house or professional projects such as developing the lab in the institute). So if students have put in enough genuine efforts but could not complete the project in time then we should consider it sympathetically and they should be given marks based on their efforts and they should get more marks as compared to students who have got their projects completed by taking major help from others/market.

13.1 End-Semester-Examination (ESE) Assessment Criteria.

Allocation Criteria of the **25 marks** are for the end-semester-examination (ESE)

S. No.	Description	Marks
1	Problem Identification/Project Title (innovation /utility of the project for industry/ user/academia) marks to be also given based on (i) accuracy or specificity of the scope and (ii) appropriateness of the work with reference to desired course outcomes.	02
2	Industrial Survey and Literature Review (marks to be given based on extent/volume and quality of the survey of industry / society / institutes/literature/internet for problem identification and possible solutions)	02
3	Project Proposal: Marks to be given also based on appropriateness, flexibility, detail and clarity in methods/planning. (In case of working models, detailed design and planning of fabrication/assembly of the prototype has to be also assessed). This proposal should include whole project including work to be done in sixth semester.	02
4	Execution of Plan in fifth semester (Since project is to be fully completed in sixth semester, the part of the project which is planned to be completed in fifth semester is only to be evaluated: marks to be also given based on ability to collect relevant information, ability to follow correct procedure, manipulative skills, ability to observe, record & interpret, ingenuity in the use of material and equipment, target achievement) In case of working models, quality of workman ship (including accuracy in dimensions, shape, tolerance limits), appropriateness of raw materials/components/ technology being used, functioning of the prototype, cost effectiveness, marketability, modernity etc. has to be also assessed.	02
5	Log book (for work during fifth semester, marks to be given based on detailed and regular entry)	03
6	Portfolio for Self learning and reflection (for work during fifth semester) Marks based on amount of reflection and completion of portfolio.	03
7	Project Report including Documentation (for work during fifth semester and planning for sixth semester) (marks based on: clarity in	04



S. No.	Description	Marks
	presentation and organization; styles and language; quality of diagrams, drawings and graphs; accuracy of conclusion drawn; citing of cross references; suggestion for further research/project work)	
8	Presentation (presentation skills including communication skills to be assessed by observing the quality of presentations and asking questions during presentation and viva/voce) Presentation should be based on work done in fifth semester and planning for sixth semester.	03
9	Defence (ability to defend the methods/materials used and technical knowledge, and involvement of individual to be assessed by asking questions during presentation and viva/voce)	04
Total		25

14. SPECIAL TEACHING STRATEGIES (If any)

- Teacher's should not spoon feed the students and let them try on their own at different stages of the project work and even first let them strive hard and only when efforts of students have failed, then teacher should guide them. Guidance should be in initially in the form of clues or hints rather than complete explanation, detailed explanation should be given only when students are not able to work based on clues/hints. The role of teacher should be limited to guide and facilitator
- Teachers should guide students in selecting a topic which is relevant and challenging (but within capacity) for students according to their abilities.
- Teachers should ensure that students prepare the project plan in as much detail as possible, since this way only they would learn the importance of planning and how to do the detail planning. Teachers should allow students to proceed ahead only when they have detailed plan with them.
- Teachers should motivate students to maintain log book and prepare portfolio. They should explain benefits of these activities to students and also train them in these activities, because most of them may be doing this first time.
- Teachers should also encourage students to openly discuss their weaknesses and shortcomings in portfolio and teachers should develop confidence in students that admitting mistakes and weaknesses helps in improving them and their marks would not be affected by revealing their mistakes. Marks related to portfolio are awarded based only on the sincerity with which it is prepared and not based on strengths and weaknesses of students.
- Teachers should continuously discuss with students about working of group and progress in the project and from this discussion should identify their personal qualities (both strengths and weaknesses) and suggest to them ways for improving those qualities.
- Internal as well as external examiners should reward students for original work and efforts of students even if they are not fully successful or not able to complete the project in comparison to those students who have taken paid help from others to complete their project.



Annexure A**CERTIFICATE**

This is to certify that Mr./Ms.....

FromCollege having Enrolment No:

has completed **Report on the Problem Definition/ Semester V Project Report/ Final Project**

Report having title

individually/ in a group consisting of..... persons under the guidance of the Faculty Guide.

.....
The mentor from the industry for the project

Name:

Telephone:.....

Annexure B**Portfolio for Self Directed Learning for Major Project Work**

Name of Student:.....

Semester:.....**Programme/Branch:**.....

Roll Number:.....

Title of the Project:.....

Name and Designation of Project Guide:.....

Name of Polytechnic:.....

Part A: Selecting the Project and Team (Answers to the following questions to be included in 'Portfolio' as Reflection related to formation of group and finalization of project topic).

Note: This section has to be prepared just after the finalization of the Project topic and formation of the Project Team .

1. How many alternatives we thought before finalizing the project topic?
2. Did we consider all the technical fields related to branch of our diploma programme?
3. Why we found present project topic as most appropriate?
4. Whether all the group members agreed on the present project topic? If not? What were the reasons of their disagreements?
5. Whether the procedure followed in assessing alternatives and finalizing the project topic was correct? If not, discuss the reasons.
6. What were the limitations in other alternatives of project topic?
7. How we formed our team?
8. Whether we faced any problem in forming the team? If yes, then what was the problem and how was it resolved?



9. Am I the leader of our project team? If yes, then why was I chosen? If not, why I could not become the project team leader?
10. Do I feel that present team leader is the best choice available in the group? If yes, then why? If not, then why?
11. According to me who should be the leader of the team and why?
12. Can we achieve the targets set in the project work within the time and cost limits?
13. What are my significant good/ bad sharable experiences while working with my team which provoked me to think? What I learned from these experiences?
14. Any other reflection which I would like to write about formation of team and finalization of project title, if any?

Part B: Reflection related to project planning (Answers to the following questions to be included in 'Portfolio' as reflection on planning)

Note: This section has to be prepared just after the finalization of the 'Project Proposal'.

1. Which activities are having maximum risk and uncertainty in our project plan?
2. What are most important activities in our project plan?
3. Is work distribution is equal for all project group members? If not? What are the reasons? How we can improve work distribution?
4. Is it possible to complete the project in given time? If not what are the reasons for it? How can we ensure that project is completed within time.
5. What extra precaution and care should be taken in executing the activities of high risk and uncertainty? If possible, how such risks and uncertainties can be reduced?
6. Can we reduce the total cost associated with the project? If yes, then describe the ways?
7. For which activities of our project plan, arrangement of resources is not easy and convenient?
8. Did we make enough provisions of extra time/expenditure etc. to carry out such activities?
9. Did we make enough provisions for time delays in our project activity? In which activities there are more chances of delay?
10. In our project schedule, which are the days of more expenditure? What provisions we have made for availability and management of cash?
11. Any other reflection which I would like to write about project planning?



Teacher Evaluation Sheet (ESE) for Capstone Project Planning

Name of Student:

Name of Programme..... Semester:

Course Title and Code:.....

Title of the Capstone Project:

A. POs addressed by the Capstone Project (Mention only those predominant POs)

- a)
- b)
- c)
- d)

B. COs addressed by the Capstone Project (Mention only those predominant POs)

- a)
- b)
- c)
- d)

C. OTHER LEARNING OUTCOMES ACHIEVED THROUGH THIS PROJECT

a) Unit Outcomes (Cognitive Domain)

- i.
- ii.
- iii.
- iv.

b) Practical Outcomes (in Psychomotor Domain)

- i.
- ii.
- iii.
- iv.

c) Affective Domain Outcomes

- i.
- ii.
- iii.
- iv.

D. SUGGESTED RUBRIC FOR ASSESSMENT OF CAPSTONE PROJECT

(please tick below the appropriate rating i.e. poor, average etc., for each characteristic to be assessed and give marks in the respective cell according to performance of student)

S. No.	Characteristic to be assessed	Poor	Average	Good	Excellent	Max. Marks	marks obtained
First Progressive Assessment (at the end of 4 th week)							



S. No.	Characteristic to be assessed	Poor	Average	Good	Excellent	Max. Marks	marks obtained
1	Problem/Task Identification (Project Title)	Relate to very few POs Scope of Problem not clear at all	i. Related to some POs ii. Scope of Problem/Task vague	i. Take care of at-least Three POs ii. Scope of Problem/task not very specific	i. Take care of more than three POs ii. Scope of problem/task very clear	02	
2	Literature Survey /Industrial Survey	Not more than ten sources (primary and secondary), very old reference	At-least 10 relevant sources, at least 5 latest	At –least 15 relevant sources, most latest	About 20 relevant sources, most latest	02	
Second Progressive Assessment (at the end of 12th week)							
3	Project proposal	Methods are not appropriate, All steps not mentioned, Design of prototype not started (if applicable).	Appropriate plan but not in much detail. Plan B for critical activities not mentioned. Time line is not developed. Design of Prototype is not complete. (if applicable)	Appropriate and detailed plan with Plan B for critical activities mentioned, but clarity is not there in methods, time line is given but not appropriate. Design of prototype is not detailed (if applicable)	Appropriate and detailed plan with Plan B for critical activities mentioned, clarity in methods with time line, Detailed design of prototype (if applicable)	02	
4	Execution of Plan in fifth semester (please write by hand about students performance in appropriate column)					02	
5	Log Book	Entries for most weeks are missing. There is no proper sequence and details are not correct.	Entries for some weeks are missing, details are not appropriate, not signed regularly by the guide.	Entries were made every week but are not in detail. Signed and approved by guide every week	Entries were made every week in detail, signed and approved by guide every week	03	
Third progressive Assessment at the end of 14th week							
6	Portfolio Preparation	Answer to only few of the 'questions from self' (prompts)	Answer to only about 50% of the 'questions from self'	Answer to most of the 'questions from self' (prompts) written. Some	Answer to nearly all the 'questions from self' (prompts) written in detail	03	



S. No.	Characteristic to be assessed	Poor	Average	Good	Excellent	Max. Marks	marks obtained
		written. Answers are not in much detail	(prompts) written. Answers are not in much detail	answers are not in much detail			
7	Final Report Preparation	Very short, poor quality sketches, Details about methods, material, precaution and conclusions omitted, some details are wrong Nearly sufficient and correct details about methods, material, precautions and conclusion. but clarity is not there in presentation, not enough graphic description.	Detailed, correct and clear description of methods, materials, precautions and	Conclusions. Sufficient Graphic Description.	Very detailed, correct, clear description of methods, materials, precautions and conclusions. Enough tables, charts and sketches	04	
8	Presentation	Major information is not included, information is not well organized .	Includes major information but not well organized and not presented well	Includes major information and well organized but not presented well	Well organized, includes major information ,well presented	03	
9	Defense	Could not reply to considerable number of question.	Replied to considerable number of questions but not very properly	Replied properly to considerable number of question.	Replied to most of the questions properly	04	
Total marks						25	

Any Other Comment:

.....

Name and designation of the Faculty Member.....

Signature.....



Program Name : Diploma in Civil Engineering/ Computer Engineering /
**Information Technology /Automobile Engineering/ Fashion &
 Clothing Technology / Electrical Engineering Group / Electronics
 Engineering Group**

Program Code : CE/CR/CS/CO/CM/CW/IF/AE/DC/EE/EP/EU/DE/EJ/ET/EN/
EX/EQ/IE/IS/IC

Semester : Fifth

Course Title : Environmental Studies

Course Code : 22447

1. RATIONALE

The world today is facing the biggest challenge of survival. Degradation of ecosystem, depletion of natural resources, increasing levels of pollution pose major threat to the survival of mankind. The need of the hour, therefore, is to concentrate on the area of environmental aspects, which shall provide an insight into various environment related issues. Environmental studies are an interdisciplinary academic field that integrates physical, chemical and biological sciences, with the study of the environment. It provides an integrated, quantitative, and interdisciplinary approach to the study of environmental system & gives an insight into solutions of environmental problems.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Diagnose and manage environment related issues

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

- Develop Public awareness about environment
- Select alternative energy resources for Engineering Practice
- Conserve Ecosystem and Biodiversity
- Apply techniques to reduce Environmental Pollution
- Manage social issues and Environmental Ethics as lifelong learning

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	-	3	90 Min	70*#	28	30*	00	100	40						

(#) Online Theory Examination.



(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

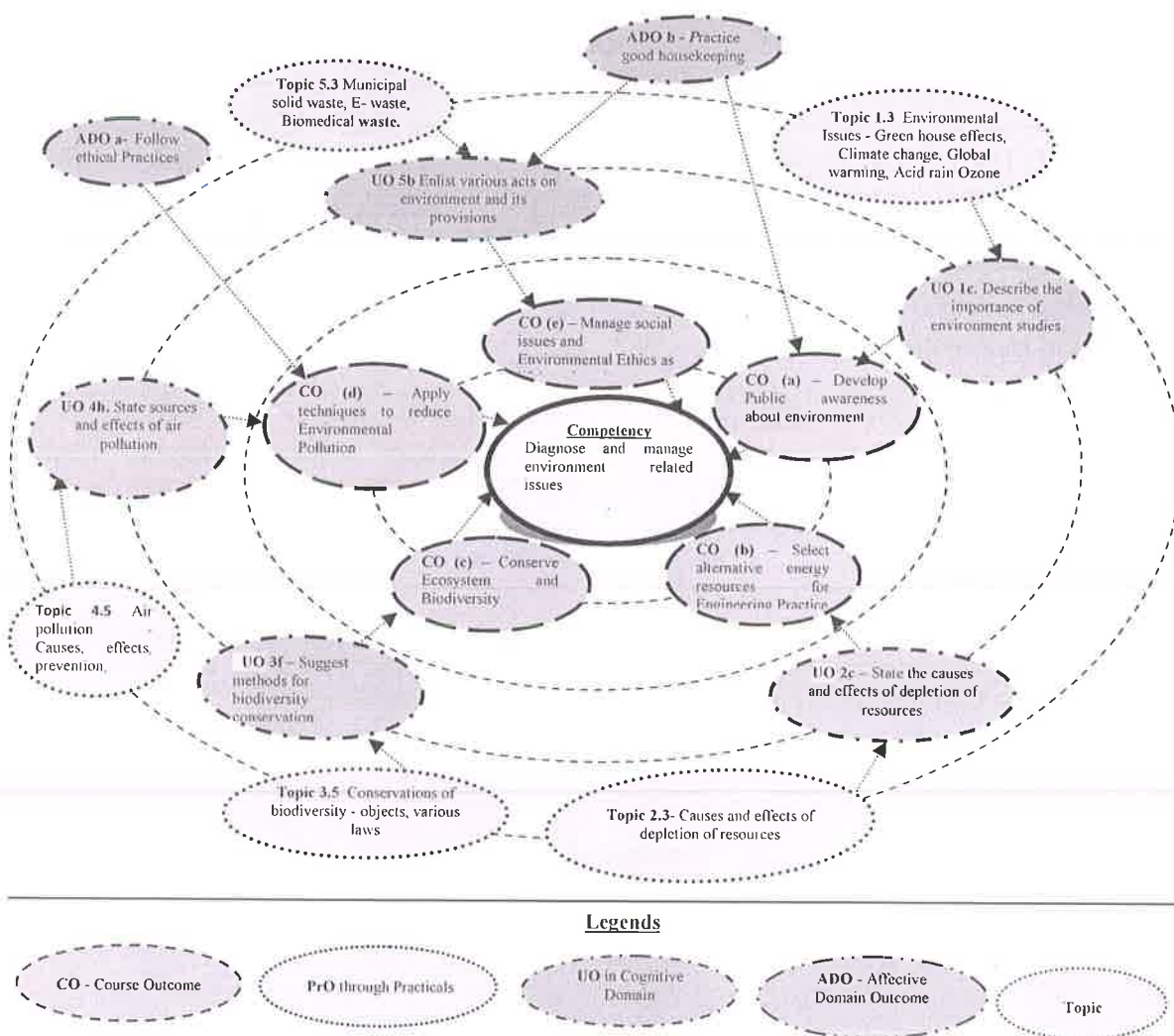


Figure 1 - Course Map

6. SUGGESTED EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency:

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
--------	---------------------------	----------	-----------------------

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	NIL		
	Total		

Note

- A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	NIL	
	Total	

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Practice energy conservation.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical Practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	NIL	-

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.



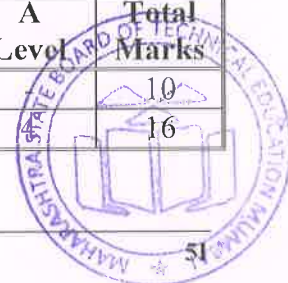
Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Environment	1a. Discuss the scope of Environment. 1b. Describe various types of environment 1c. Describe the importance of environment studies. 1d. Discuss about the need of public awareness about environment. 1e. Describe various environmental issues.	1.1 Definitions, need of environmental studies. 1.2 Segments of environment- Atmosphere, Hydrosphere Lithosphere, Biosphere. 1.3 Environmental Issues - Green house effects, Climate change, Global warming, Acid rain Ozone layer depletion, Nuclear accidents. 1.4 Concept of 4R (Reduce, Reuse, Recycle and Recover), 1.5 Public awareness about environment.
Unit– II Energy Resources	2a. List various natural resources. 2b. Describe Renewable, Nonrenewable and Cyclic resources. 2c. State the causes and effects of depletion of resources. 2d. State advantages and disadvantages of forms of energy. 2e. Select appropriate solutions of efficient use of energy. 2f. State the impacts of overuse of natural resources.	2.1 Natural Resources - Forest Resources, Water Resources, Energy Resources, Land resources, Mineral resources. 2.2 Renewable, Non-renewable and Cyclic Resources. 2.3 Causes and effects of depletion of resources. 2.4 Energy forms (Conventional and non-conventional). 2.5 Present global energy use and future demands. 2.6 Energy conservation. 2.7 Over use of natural resources and its impacts on environment.
Unit- III Ecosystem and Biodiversity	3a. State the aspects and division of ecosystem. 3b. State the general characteristics and function of ecosystem. 3c. List levels of biodiversity. 3d. Enlist the endangered species. 3e. Describe value of biodiversity. 3f. Suggest methods for biodiversity conservation.	3.1 Ecosystem - Definition , Aspects of ecosystem, Division of ecosystem, General characteristics of ecosystem, Functions of ecosystem. 3.2 Biodiversity - Definitions, Levels, Value and loss of biodiversity. 3.3 Biodiversity assessment initiatives in India. 3.4 Threats and Hotspots of biodiversity. 3.5 Conservations of biodiversity - objects, various laws.
Unit– IV Environmental Pollution	4a. Define pollution. 4b. State the sources of pollution. 4c. State the effects of land pollution on environment and lives. 4d. State various units and their functions of water treatment plant. 4e. State the needs of water conservation.	4.1 Definition of pollution, types- Natural & Artificial (Man- made). 4.2 Soil / Land Pollution – Causes and effects on environment and lives , preventive measures. 4.3 Water Pollution - Sources of water (surface and sub surface), sources of water pollution, effects on environment and lives, preventive measures, BIS water quality

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	4f. State the impacts of sewage. 4g. State various units and their functions of sewage treatment plant. 4h. State sources and effects of air pollution. 4i. Describe various methods to prevent air pollution. 4j. State sources and effects of noise pollution. 4k. Describe preventive measures for noise pollution. 4l. State characteristics of solid waste. 4m. State the impacts of solid waste. 4n. Describe incineration, RDF and sanitary landfilling. 4o. State the standards limiting/controlling values of various types of pollution.	standards, flow diagram of water treatment plant, Water conservation. 4.4 Wastewater - Generation(domestic and industrial), Impacts, flow diagram of sewage treatment plant, CPCB norms of sewage discharge. 4.5 Air pollution - Causes, effects, prevention, Ambient air quality standards. 4.6 Noise pollution - Sources, effects, prevention, noise levels at various zones of the city. 4.7 Municipal Solid Waste, Bio-medical waste and E-waste - Sources, generation, characteristics, effects, and methods to manage.
Unit-V Social Issues and Environmental Education	5a. Elaborate article (48-A) and (51-A (g)) 5b. Enlist various acts on environment and its provisions. 5c. State the roles and responsibilities of CPCB. 5d. Define sustainable development, and EIA. 5e. Describe rain water harvesting and groundwater recharge. 5f. Differentiate between formal and non formal education.	5.1 Article (48-A) and (51-A (g)) of Indian Constitution regarding environment, Environmental protection and prevention acts, CPCB and MPCB norms and responsibilities, The role of NGOs. 5.2 Concept of sustainable development, EIA and environmental morality. 5.3 Management Measures - Rain Water harvesting, Ground water recharge, Green Belt Development, Use of Renewable energy, water shed management, interlinking of rivers. 5.4 Role of information technology in environment and human health.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Environment	06	4	6		10
II	Energy Resources	10	4	8		16



Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
III	Ecosystem and Biodiversity	08	4	4	4	12
IV	Environmental Pollution	16	8	8	4	20
V	Social Issues and Environmental Education	08	4	4	4	12
Total		48	24	30	16	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Plant and adopt a tree in your nearby locality/Polytechnic campus and prepare report about its growth and survival after six months with photos.
- Organize seminar on air pollutants of relevant MIDC area/vehicle
- Organize poster exhibition about global warming and ozone depletion.
- Visit a nearest water purification/effluent treatment plant.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Guide student(s) in undertaking micro-projects.
- Use proper equivalent analogy to explain different concepts.
- Use Flash/Animations to explain various topics.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so



that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

- a. Prepare a report on visit to PUC Center.
- b. Visit a near by RO plant and prepare detail technical report.
- c. Prepare report on Household water filtration unit
- d. Prepare a list of polluted natural resources which are responsible for pollution and collect information on how to manage them .
- e. **Collection of Data from Hospital:** Collect everyday information on percentage of solid hazardous and toxic waste for two month
- f. **Visit of Municipal Effluent Treatment Plant:** Visit effluent treatment plant and prepare report on waste management.
- g. **Visit of Water Treatment Plant:** Visit water treatment plant and prepare report on various units of water treatment and its management.
- h. **Preparation of report:** Prepare the chart of solid waste management showing effects on environment.
- i. **And any other relevant topic related to course**

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Basic Environmental Sciences	Michael Allaby	Routledge Publication, 2 nd Edition, 2000, ISBN: 0-415-21176-X
2	Environmental Science	Y. K. Singh	New Age International Publishers, 2006, ISBN: 81-224-2330-2
3	Environmental Studies	Erach Bharucha	University Grants Commission, New Delhi
4	Environmental Studies	Rajagopalan	Third Edition, Oxford University Press, USA, ISBN: 9780199459759, 0199459754
5	A text book of Environmental Science	Arvind Kumar	APH Publishing New Delhi
6	A text book of Environmental Studies	Shashi Chawla	Tata Mc Graw-Hill New Delhi

14. SOFTWARE/LEARNING WEBSITES

- a. www.eco-prayer.org
- b. www.teriin.org
- c. www.cpcb.nic.in



- d. www.indiaenvironmentportal.org.in
- e. www.whatis.techtarget.com
- f. www.sustainabledevelopment.un.org
- g. www.conserve-energy-future.com



Program Name : Computer Engineering Program Group
Program Code : CO/CM/IF/CW
Semester : Fifth
Course Title : Advanced Java Programming
Course Code : 22517

1. RATIONALE

Java technology is widely used for web applications development. Based on the object oriented concepts and core Java concepts, this course will equip the students with the required knowledge and skill of object oriented programming approach needed for the development of robust, powerful web applications. Through this course students will get hands-on experience on GUI Technologies viz. AWT and Swings, event handling mechanisms and network programming. The course also gives coverage to various web applications aspects like Database Interaction, server side components and servlets.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Develop web and stand-alone applications using advanced concepts of Java.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Develop programs using GUI Framework (AWT and Swing).
- Handle events of AWT and Swings components.
- Develop programs to handle events in Java Programming.
- Develop Java programs using networking concepts.
- Develop programs using database.
- Develop programs using Servlets.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	1	2	6	90 Min	70*#	28	30*	00	100	40	25#	10	25	10	50	20

(*): Under the theory PA; Out of 30 marks, 10 marks of theory PA are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: **L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** -Practical; **C** – Credit, **ESE** -End Semester Examination; **PA** - Progressive Assessment.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the



course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

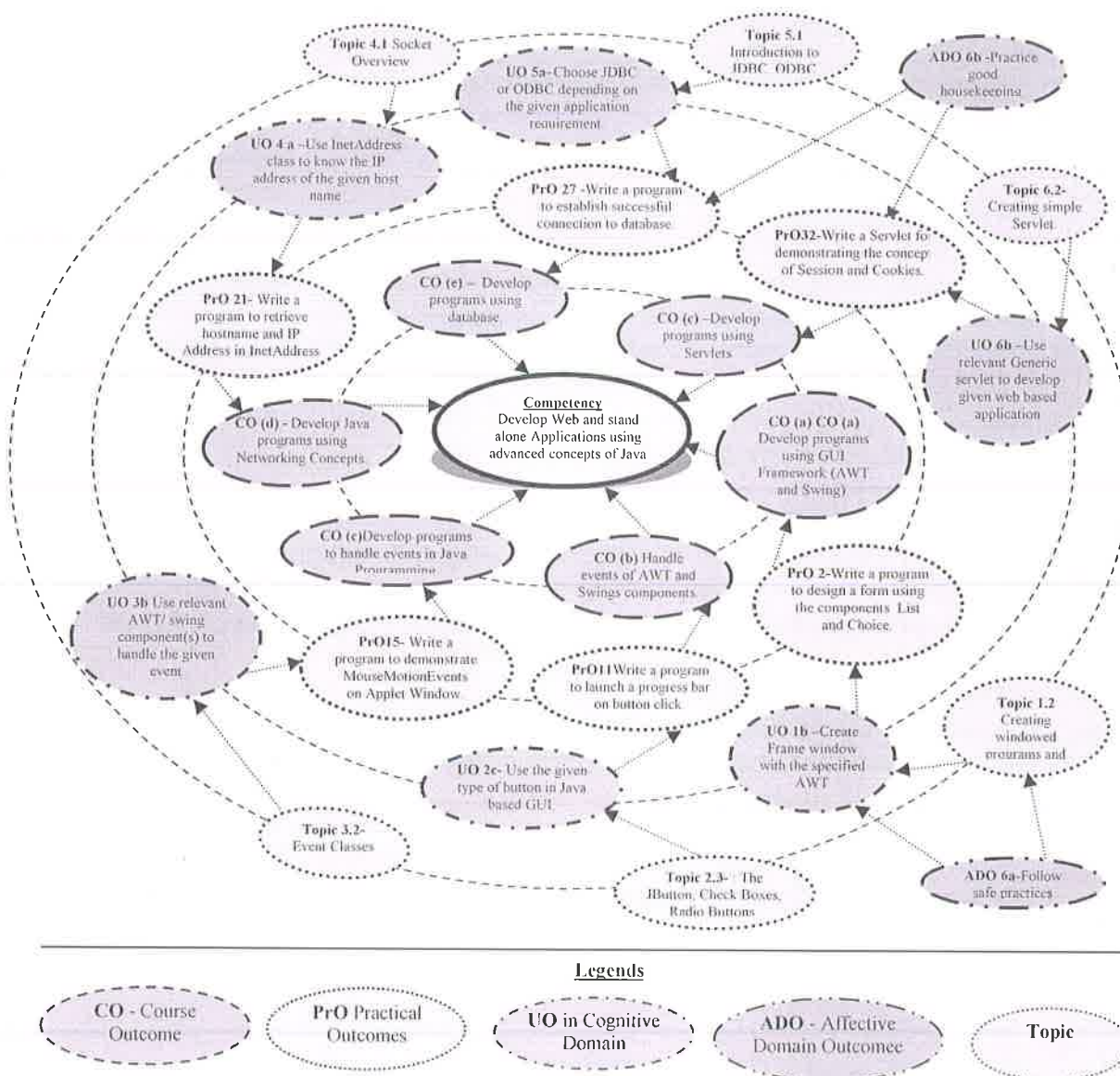


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs(i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1.	Write a program to demonstrate the use of AWT components like Label, Textfield, TextArea, Button, Checkbox, RadioButton etc.	I	02*
2.	Write a program to design a form using the components List and Choice.	I	02*
3.	Write a program to design simple calculator with the use of GridLayout	I	02*
4.	Write a program to create a two-level card deck that allows the user to select component of Panel using CardLayout	I	02*
5.	Write a program using AWT to create a menubar where menubar contains menu items such as File, Edit, View and create a submenu	I	02*



Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	under the File menu: New and Open.		
6.	Write a program using swing to display a ScrollPane and JComboBox in an Applet with the items – English, Marathi, Hindi, Sanskrit.	II	02*
7.	Write a program to create a Jtree.	II	02*
8.	Write a program to create a JTable.	II	02
9.	Write a program to launch a JProgressBar	II	02
10.	Write a program to demonstrate status of key on Applet window such as KeyPressed, KeyReleased, KeyUp, KeyDown	III	02*
11.	Write a program to demonstrate various mouse events using MouseListener and MouseMotionListener interface	III	02*
12.	Write a program to demonstrate the use of JTextField and JPasswordField using Listener Interface	II	02*
13.	Write a program to demonstrate the use of WindowAdapter class.	III	02
14.	Write a program to demonstrate the use of InetAddress class and its factory methods.	IV	02*
15.	Write a program to demonstrate the use of URL and URLConnection class and its methods	IV	02*
16.	Write a program to implement chat Server using ServerSocket and Socket class.	IV	02
17.	Write a program to demonstrate use of DatagramSocket and Datagram Packet	IV	02
18.	Write a program to insert and retrieve the data from database using JDBC	V	02*
19.	Write a program to demonstrate the use of PreparedStatement and ResultSet interface	V	02
20.	Write a program to update and delete a record from a database table.	V	02
21.	Write a program to demonstrate the use of HttpServlet as a parameterized Servlet	VI	02
22.	Write a Servlet program to send username and password using HTML forms and authenticate the user	VI	02*
23.	Write a program to create Session using HttpSession class	VI	02
24.	Write a program to implement Session tracking using Cookies.	VI	02

Note

- A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 14 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Application Level' of Bloom's Taxonomy as generally required by the industry.
- It is advisable to conduct 50% of the practicals using ASCII text editor and compilation on command prompt so as to enhance fundamental understanding of basic concepts and syntax. The IDEs must be Introduced at later stage.
- The 'Process' and 'Product' related skills associated with each PrO are to be assessed according to a suggested sample given below:



Sr. No.	Performance Indicators	Weightage in %
1	Logic Building and Coding	50
2	Testing and Debugging of the Program.	30
3	Correctness of ProgramOutput.	10
4	Submission of practical assignment in time.	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Work as a leader/a team member.
- Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year and
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrONo.
1	Computer with JDK1.5 or above ,any IDE for Java Programming such as Eclipse, Jcreator, NetBeans.	All
2	Databases like MySQL, Oracle, MS-Access or any other	18,19,20
3	Apache Tomcat web server version 7 or higher.	21-24

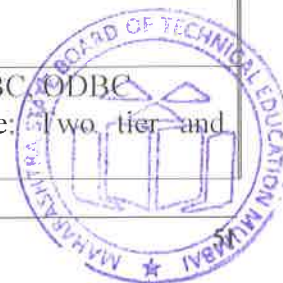
8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Abstract Windowing Toolkit(AWT)	1a. Develop Graphical user interface (GUI) programs using AWT components for the given problem. 1b. Create Frame window with the specified AWT components. 1c. Arrange the GUI components using specified layout manager. 1d. Develop a program using menu and Dialog Boxes for the given problem.	1.1 Component, container, window, frame, panel. 1.2 Creating windowed programs and applets. 1.3 AWT controls and layout managers: use of AWT controls: labels, buttons, checkbox, checkbox group, scroll bars, text field, text area. 1.4 Use of layout managers: flowLayout, BorderLayout.



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		gridLayout, cardLayout, gridbagLayout, menubars, menus, dialog boxes, file dialog.
Unit-II Swings	2a. Differentiate between AWT and Swing on the given aspect. 2b. Develop Graphical user interface (GUI) programs using swing components for the given problem. 2c. Use the given type of button in Java based GUI. 2d. Develop Graphical user interface (GUI) programs using advanced swing components for the given problem.	2.1 Introduction to swing: Swing features, Difference between AWT and Swing. 2.2 Swing Components: JApplet, Icons and Labels, Text Fields, Combo Boxes. 2.3 Buttons: The JButton, Check Boxes, Radio Buttons. 2.4 Advanced Swing Components: Tabbed Panes, Scroll Panes, Trees, Tables, Progress bar, tool tips. 2.5 MVC Architecture.
Unit- III Event Handling	3a. Use delegation event model to develop event driven program for the given problem. 3b. Use relevant AWT/ swing component(s) to handle the given event. 3c. Use Adapter classes in Java program to solve the given problem. 3d. Use inner classes in java program to solve the given problem.	3.1 The delegation Event Model: Event sources, Event listeners 3.2 Event classes: The Action Event class, the Item Event class, the Key Event class, the Mouse Event class, the Text Event class, the Window Event class. 3.3 Adapter classes. 3.4 Inner classes. 3.5 Event listener interfaces: ActionListener Interface, ItemListener Interface, KeyListener Interface, MouseListener Interface, MouseMotion Interface, TextListener Interface, WindowListener Interface.
Unit- IV Networking Basics	4a. Use InetAddress class to know the IP address of the given host name. 4b. Use URLConnection classes to read and write data to the specified resource referred by the given URL. 4c. Develop program for Client/Server communication through TCP/IP Server sockets for the given problem. 4d. Write program to illustrate the Client/Server communication using datagram protocol for the given problem.	4.1 Socket Overview: Client/Server, Reserved Sockets, Proxy Servers, Internet Addressing. 4.2 Java and the Net: The Networking Classes and interfaces. 4.3 InetAddress: Factory Methods, Instance Methods. 4.4 TCP/IP Client Sockets: Whois 4.5 URL: Format, The URI Class. 4.6 URLConnection: TCP/IP Server Sockets. 4.7 Datagrams: DatagramPacket, Datagram Server and Client.
Unit -V Interacting with	5a. Choose JDBC or ODBC depending on the given application requirement.	5.1 Introduction to JDBC, ODBC 5.2 JDBC Architecture: two tier and three tier models



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Database	5b. Explain function of the given tier of JDBC architecture for two tier/three tier models. 5c. Use relevant type of JDBC Driver for the specified environment. 5d. Elaborate steps with example to establish connectivity with the specified database.	5.3 Types of JDBC Drivers 5.4 Driver Interfaces and Driver Manager class: Connection Interface, Statement Interface, PreparedStatement Interface, ResultSet Interface 5.5 The essential JDBC Program
Unit –VI Servlets	6a. Explain function of the given method of Servlet life cycle. 6b. Use relevant Generic servlet to develop given web based application. 6c. Use relevant HTTP servlet to develop specified web based application. 6d. Develop servlet for cookies and session tracking to implement the given problem.	6.1 The Life Cycle of a Servlet 6.2 Creating simple Servlet: The Servlet API, javax.servlet Package, Servlet Interface, ServletConfig Interface, ServletContext Interface, ServletRequest Interface, ServletResponse Interface, GenericServlet Class 6.3 The javax.servlet.http package: HttpServletRequest Interface, HttpServletResponse Interface, HttpSession Interface, Cookie Class, HttpServlet Class, HttpSessionEvent Class, HttpSessionBindingEvent Class. 6.4 Handling HTTP Requests and Responses Handling HTTP GET Requests Handling HTTP POST Requests. 6.5 Cookies and Session Tracking.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Abstract Windowing Toolkit (AWT)	08	02	04	06	12
II	Swings	08	02	02	06	10
III	Event Handling	08	02	02	08	12
IV	Networking Basics	06	02	04	04	10
V	Interacting with Database	08	02	04	06	12
VI	Servlets	10	04	04	06	14
Total		48	14	20	36	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)



Note: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of LOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare journals based on practical performed in laboratory.
- Follow coding standards.
- Develop variety of programs to improve the logical skills.
- Develop Application oriented real world programs.
- Prepare power point presentation depicting different advanced concepts in Java.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Use different Audio Visual media for Concept understanding.
- Guide student(s) in undertaking micro-projects.
- Demonstrate students thoroughly before they start doing the practice.
- Observe continuously and monitor the performance of students in Lab.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

- Energy Billing System: Expected to develop bill amount module based on usage of energy consumption.



- b) Medical Store stock Management System: Expected to develop an Inventory module.
- c) Library book issue Management System.
- d) Restaurant Management System: Expected to develop a module to place an order and generate bill.
- e) Online Bus ReservationSystem: Expected to develop Ticket booking module.

Follow the below given guidelines for micro projects:

- i. Must implement concepts of AWT or SWING andEvent Handling.
- ii. UseJDBC concepts.
- iii. UseServlet.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	Complete Reference	Schildt, Herbert	Mcgraw Hill Education, New Delhi ISBN:9789339212094
2.	Java 2 Programming Black Book	Holzner, Steven et al.	Dreamtech Press, New Delhi ISBN 10: 817722655X/ ISBN 13: 9788177226553
3.	Java Server Programming Tutorial JAVA EE6 Black Book	Kogent Learning Solutions	Dreamtech Press, New Delhi ISBN :978-81-7722-937-0

14. SOFTWARE/LEARNING WEBSITES

- a) <https://www.tutorialspoint.com/java>
- b) <http://nptel.ac.in/courses/106105084/30>
- c) <https://www.javatpoint.com/servlet-tutorial>
- d) <https://www.tutorialspoint.com/servlets>
- e) <https://www.javatpoint.com/free-java-projects>
- f) <http://1000projects.org/java-projects.html>



Program Name : Computer Engineering Program Group
Program Code : CO/CM/IF/CW
Semester : Fifth
Course Title : Operating System
Course Code : 22516

1. RATIONALE

An Operating System is basically a system program that controls the execution of application programs and acts as an interface between applications and the computer hardware. It manages the computer system resources to be used in an efficient manner. This course enables to learn internal functioning of operating system and will help in identifying appropriate Operating System for given applications/task. This course is also a prerequisite for the group of courses included in 'Cloud Infrastructure Maintenance' Elective group.

2. COMPETENCY

The aim of this course is to help the students to attain the following industry identified competency through various teaching learning experiences:

- **Manage operations of Operating System.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Install operating system and configure it.
- Use operating system tools to perform various functions.
- Execute process commands for performing process management operations.
- Apply scheduling algorithms to calculate turnaround time and average waiting time.
- Calculate efficiency of different memory management techniques.
- Apply file management techniques.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20

(*): Under the theory PA; Out of 30 marks, 10 marks of theory PA are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: **L**-Lecture; **T**– Tutorial/Teacher Guided Theory Practice; **P** - Practical; **C** – Credit, **ESE** - End Semester Examination; **PA** - Progressive Assessment

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the



course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

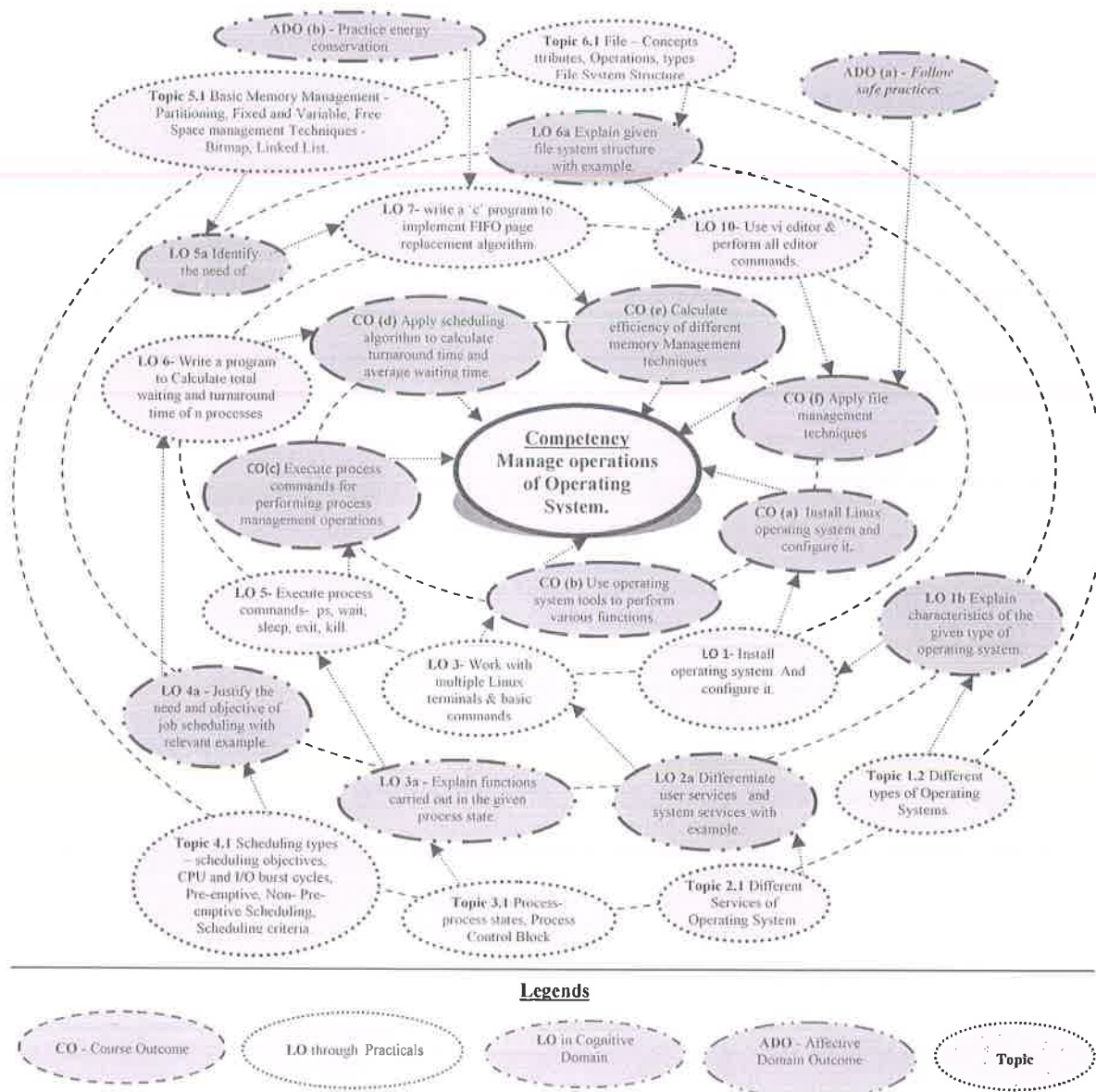


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency:

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1.	Install and configure Linux (or alike) operating system.	I	02*
2.	Execute general purpose commands date, time, cal, clear, banner, tty, script, man.	I	02*
3.	Work with multiple linux terminals and basic commands: who, who am I, login, passwd, su, pwd.	II	02*
4.	a) Use Operating services(Editor, GUI, File handling.)	II	02*



Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	b) Run commands to start, stop, and restart the specified service in Linux.		
5.	Execute process commands- ps, wait, sleep, exit, kill.	III	02*
6.	Write a program to calculate total waiting and turnaround time of n processes with First Come First Serve CPU scheduling algorithm.	IV	02
7.	Write a 'C' program to implement FIFO page replacement algorithm.	V	02
8.	Execute file and directory manipulation commands – ls, rm, mv, cp, join, split, cat (file saving and redirection operator), head, tail, touch,	VI	02*
9.	Execute file and directory manipulation commands – diff, comm., pr, chmod, mkdir, rmdir, cd, pwd, dir, cmp. (Use wild card character).	VI	02*
10.	Execute text processing tr, wc, cut, paste, spell, sort, grep, more.	VI	02*
11.	Use vi editor and perform all editor commands.	VI	04*
12.	Write and execute Shell Script by using following Control statements features- "if" statement	VI	02*
13.	Write and execute Shell Script by using following Control statements features- "for" statement, exit, break, continue	VI	02*
14.	Write Shell script to find out whether - Given file exists?	VI	02
15.	Write Shell script to find out whether - File has read, write, and execute permissions?	VI	02*
Total			32

Note

- In the above listed example wherever **Linux** as operating system is mentioned, it could be replaced with other alike operating systems such as **Ubuntu, CentOS** or any other OS.
- A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Application Level' of Bloom's Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO are to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
a.	Installation/configuration of operating system	25
b.	Correctness of Executing various commands	25
c.	Writing and executing programs to get desired output	20
d.	Debugging the program	15
e.	Submit journal report in time	15
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.



- c. Demonstrate working as a leader/a team member.
- d. Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year and
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

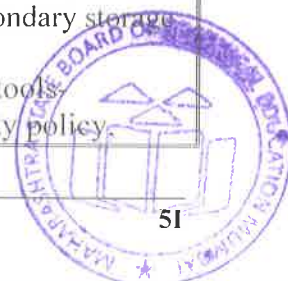
The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO S. No.
1	Computer system (Any computer system with basic configuration)	All
2	Linux or alike operating system such as Ubuntu, CentOS or any other.	

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Overview of Operating System	1a. Explain the functioning of given component of OS. 1b. Explain characteristics of the given type of operating system. 1c. Identify type of operating system suitable for the given type of application. 1d. Execute command on command line for the given task.	1.1 Operating System – Concept, Components of operating system, operations of OS: Program Management, Resource management, Security and protection. Views of OS: User view, System View 1.2 Different Types of Operating systems- Batch operating system, Multi Programmed, Time Shared OS, Multiprocessor Systems, Distributed Systems, Real time systems. Mobile OS (Android,iOS). 1.3 Command line based OS – DOS, UNIX GUI based OS –WINDOWS, LINUX.
Unit– II Services and Component s of Operating System	2a. Start, stop, and restart the given service in Linux. 2b. Explain use of the given System call of specified OS. 2c. Explain process the OS follows in managing the given resource. 2d. Explain use of the given operating system tool.	2.1 Different Services of Operating System. 2.2 System Calls- Concept, types of system calls 2.3 OS Components: - Process Management, Main Memory Management, File Management, I/O System management, Secondary storage management. 2.4 Use of operating system tools- user management, security policy.



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		device management, performance monitor, task scheduler
Unit- III Process Managem nt	3a. Explain functions carried out in the given process state. 3b. Describe the function of the given component of process stack in PCB. 3c. Explain characteristics of the given multithreading model. 3d. Describe method of executing the given process command with example.	3.1 Process:- process states, Process Control Block (PCB). 3.2 Process Scheduling- Scheduling Queues, Schedulers, Context switch. 3.3 Inter-process communication (IPC): Introduction, shared memory system and message passing system. 3.4 Threads - Benefits, users and kernel threads, Multithreading Models - Many to One, One to One, Many to Many. 3.5 Execute process commands- like ps, wait, sleep, exit, kill
Unit-IV CPU Scheduling and Algorithms	4a. Justify the need and objective of given job scheduling criteria with relevant example. 4b. Explain with example the procedure of allocating CPU to the given process using the specified OS. 4c. Calculate turnaround time and average waiting time of the given scheduling algorithm. 4d. Explain functioning of the given necessary condition leading to deadlock.	4.1 Scheduling types – scheduling Objectives, CPU and I/O burst cycles, Pre-emptive, Non- Pre-emptive Scheduling, Scheduling criteria. 4.2 Types of Scheduling algorithms - First come first served (FCFS), Shortest Job First (SJF), Shortest Remaining Time(SRTN), Round Robin (RR) Priority scheduling, multilevel queue scheduling. 4.3 Deadlock - System Models, Necessary Conditions leading to Deadlocks, Deadlock Handling - Preventions, avoidance.
Unit –V Memory Managem ent	5a. Describe the working of specified memory management function. 5b. Explain characteristic of the given memory management techniques. 5c. Write algorithm for the given page replacement technique. 5d. Calculate Page fault for the given page reference string.	5.1 Basic Memory Management - Partitioning, Fixed and Variable, Free Space management Techniques - Bitmap, Linked List. 5.2 Virtual Memory – Introduction to Paging, Segmentation, Fragmentation, and Page fault. 5.3 Page Replacement Algorithms: FIFO, LRU, Optimal.
Unit-VI File Managem ent	6a. Explain structure of the given file system with example. 6b. Describe mechanism of the given file access method. 6c. Explain procedure to create and access directories and assign the given files access permissions. 6d. Explain features of the given Raid level structure of hard disk.	6.1 File – Concepts, Attributes, Operations, types and File System Structure. 6.2 Access Methods – Sequential, Direct, Swapping, File Allocation Methods- Contiguous, Linked, Indexed. 6.3 Directory structure— Single level, two levels, tree-structured directory, Disk Organization and disk Structure- Physical structure, Logical structure, Raid structure of disk, raid level 0 to 6.



Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Overview of Operating System	06	02	02	04	08
II	Services and Components of Operating System	06	02	04	04	10
III	Process Management	10	02	04	08	14
IV	CPU Scheduling and Algorithms	10	02	04	08	14
V	Memory Management	10	02	04	08	14
VI	File Management	06	02	04	04	10
Total		48	12	22	36	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of LOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

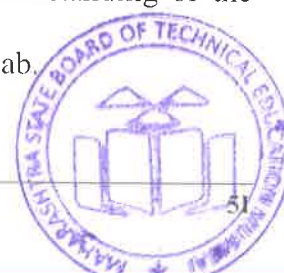
Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare journal of practicals.
- Undertake micro-projects.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Guide student(s) in undertaking micro-projects.
- Demonstrate students thoroughly before they start doing the practice.
- Encourage students to refer different websites to have deeper understanding of the subject.
- Observe continuously and monitor the performance of students in Lab.



12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

- Create a report depicting features of different types of Operating systems- Batch operating system, Multi Programmed, Time Shared, Multiprocessor Systems, , Real time systems. Mobile OS with example.
- Make a comparative statement to calculate page fault for given page reference string by using different page replacement algorithms.
- Prepare help guide using shell script for all the major Linux commands.
- Make a comparative chart to calculate total waiting and turnaround time of n processes with different CPU scheduling algorithm.

Any other micro-projects suggested by subject faculty on similar line.

(Use features of 'C' or shell scripts to develop above listed applications)

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Operating System Concepts	Silberschatz, Galvin	John Wiley and Sons, Ninth Edition, 2015, ISBN: 978-51-265-5427-0
2	Operating System	Godbole, Achyut S.	Tata McGraw Hill Education, 2015, ISBN: 9780070591134
3	Operating Systems: Internals and Design Principles	Stallings, William	Pearsons, 8 edition 2015 ISBN: 978-0133805918
4	Unix Concept and Programming	Das, Sumitabha	McGraw Hill education, 2015, ISBN: 978-0070635463
5	Operating System	Dhamdhere, Dhanjay M.	McGraw Hill, 2015 ISBN MO 978-1-25-900558-9
6	Operating System	Dr. Rajendra Kawale	Devraj Publications, Mumbai ISBN 978-81-933551-1-4

14. SOFTWARE/LEARNING WEBSITES

- www.cs.wisc.edu/~bart/537 lecture notes-University of Wisconsin Madison.
- www.cs.kent.edu/osf/o3/notes/index.html- Vilinius Gediminas Technical University
- <http://www.howstuffworks.com/operating-system1.htm>
- www.computerhope.com/jargon/o/os.htm
- www.en.wikipedia.org/wiki/Operating_system
- <https://www.cs.uic.edu/~jbell/CourseNotes/OperatingSystems/12-MassStorage.html>





Program Name : Computer Engineering Program Group
Program Code : CO/CM/CW
Semester : Fifth
Course Title : Software Testing
Course Code : 22518

1. RATIONALE

In today's software environment writing bug-free code is challenging task, which make software testing important tool to get the quality software. Testing techniques include the process of executing a program or application with the intent of finding software bugs and verifying that the software product is fit for use. Students will learn the way to find bugs by applying types, levels and methods of software testing on applications with effective test planning approach. It also covers manual testing.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Apply types, levels and methods of software testing on applications.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Apply various software testing methods.
- Prepare test cases for different types and levels of testing.
- Prepare test plan for an application.
- Identify bugs to create defect report of given application.
- Test software for performance measures using automated testing tools.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20

(*): Under the theory PA; Out of 30 marks, 10 marks of theory PA are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the



course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

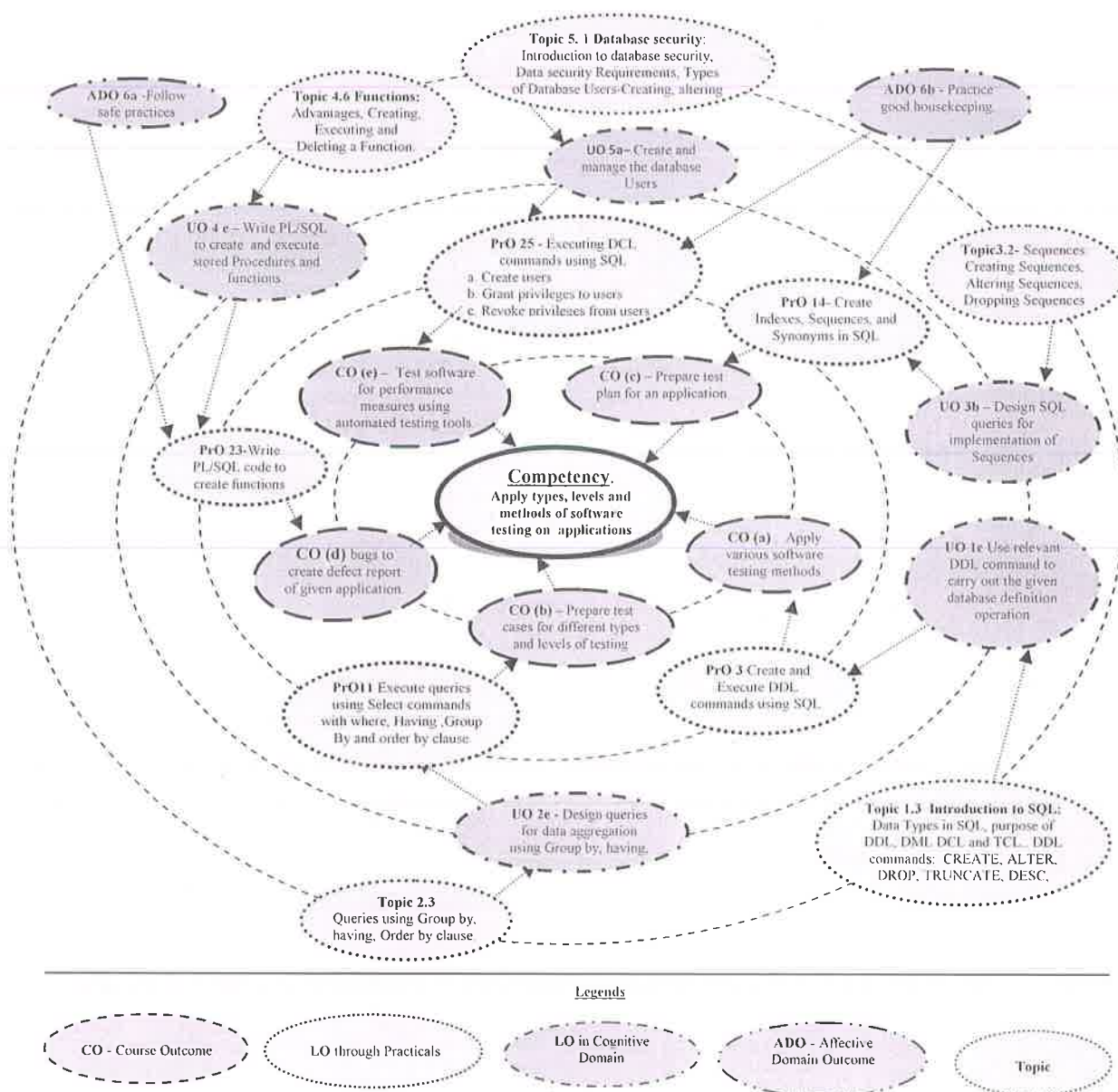


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Identify system specification & design test cases for purchase order Management.	I	02*
2	Identify system specification & design test cases for Inventory management	I	02*
3	Design test cases for simple calculator application.(BB Testing)	I	02*
4	Design test cases for railway reservation form	II	02*
5	Design test cases for e-commerce (Flipkart, Amazon) login form	II	02*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
6	Design test cases for Web Pages Testing any Web Sites	II	02*
7	Write program and design test cases for the following Control and decision making statement. 1) For... Loop 2) Switch...case 3) Do...While 4) If...else	II	02*
8	Prepare test plan for an identified Mobile application.	III	02*
9	Design test plan and test cases for Notepad (MS Window based) Application.	III	02*
10	Prepare defect report after executing test cases for library management system	IV	02*
11	Prepare defect report after executing test cases for Withdrawn of amount from ATM Machine.	IV	02
12	Prepare defect report after executing test cases for any login form.	IV	02
13	Design and run test cases for WordPad (MS Windows based). Using an Automated tool.	V	02*
14	Design and run test cases for MS Word application using an Automation Tool.	V	02
15	Project Assignment		04*
	Total		32

Note

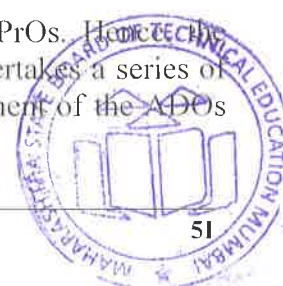
- A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Preparation of system specification, designing test plan using MS Excel.	50
2	Preparation of defect report	10
3	Execution of test cases using automation tool.	20
4	Answer to sample questions	10
5	Submit report in time	10
	Total	100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Work as a leader/a team member.
- Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs



according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year and
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO S. No.
1.1	Computer system (Any computer system with basic configuration)	All
1.2	Selenium	V
1.3	Mantis Bug Tracker	IV
1.4	IBM Rational Functional Tester	V
1.5	Spreadsheet Package	I, II, III
1.6	Bugzilla	IV

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Basics of Software Testing and Testing Methods	1a. Identify errors and bugs in the given program. 1b. Prepare test case for the given application. 1c. Describe the Entry and Exit Criteria for the given test application. 1d. Validate the given application using V model in relation with quality assurance. 1e. Describe features of the given testing method.	1.1 Software Testing, Objectives of Testing. 1.2 Failure, Error, Fault, Defect, Bug Terminology. 1.3 Test Case, When to Start and Stop Testing of Software (Entry and Exit Criteria). 1.4 Verification and Validation (V Model), Quality Assurance, Quality Control. 1.5 Methods of Testing: Static and dynamic Testing 1.6 The box approach : White Box Testing: Inspections, Walkthroughs, Technical Reviews, Functional Testing, Code Coverage Testing, Code Complexity Testing. 1.7 Black Box Testing: Requirement Based Testing, Boundary Value Analysis, Equivalence Partitioning,
Unit– II Types and Levels of Testing	2a Apply specified testing level for the given web based application. 2b Apply Acceptance testing for given web based application. 2c Apply the given performance testing for the specified application.	2.1 Levels of testing 2.1 Unit Testing: Driver, Stub 2.2 Integration Testing: Top-Down Integration, Bottom-Up Integration, Bi-Directional Integration 2.3 Testing on Web Application: Load Testing, Performance Testing: Load Testing.

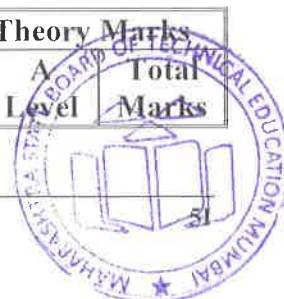


Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	2d. Generate test cases for the given application using regression and GUI testing.	Stress Testing, Security Testing. Client-Server Testing 2.4 Acceptance Testing: Alpha Testing and Beta Testing, Special Tests: Regression Testing, GUI Testing,
Unit III- Test Managem ent	3a. Prepare test plan for the given application. 3b. Identify the resource requirement of the given application. 3c. Prepare test cases for the given application. 3d. Prepare test report of executed test cases for given application.	3.1 Test Planning : Preparing a Test Plan, Deciding Test Approach, Setting Up Criteria for Testing, Identifying Responsibilities, Staffing, Resource Requirements, Test Deliverables, Testing Tasks 3.2 Test Management: Test Infrastructure Management, Test People Management. 3.3 Test Process: Base Lining a Test Plan, Test Case Specification. 3.4 Test Reporting: Executing Test Cases, Preparing Test Summary Report.
Unit-IV Defect Managem ent	4a. Classify defects on the basis estimated impact. 4b. Prepare defect template on the given application. 4c. Apply defect management process on the given application. 4d. Write procedure to find defect using the given technique.	4.1. Defect Classification, Defect Management Process. 4.2. Defect Life Cycle, Defect Template 4.3. Estimate Expected Impact of a Defect, Techniques for Finding Defects, Reporting a Defect.
Unit –V Testing Tools and Measurem ents	5a. Improve testing efficiency using automated tool for given application. 5b. Identify different testing tools to test the given application. 5c. Describe Metrics and Measurement for the given application 5d. Explain Object oriented metrics used in the given testing application	5.1 Manual Testing and Need for Automated Testing Tools 5.2 Advantages and Disadvantages of Using Tools 5.3 Selecting a Testing Tool 5.4 When to Use Automated Test Tools, Testing Using Automated Tools. 5.5 5.6 Metrics and Measurement: Types of Metrics, Product Metrics and Process Metrics, Object oriented metrics in testing.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks



Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Basics of Software Testing and Testing Method	10	04	04	06	14
II	Types and Levels of Testing	12	04	06	08	18
III	Test Management	10	04	04	06	14
IV	Defect Management	08	04	02	06	12
V	Testing Tools and Measurements	08	02	04	06	12
Total		48	18	20	32	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare journals based on practical performed in laboratory.
- Give seminar on relevant topic.
- Undertake micro-projects.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Guide student(s) in undertaking micro-projects.
- Demonstrate students thoroughly before they start doing the practice.
- Encourage students to refer different websites to have deeper understanding of the subject.
- Observe continuously and monitor the performance of students in Lab.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be individually undertaken to build up the skill and confidence in every student to become problem solver so



that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should not exceed three.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than 16 (sixteen) student engagement hours during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

- a) Library Management: book issue /book stock system.
- b) Any other micro-projects suggested by subject faculty on similar line.

13. SUGGESTED LEARNING RESOURCES :

S. No.	Title of Book	Author	Publication
1	Software Testing: Principles and Practices	Srinivasan Desikan Gopalaswamy Ramesh	PEARSON Publisher: Pearson India 2005, ISBN: 9788177581218,
2	Software Testing: Principles, Techniques and Tools	Limaye M. G.	Tata McGraw Hill Education, New Delhi., 2007 ISBN 13: 9780070139909
3	Software Testing: Principles and Practices	Chauhan Naresh	Oxford University Press Noida –
4	Software Testing	Singh Yogesh	Cambridge University Press, Bangluru. ISBN 978-1-107-65278-1

Note: Other available testing tools can be used at institute level.

14. SOFTWARE/LEARNING WEBSITES

- a. <http://www.selenium.com>
- b. http://en.wikipedia.org/wiki/Test_automation
- c. http://en.wikipedia.org/wiki/Software_testing#Testing_tools
- d. <http://www.softwaretestingsoftware.com>
- e. www.toolsqa.com



Program Name : Computer Engineering Program Group
Program Code : CO/CM/IF/CW
Semester : Fifth
Course Title : Client Side Scripting Language (Elective)
Course Code : 22519

1. RATIONALE

JavaScript is limited featured client side programming language. JavaScript runs at the client end through the user's browser without sending messages back and forth to the server. It is widely used by the web developers to do things such as build dynamic web pages, respond to events, create interactive forms, validate data that the visitor enters into a form, control the browser etc. This course helps student to create highly interactive web pages using these features.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Develop Dynamic Web Pages using JavaScript.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Create interactive web pages using program flow control structure.
- Implement Arrays and functions in Java script.
- Create event based web forms using Java script.
- Use JavaScript for handling cookies.
- Create interactive webpage using regular expressions for validations.
- Create Menus and navigations in web Pages.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25#	10	25	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P -Practical; C – Credit, ESE -End Semester Examination; PA - Progressive Assessment.

5. COURSE MAP(with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.



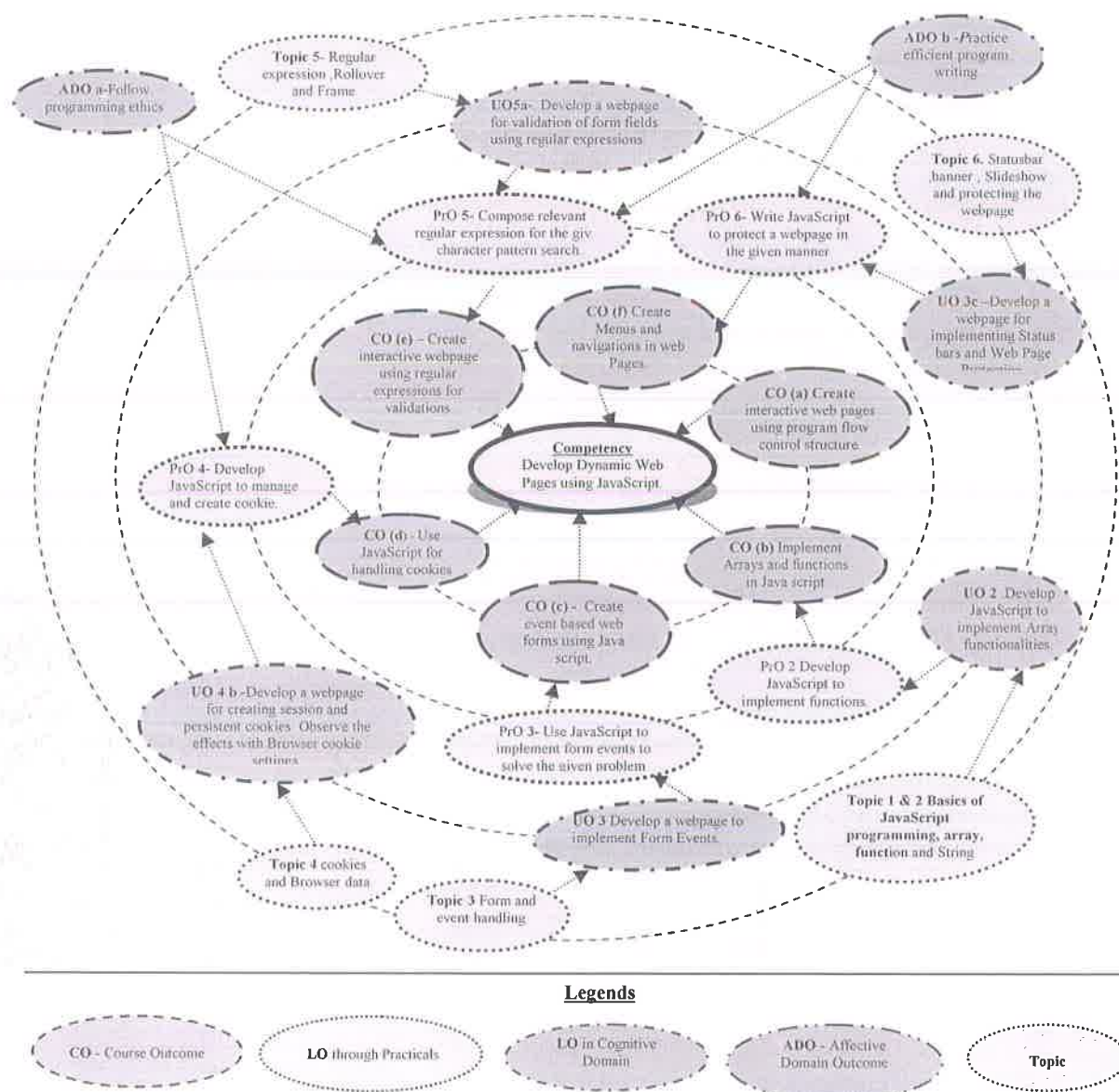


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1.	Write simple javascript with HTML for arithmetic expression evaluation and message printing	I	02
2.	Develop JavaScript to use decision making and looping statements.	I	02*
3.	Develop JavaScript to implement Array functionalities.	II	02*
4.	Develop JavaScript to implement functions.	II	02*
5.	Develop JavaScript to implement strings.	II	02
6.	Create a webpage using Form Elements.	III	02
7.	Create a webpage to implement Form Events. Part-I	III	02*



Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
8.	Create a webpage to implement Form Events. Part-II	III	02*
9.	Develop a webpage using Intrinsic Java Functions.	III	02*
10.	Develop a webpage for creating session and persistent cookies. Observe the effects with Browser cookie settings.	IV	02*
11.	Develop a webpage for placing the Window on the screen and working with child window.	IV	02*
12.	Develop a webpage for validation of form fields using regular expressions.	V	02*
13.	Create a webpage with Rollovers effect.	VI	02
14.	Develop a webpage for implementing Menus.	VI	02*
15.	Develop a webpage for implementing Status bars and Web Page Protection.	VI	02
16.	Develop a webpage for implementing Slideshow, banner.	VI	02*
Total			32

Note:

- A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Application Level' of Bloom's Taxonomy' as generally required by the industry.
- 50% of Lab assignments must be done using traditional editor and run in different browsers so as to build up fundamental understanding capabilities of students.
- The 'Process' and 'Product' related skills associated with each PrO are to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Use of relevant tags and attributes	10
2	Correctness of Coding.	40
4	Testing and Debugging of the Program.	30
5	Appearance of Program Output.	10
6	Submission of report in time.	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.



7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. S.No.
1	Browser and Notepad/any Text editor/	All
2	Free Web page Designing Tool	All
3	Any IDE like Eclipse	All

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Basics of JavaScript Programmi ng	1a. Create object to solve the given problem. 1b. Develop JavaScript to implement the switch-case statement for the given problem. 1c. Develop JavaScript to implement loop for solving the given iterative problem. 1d. Display properties of the given object using getters and setters. 1e. Develop program using basic features of JavaScript to solve the given problem.	1.1 Features of JavaScript 1.2 Object Name, Property, method, Dot syntax, main event. 1.3 Values and Variables 1.4 Operators and Expressions- Primary Expressions, Object and Array initializers, function definition expression, property access expressions, invocation expressions. 1.5 If Statement, if...else, if..elseif, nested if statement. 1.6 Switch...case statement 1.7 Loop statement – for loop, for...in loop, while loop, do...while loop, continue statement. 1.8 Querying and setting properties and deleting properties, property getters and setters.
Unit-II Array, Function and String	2a. Create array to solve the given problem. 2b. Perform the specified string manipulation operation on the given String(s). 2c. Develop JavaScript to implement the given function. 2d. Develop JavaScript to convert the given Unicode to character form. 2e. Develop JavaScript to convert the given character to Unicode and vice-versa.	2.1 Array - declaring an Array, Initializing an Array, defining an Array elements, Looping an Array, Adding an Array element, sorting an Array element, Combining an Array elements into a String, changing elements of an Array, Objects as associative Arrays 2.2 Function – defining a function, writing a function, adding an arguments, scope of variable and arguments, 2.3 Calling a function – calling a function with or without an argument, calling function from HTML, function calling another function. Returning a value from a function 2.4 String -- manipulate a string, joining a



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		string, retrieving a character from given position, retrieving a position of character in a string, dividing text, copying a sub string, converting string to number and numbers to string, changing the case of string, finding a Unicode of a character-charCodeAt(), fromCharCode().
Unit– III Form and Event Handling	3a. Write JavaScript to design a form to accept input values for the given problem. 3b. Use JavaScript to implement form events to solve the given problem. 3c. Develop JavaScript to dynamically assign specified attribute value to the given form control. 3d. Use the given intrinsic function with specified parameters.	3.1 Building blocks of a Form, properties and methods of form, button, text, text area, checkbox, radio button, select element. 3.2 Form events- mouse event, key events. 3.3 Form objects and elements. 3.4 Changing attribute value dynamically. 3.5 Changing option list dynamically 3.6 Evaluating checkbox selection 3.7 Changing a label dynamically 3.8 Manipulating form elements 3.9 Intrinsic JavaScript functions, disabling elements, read only elements.
Unit– IV Cookies and Browser Data	4a. Create cookies based on the given problem. 4b. Develop JavaScript to manage a cookie in the given manner. 4c. Write JavaScript to manipulate the specified attributes of window object in the given manner. 4d. Write JavaScript to create browser history of the given object.	4.1 Cookies – basic of cookies, reading a cookie value, writing a cookie value, creating a cookies, deleting a cookies, setting the expiration date of cookie 4.2 Browser – opening a window, giving the new window focus, window position, changing the content of window, closing a window, scrolling a web page, multiple windows at once, creating a web page in new window, JavaScript in URLs, JavaScript security, Timers, Browser location and history.
Unit –V Regular Expression, Rollover and Frames	5a. Compose relevant regular expression for the given character pattern search. 5b. Develop JavaScript to implement validations using the given regular expression. 5c. Create frames based on the given problem. 5d. Create window object as per	5.1 Regular Expression - language of regular expression, finding non matching characters, entering a range of characters, matching digits and non digits, matching punctuations and symbols, matching words, replacing a the text using regular expressions, returning the matched characters, regular expression object properties.



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	the given problem. 5e. Develop JavaScript for creating rollover effect for the given situation.	5.2 Frames – create a frame, invisible borders of frame, calling a child windows, changing a content and focus of a child window, writing to a child window, accessing elements of another child window. 5.3 Rollover – creating rollover, text rollover, Multiple actions for rollover, more efficient rollover.
Unit –VI Menus, navigation and web page protection	6a. Develop JavaScript to manage the given status bar. 6b. Develop JavaScript to create the given banner. 6c. Develop JavaScript to create the given slide show. 6d. Develop JavaScript to create the given Menu. 6e. Write JavaScript to protect a webpage in the specified manner.	6.1 Status bar- builds a static message, changing the message using rollover, moving the message along the status bar 6.2 Banner –loading and displaying banner advertisement. Linking a banner advertisement to url 6.3 Slide Show – creating a slide show 6.4 Menus- creating a pulldown menu, dynamically changing a menu, validating menu selection, Floating menu, chain select menu, tab menu, pop-up menu, sliding menu, highlighted menu, folding a tree menu, context menu, scrollable menu, side bar menu. 6.5 Protecting web page – hiding your code, disabling the right mouse button, JavaScript, concealing email address. 6.6 Frameworks of javascript and its application

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Basics of JavaScript Programming	10	04	04	04	12
II	Array, Function and String	10	02	04	08	14
III	Form and Event Handling	06	02	04	04	10
IV	Cookies and Browser Data	06	02	02	04	08
V	Regular Expression, Rollover & Frames	08	02	06	06	14
VI	Menus, navigation and web page protection	08	02	04	06	12
Total		48	14	24	32	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)



Note: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

- a) Prepare journals based on practical performed in laboratory.
- b) Prepare powerpoint presentation or animation for understanding different Client side scripting Concepts.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- a) Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- b) '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c) About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d) With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- e) Use different Audio Visual materials for Concept understanding.
- f) Guide student(s) in undertaking micro-projects.
- g) Encourage students to refer different websites to have deeper understanding of the subject.
- h) Observe continuously and monitor the performance of students in Lab.
- i) 50% of Lab assignments must be done using traditional editor and run in different browsers so as to build up fundamental understanding capabilities of students.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:



- a) Create a web page that displays buyers information entry form containing name, address, city, pin code, mail Id, Phone Number, product details , payment mode. Frame different validation rules for user inputs. Use JavaScript and regular expressions to perform error checking on user input as per validation rules.
- b) Build a simple slide show in JavaScript with six unique images. Design appropriate web page with at least two sections: with slide show in one section. When any image on this slide show is clicked display information about it in other section. Use features for controlling window locations.
- c) Design and create web pages of an institute with different sections. Use pulldown menus in one section and implement validation of menu selections. Use other sections for displaying information about respective selected menu item.
- d) Create a simple animation in JavaScript : create a basic page showing circle of white marble. Using the setTimeout() method create an animation on the page that that makes an orange marble rotate around this circle by moving the orange marble to the next location in the circle every second. Allow the user to stop the animation by placing the cursor on any marble(use clearTimeout()).

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	JavaScript Demystified	Keogh, Jim	McGraw-Hill, 2015, New Delhi ISBN:0-07-060347-2
2.	Beginning JavaScript	Wilton, Paul	Wily India, New Delhi, 2015, ISBN:0-7645-5587-1
3.	Beginning JavaScript	McPeak, Jeremy and Wilton, Paul	Wily India, New Delhi, 2015, ISBN:81-265-1304-7
4.	JavaScript in 24 hours (SAMS teach yourself)	Moncur, Michael	TechMedia, New Delhi, 2015, ISBN:978-0-672-33608-9

14. SOFTWARE/LEARNING WEBSITES

- a) <https://www.w3schools.com>
- b) <http://www.nptelvideos.com>
- c) <http://www.tutorialspoint.com>.
- d) <Http://javapoint.com>



Program Name : Computer Engineering Program Group
Program Code : CO/CM/IF/CW
Semester : Fifth
Course Title : Advanced Computer Network (Elective)
Course Code : 22520

1. RATIONALE

The modern computer network includes different routing protocols and applying the concepts of network, transport and application layer protocols. In order to work with existing technology in building large, complex networked systems, students must be acquainted with the principles, architectures, and protocols used in modern networked systems. This course covers advanced computer network protocols, and advanced principles of the design of computer networks. After completing this course students will be able to configure various TCP/IP protocols at different layers.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Configure network protocols at different layers of TCP/IP protocol set.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Implement Network Layer Protocols.
- Configure IPv6 Network.
- Choose routing protocol in the given network situation.
- Implement different Transport Layer Protocols.
- Configure various Application Layer Protocols.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme													
L	T	P		Theory								Practical					
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
3	-	2	5	3	70	28	30*	00	100	40	25#	10	25	10	50	20	

(*): Under the theory PA; Out of 30 marks, 10 marks of theory PA are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: **L**-Lecture; **T**– Tutorial/Teacher Guided Theory Practice; **P** - Practical; **C** – Credit, **ESE** - End Semester Examination; **PA** - Progressive Assessment.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the



course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

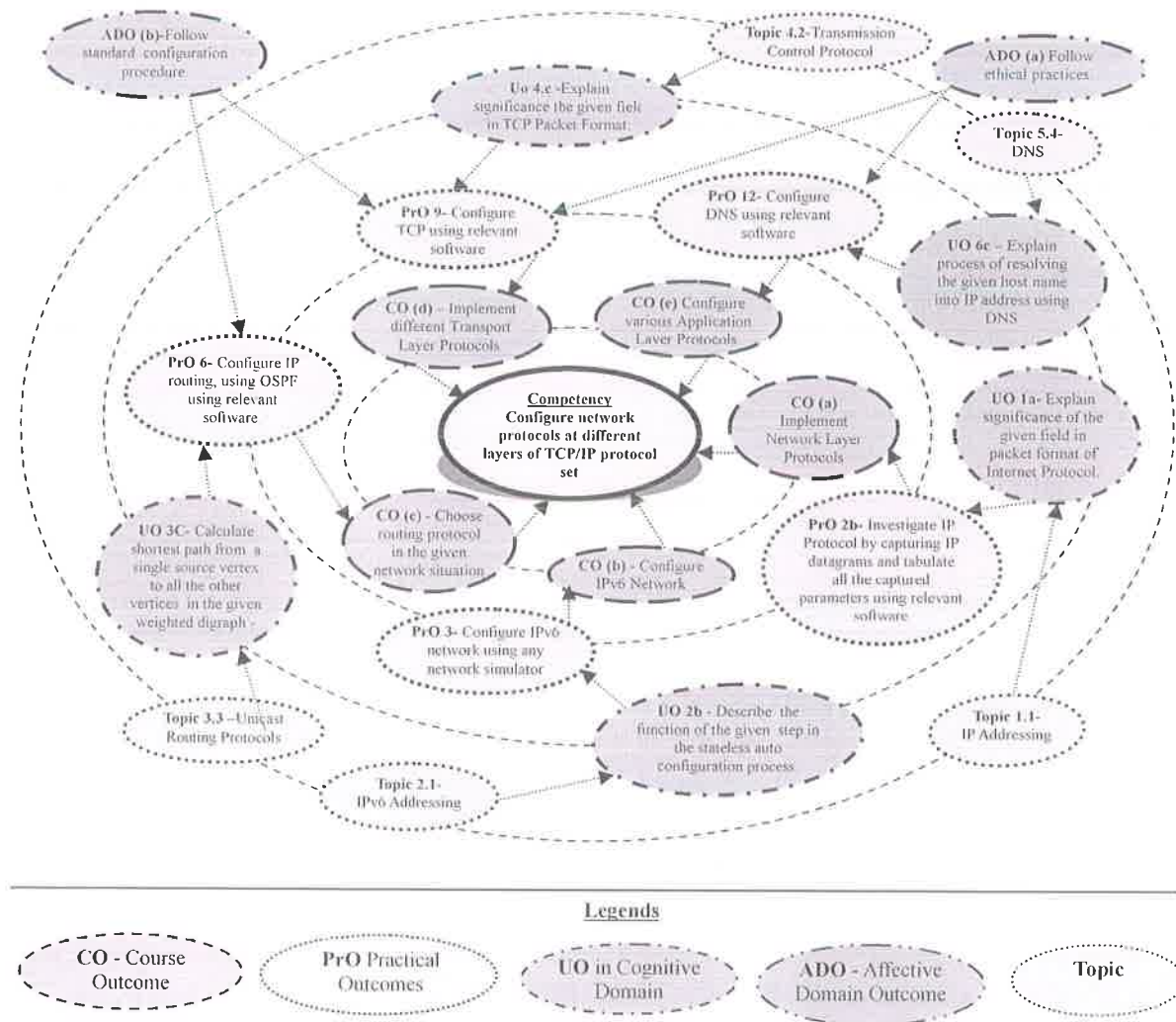


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1.	<p>Given an IP address, network mask, and subnetwork mask, determine other information and implement it. about the IP address such as:</p> <ol style="list-style-type: none"> The subnet address of this subnet. The broadcast address of this subnet. The range of host addresses for this subnet. The maximum number of subnets for this subnet mask. The number of hosts for each subnet. The number of subnet bits. 	I	2

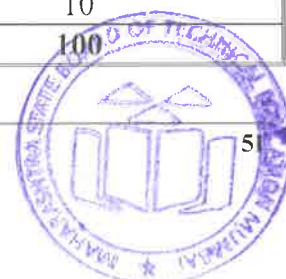


S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	vii. The number of this subnet.		
2.	a. Capture ICMPv4 packets generated by utility programs like ping, traceroute and tabulate all the captured parameters using relevant software. b. Investigate IP Protocol by capturing IP datagrams and tabulate all the captured parameters using relevant software	I	2*
3.	Configure IPv6 network using any network simulator.	II	2*
4.	Configure IP static routing using relevant software.	III	02
5.	Configure IP routing with RIP using relevant software.	III	02*
6.	Configure IP routing with OSPF using relevant software	III	02*
7.	Configure User Datagram Protocol (UDP) Part-I using relevant software.	IV	02*
8.	Configure User Datagram Protocol (UDP) Part-II using relevant software.	IV	02*
9.	Configure Transmission Control Protocol (TCP) using relevant software.	IV	02*
10.	Run different STCP commands.	IV	02
11.	Configure Dynamic Host Configuration Protocol (DHCP) using relevant software.	V	02*
12.	Configure Domain Name Server (DNS) using relevant software.	V	02*
13.	a. Configure File Transfer Protocol (FTP) using relevant software. b. Configure Hypertext Transfer Protocol (HTTP) using relevant software.	V	02*
14.	a. Use Telnet to login a remote machine. b. Connect remote machine using Secure Shell (SSH).	V	02*
15.	Configure SMTP, POP3 and IMAP using relevant software.	V	02*
16.	Configure MIME and SNMP using relevant software.	V	02
	Total		32

Note

- A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practicals need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Application Level' of Bloom's Taxonomy as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO are to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1.	Completion of given task.	25
2.	Correctness of the given task.	50
3.	Answer to sample questions.	15
4.	Submit report in time.	10
	Total	100



The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Work as a leader/a team member.
- Follow standard configuration procedures.
- Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year and
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO S. No.
1	Computer system (Any computer system with basic configuration, connected to LAN)	All
2	Wireshark or any other similar software to capture and investigate packets	1, 2
3	Cisco Packet Tracer or any other similar software	3 to 16

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Network Layer and Protocols	1a. Explain significance of the given field in the packet format of Internet Protocol. 1b. Implement IP addressing for the given network. 1c. Explain significance of the given field in packet format of ICMPv4. 1d. Explain the given inefficiency in Mobile IP.	1.1 IP Addressing: Address Space, Notations, Classfull addressing, Classless addressing, Network Address Translation (NAT). 1.2 Internet Protocol (IP): Datagram Format, Fragmentation, Options. 1.3 ICMPv4: Messages, Debugging Tools, ICMP Checksum. 1.4 Mobile IP: Addressing, Agents, Three Phases, Inefficiency in Mobile IP. 1.5 Virtual Private Networks (VPN) Technology.



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit– II Next Generation IP	2a. Map the given IPv4 address to IPv6 address. 2b. Describe function of the given step in the stateless auto configuration process. 2c. Outline the given strategy of Transition from IPv4 to IPv6. 2d. Explain significance of the given field in Datagram format of IPv6.	2.1 IPv6 Addressing: Representation, address space, address space allocation, Autoconfiguration, Renumbering. 2.2 Transition from IPv4 to IPv6: Dual Stack, Tunneling, Header Translation. 2.3 IPv6 Protocol: Packet format, Extension Header.
Unit III- Unicast and Multicast Routing Protocols	3a. Choose relevant routing Protocol for the given network situation. 3b. Compare Dynamic Routing and Static Routing on the given aspect. 3c. Calculate shortest paths from a single source vertex to all the other vertices in the given weighted digraph. 3d. Explain functioning of the given multicast routing protocol.	3.1 Introduction: Inter-domain, Intra-domain Routing. 3.2 Routing Algorithms: Distance Vector Routing, Bellman–Ford algorithm, Link State Routing, Path Vector Routing. 3.3 Unicast Routing Protocols: Internet Structure, Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Border Gateway Protocol Version 4 (BGP4). 3.4 Introduction: Unicast, Multicast and Broadcast. 3.5 Intradomain Multicast Protocols: Multicast Distance Vector (DVMRP), Multicast Link State (MOSPF), Protocol Independent Multicast (PIM).
Unit-IV Transport Layer Protocols	4a. Explain significance of the given field in UDP Packet format. 4b. Describe the given State Transition of TCP. 4c. Explain significance of the given field in TCP Packet format. 4d. Describe the given field in the packet format of SCTP. 4e. Explain the functioning of the given Protocol with Flow and Error control by taking an example.	4.1 User Datagram Protocol: User Datagram, UDP Services, UDP Applications. 4.2 Transmission Control Protocol: TCP Services, TCP features, Segment, A TCP Connection, State Transition Diagram, Windows in TCP, Flow Control, Error Control, TCP Congestion Control, TCP Timers, Options. 4.3 SCTP: SCTP Services, SCTP Features, Packet Format, An SCTP Association, Flow Control, Error Control.
Unit –V Application Layer	5a. Explain function of the given application layer protocol. 5b. Explain function of the given	5.1 World Wide Web and HTTP 5.2 File Transfer: FTP and TFTP 5.3 Electronic Mail: Architecture



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
protocols	FTP command. 5c. Explain working of the given components in the Architecture of Electronic Mail. 5d. Explain process of resolving the given host name into IP address using DNS. 5e. Explain working of the given Remote Login Protocol.	Web-Based Mail, Email Security, SMTP, POP, IMAP and MIME, SNMP. 5.4 DNS – Concept of Domain name space, DNS operation. 5.5 DHCP – Static and Dynamic Allocation, DHCP Operation. 5.6 Remote Login: TELNET and SSH.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Network Layer and Protocols	06	02	02	04	08
II	Next Generation IP	08	02	04	04	10
III	Unicast and Multicast Routing Protocols.	10	02	04	08	14
IV	Transport Layer Protocols	12	02	08	08	18
V	Application Layer Protocols.	12	04	08	08	20
Total		48	12	26	32	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare journals based on practical performed in laboratory.
- Give seminar on Identified topic.
- Undertake micro-projects.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcome.



- c. About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- e. Guide student(s) in undertaking micro-projects.
- f. Demonstrate students thoroughly before they start doing the practice.
- g. Encourage students to refer different websites to have deeper understanding of the topic.
- h. Observe continuously and monitor the performance of students in Lab.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

- i. Prepare one Static and One dynamic Network with DHCP server. Use Routing Protocol to route packets between these networks using Cisco packet tracer or any other similar software.
- ii. Setup a FTP server and client on one network. Transfer files from Client to server and vice versa.
- iii. (a) Create DNS,
(b) Create Web server,
(c) Serve an HTML page on web server and call it on browser through DNS.
- iv. Set-up a mailing system of users on intranet.

13. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Data Communication and Networking 5E	Forouzan Behrouz A.	McGraw Hill Education (India), New Delhi, 2005, ISBN-13:978-1-25-906475-3
2	Internetworking with TCP/IP, Volume I, Fourth Edition.	Comer Douglas E.	Prentice Hall of India Private Limited, New Delhi, 2014 ISBN-81-203-2065-4
3	Computer Networks, Fourth Edition	Tanenbaum Andrew S.	PHI Learning, New Delhi- 2014 ISBN-81-203-2175-8



4	Advanced Computer Network	B.M. Harwani and DT Editorial Services	Dreamtech New Delhi- 2014 ISBN 978-93-5004-013-3
5	Computer Networks Principles, Technologies And Protocols For Network Design	Natalia Olifer, Victor Olifer	Wiley ISBN

14. SOFTWARE/LEARNING WEBSITES

- a) TCP/IP Illustrated, Volume 1 The Protocols W. Richard Stevens
- b) <http://study-ccna.com/>
- c) <http://www.packettracernetwork.com/>
- d) <https://www.tutorialspoint.com/listtutorials/networking/1>
- e) www.txv6tf.org/wp-content/uploads/2010/08/Muhammad-Tutorial-ipv6-basics.pdf
- f) <http://cnp3book.info.ucl.ac.be/2nd/html/protocols/bgp.html>
- g) <https://campus.barracuda.com/product/nextgenfirewallf/doc/46209264/dynamic-routing-protocols-ospf-rip-bgp/>
- h) <http://www.ciscopress.com/articles/article.asp?p=2180210andseqNum=5>
- i) http://www.allsyllabus.com/aj/note/Computer_Science/Computer%20Networks%20-%20II/



Program Name : Computer Engineering Program Group
Program Code : CO/CM/CW
Semester : Fifth
Course Title : Advanced Database Management Systems (Elective)
Course Code : 22521

1. RATIONALE

Advanced database management systems contain comprehensive contents on various concepts related to database systems, database design and management. Broadly it discusses about parallel and distributed database systems, database transactions, big data management and advances in database data. The student will get a detailed introduction about database administration and management, the role of machine learning in big data management. This course includes study of structured and unstructured database like MongoDB, SQL and XML for data management. The concept big data is used in today's information driven business world for managing big data. After learning this subject student will be able to use ADBMS as a backend for developing database.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Apply Advanced Database Management Systems concepts using MongoDB and XML**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Differentiate various database architectures.
- Use Object Oriented and Advanced XML queries on Database.
- Manipulate data using MongoDB commands.
- Use Data Mining And Data Warehousing Concepts.
- Use Big Data Concepts.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25#	10	25	10	50	20

(*): Under the theory PA; Out of 30 marks, 10 marks of theory PA are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment.



This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

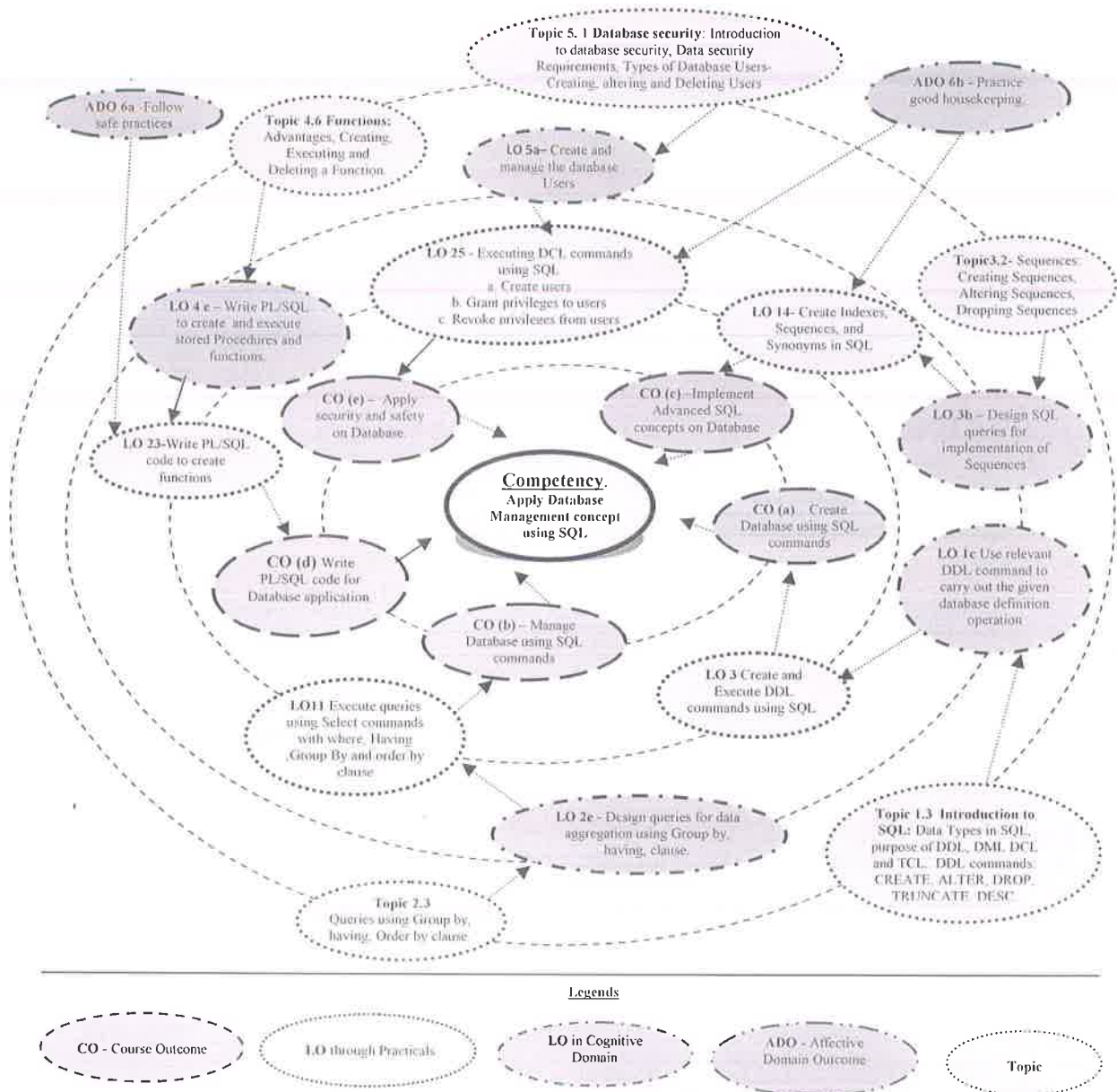
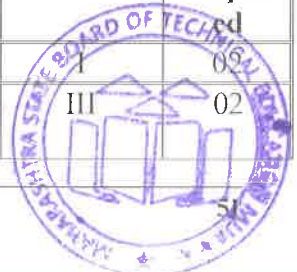


Figure 1 - Course Map

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1.	Implementing Locking protocols	I	05
2.	Install and configure Database system (such as MySQL, MongoDB or any other relational database system)	III	02



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1.	Implementing Locking protocols	I	02
3.	Create database using XML attributes and Elements.	II	02
4.	Implement queries based on FLOWER expressions and joins using XQuery.	II	02
5.	Implement queries based on Nested queries and sorting of results using XQuery.	II	02
6.	Implement queries based on functions and types using XQuery.	II	02
7.	Execute queries using structured type in SQL	II	02
8.	Execute queries using type inheritance and table inheritance in SQL	II	02
9.	Implement queries using Array and Multiset types in SQL	II	02
10.	Execute queries using object identity and reference types in SQL	II	02
11.	Design and Develop MongoDB Queries using basic operations	III	02
12.	Implement aggregation Queries using MongoDB	III	02
13.	Implement MongoDB Queries Using find() function	III	02
14.	Implement aggregation Queries in MongoDB through MapReduce	III	02
15.	Install and configure Any data mining tool (like WEKA) .	IV	02
16.	Make use of installed data mining tool(like WEKA)	IV	02
Total			32

Note

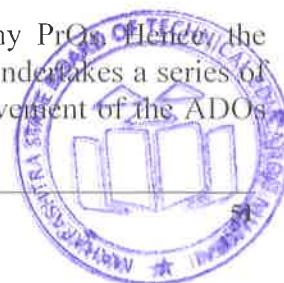
- A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 24 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
a.	Installation and configuration of database system	10
b.	Coding of queries and MongoDB programming	40
c.	Quality of result displayed by queries.	30
d.	Answer to sample questions	10
e.	Submit report in time	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Work as a leader/a team member.
- Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs



according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year and
- 'Characterising Level' in 3rd year.

17. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Exp. S. No.
1.1	Computer system (Any computer system with basic configuration)	All
1.2	Any RDBMS software (MySQL/Oracle/SQL server/MongoDB or any other)	All

18. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Database Architecture	1a. Describe the given client-server Database Model. 1b. Use the given locking protocols for concurrency control. 1c. Apply parallel and distributed database techniques in given situation. 1d. Differentiate between Parallel and Distributed Databases.	1.1 Introduction to client-server Database Model: Two-Tier Client server model, Three-Tier Client server model. 1.2 Concurrency Control Techniques: Concurrency control protocols: Locked Based protocols, granting of locks, Two Phase Locking protocol. 1.3 Introduction to parallel databases: Parallel database system architecture, Types of parallelism, Parallel Database Implementation. 1.4 Introduction to distributed databases: Distributed database system architecture, Benefits of distributed database system, Issues with distributed database systems.
Unit II- Object Based Databases and XML	2a Create the given object based database using SQL 2b Write given SQL queries using Table Inheritance 2c Write given SQL queries using Array and Multiset. 2d Implement SQL queries to refer the given object using object identity. 2e Write XML queries on given data.	2.1 Object Based Databases overview 2.2 Complex data types 2.3 Structured types and inheritance in SQL 2.4 Table inheritance 2.5 Array and multiset types in SQL 2.6 Object identity (OI) and reference types in SQL 2.7 XML: Introduction, structure of XML data, XML document schema ,Xpath, XQuery:FLOWER Expressions, Joins,Nested Queries, Sorting functions, Functions and types
Unit– II	3a. Differentiate structured and	3.1 Structured versus Unstructured Data



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Advanced Database Techniques	Unstructured Data. 3b. Use NoSQL database to solve given queries. 3c. Use MongoDB to solve given queries. 3d. Differentiate SQL and NoSQL databases. 3e. Write query to execute find() function on given data. 3f. Implement basic operations performed on MongoDB shell on given data. 3g. Write query using aggregate() method on given data.	3.2 NoSQL database concepts: Types of NoSQL databases, NoSQL data modeling, Benefits of NoSQL, comparison between SQL and NoSQL database system. 3.3 NoSQL using MongoDB: Introduction to MongoDB Shell, Running the MongoDB shell, MongoDB client, Basic operations with MongoDB shell, Basic Data Types ,Arrays, Embedded Documents 3.4 Querying with MongoDB: find() function, specifying which keys to return, query criteria, OR queries, Types specific querying 3.5 Aggregation Introduction: Aggregation Pipeline, Aggregation using Map reduce, Single purpose aggregation
Unit –IV Advances in Databases	4a. Define data mart, meta data 4b. Explain architecture of data warehouse 4c. Analyze given data using data mining. 4d. Describe the features of BI and BI components framework. 4e. Explain use of spatial databases in a given situation.	4.1 Introduction to Data Warehouse :Characteristics, Types of Data Warehouse Architecture, Data Marts, Data Warehousing Lifecycle, Data Warehouse Development 4.2 Introduction to Data Mining Techniques: Data mining technology and its relation to data warehousing, Association rules, classification and clustering, Applications of data mining. 4.3 Introduction to business Intelligence: Features, frameworks, Types and approaches for machine learning 4.4 Introduction to Multimedia Databases, Mobile Databases and digital databases
Unit-V Big Data Management	5.a Analyze the given situation for the use of Big data. 5.b Describe the given architecture of Hadoop. 5.c Explain given components of Hadoop. 5.d Explain use of cloudera in given situation. 5.e Explain given features of R-programming.	5.1 Big Data 5.2 Introduction to Hadoop: Building Blocks and Components, Hadoop architecture, HBase, HIVE, Solid -State Drive 5.3 Cloudera, Oracle cloud, 5.4 Introduction to R-programming

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN



Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Database Architecture	08	04	04	04	12
II	Object Based Databases and XML	14	04	04	10	18
III	Advanced Database Techniques	12	06	04	06	16
IV	Advances in Databases	08	02	08	04	14
V	Big Data Management	06	02	04	04	10
Total		48	18	24	28	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare journals based on practical performed in laboratory.
- Undertake micro-projects.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Guide student(s) in undertaking micro-projects.
- Demonstrate students thoroughly before they start doing the practice.
- Encourage students to refer different websites to have deeper understanding of the subject.
- Observe continuously and monitor the performance of students in Lab.
- Demonstrate students thoroughly before they start doing the practice.
- Encourage students to refer different websites to have deeper understanding of the subject.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be individually undertaken to build up the skill and confidence in every student to become problem solver so



that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should not exceed three.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than 16 (sixteen) student engagement hours during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

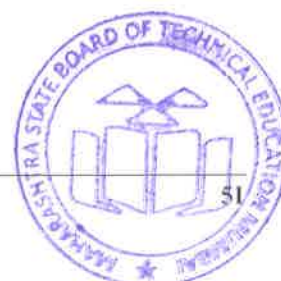
- a. Develop and maintain XML database for Employee information System.
- b. Design and develop MongoDB database for library management system.
- c. Perform preprocessing of data using any data mining tool (like WEKA).
- d. Install and configure Hadoop.
- e. Perform database connectivity with any front end tool.

13. SUGGESTED LEARNING RESOURCES :

S. No.	Title of Book	Author	Publication
1	Database Management Systems Application	Kogent Learning Solutions Inc.	Dreamtech Press 2014, ISBN-978-93-5119-476-7
2	Database System Concepts	Korth Henery	Tata McGraw Hill Education, 6 th Edition, ISBN -13:978-93-329-0138-4
3	Complete Reference: Mysql	Vaswani Vikram	McGraw Hill Education, ISBN-13: 9780070586840
4	SQL, PL/SQL The Programming Language of ORACLE	Bayross Ivan	BPB Publications, 3 rd Edition ISBN-13: 978-8176569644

14. SOFTWARE/LEARNING WEBSITES

- a) <https://www.tutorialspoint.com>
- b) <https://www.w3schools.com>
- c) <http://db.ucs.d.edu/static/cse132b-sp01/oql.htm>
- d) <https://docs.mongodb.com/manual/tutorial/install-mongodb-on-windows/>
- e) <http://www.cs.stir.ac.uk/courses/CSC9T6/practicals/1%20Data%20Mining/1%20-%20Weka%201.pdf>







Maharashtra State Board Of Technical Education, Mumbai

Teaching And Examination Scheme For Post S.S.C. Diploma Courses

Program Name : Diploma in Electronics & Tele-Communication, Diploma in Electronics, Diploma in Communication Technology, Diploma in Communication Engineering, Diploma in Electronics Engineering

Program Code : EJ/EN/EQ/ET/EX

With Effect From Academic Year: 2017 - 18

Duration of Program : 6 Semesters

Duration : 16 Weeks

Semester : Fifth

Scheme - I

S. N.	Course Title	Course Abbre- viation	Course Code	Teaching Scheme			Credit (L+T+P)	Examination Scheme												Grand Total	
				L	T	P		Theory						Practical							
								Exam Duration in Hrs.	ESE		PA		Total		ESE		PA		Total		
									Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks		Min Marks
1	Environmental Studies	EST	22447	3	-	-	3	90 Min	70*#	28	30*	00	100	40	--	--	--	--	--	--	100
2	Control Systems and PLC	CSP	22531	4	-	2	6	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150
3	Embedded Systems	ESY	22532	3	-	2	5	3	70	28	30*	00	100	40	25#	10	25	10	50	20	150
4	Mobile and Wireless Communication	MWC	22533	4	-	4	8	3	70	28	30*	00	100	40	50#	20	50	20	100	40	200
Elective (Any One)																					
5	Industrial Automation	IAU	22534	3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150
	Microwave and RADAR	MAR	22535	3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150
6	Industrial Training	ITR	22057	-	-	6	6	--	--	--	--	--	--	--	75#	30	75	30	150	60	150
7	Capstone Project Planning	CPP	22058	-	-	2	2	--	--	--	--	--	--	--	25@	10	25	10	50	20	50
Total				17	-	18	35	--	350	--	150	--	500	--	225	--	225	--	450	--	950

Student Contact Hours Per Week: **35 Hrs.**

Medium of Instruction: **English**

Theory and practical periods of 60 minutes each.

Total Marks : 950

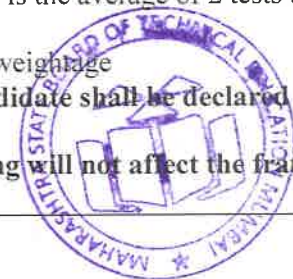
Abbreviations: ESE- End Semester Exam, PA- Progressive Assessment, L - Lectures, T - Tutorial, P - Practical

@ Internal Assessment, # External Assessment, *# On Line Examination, ^ Computer Based Assessment

* Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain LOs required for the attainment of the COs.

~ For the courses having ONLY Practical Examination, the PA marks. Practical Part - with 60% weightage and Micro-Project Part with 40% weightage

- If Candidate not securing minimum marks for passing in the "PA" part of practical of any course of any semester then the candidate shall be declared as "Detained" for that semester.
- Evaluation of Industrial Training and its reports is to be done after completion of Industrial Training. Credits of Industrial Training will not affect the framing of time table.



Program Name : All Branches of Diploma in Engineering and Technology.
Program Code : CE/CR/CS/CH/CM/CO/IF/CW/DE/EJ/EN/EQ/ET/EX/IE/
MU/EE/EP/EU/IS/IC/AE/FG/ME/PG/PT/DC/TX/TC
Semester : Fifth
Course Title : Capstone Project – Planning
Course Code : 22058

1. RATIONALE

According to the requirement of National Board of Accreditation (NBA), 'learning to learn' is an important Graduate Attribute (GA No.11). It is required to develop this skill in the students so that they continue to acquire on their own new knowledge and skills from different 'on the job experiences' during their career in industry. An educational 'project' just does that and may be defined as *'a purposeful student activity, planned, designed and performed by a student or group of students to solve/ complete the identified problem/task, which require students to integrate the various skills acquired over a period to accomplish higher level cognitive and affective domain outcomes and sometimes the psychomotor domain outcomes as well'*. Projects mainly serve this purpose of developing learning-to-learn skills with an aim to develop the following attributes in the students:

- a) Initiative, confidence and ability to tackle new problems
- b) Spirit of enquiry
- c) Creativity and innovativeness
- d) Planning and decision making skills
- e) Ability to work in a team and to lead a team
- f) Ability of self directed learning which is required for lifelong learning
- g) Persistence (habit of not giving up quickly and trying different solutions in case of momentary failures, till success is achieved)
- h) Resourcefulness
- i) Habit of keeping proper records of events and to present a formal comprehensive report of their work.

2. COMPETENCY

The course should be taught and implemented with the aim to develop the required course outcomes (COs) so that students will acquire following competency needed by the industry:

- **Plan innovative/creative solutions independently and/or collaboratively to integrate various competencies acquired during the semesters to solve/complete the identified problems/task/shortcomings faced by industry/user related to the concerned occupation.**

3. COURSE OUTCOMES (COs)

The following could be some of the major course outcomes depending upon the nature of the projects undertaken. However, in case of some projects few of the following course outcomes may not be applicable.

- a) Write the problem/task specification in existing systems related to the occupation.
- b) Select, collect and use required information/knowledge to solve the problem/complete the task.
- c) Logically choose relevant possible solution(s).
- d) Consider the ethical issues related to the project (if there are any).
- e) Assess the impact of the project on society (if there is any).
- f) Prepare 'project proposals' with action plan and time duration scientifically before beginning of project.



- g) Communicate effectively and confidently as a member and leader of team.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme													
L	T	P		Theory								Practical					
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
-	-	2	2	-	-	-	-	-	-	-	25@	10	25	10	50	20	

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment

5. Capstones Project

One of the dictionary meaning is the ‘crown’ or the stone placed on top of the building structure like ‘kalash on top of Temples and Mosques’ or ‘Cross on top of churches’. Capstone projects are culminating experiences in which students synthesize the competencies acquired over whole programme. In some cases they also integrate cross-disciplinary knowledge. Thus Capstone projects prepare students for entry into a career and can be described as a ‘rite of passage’ or ‘minimal threshold’ through which participants change their status from student to graduate. A capstone project therefore should serve as a synthesis — reflection and integration— to bridge the real-world preparatory experience to real life. Thus capstone project should have emphasis on integration, experiential learning, and real-world problem solving and hence these projects are very important for students. To develop the highly essential industry oriented skills and competencies in the students, the capstone projects are offered in the last two semesters to serve for following purposes:

- Integrate the competencies acquired by the students in the previous and current semesters.
- Provide opportunities for interdisciplinary work in tackling problems likely to be faced by them in industry which are exciting and challenging.

6. Capstone Project Planning

Students are supposed to find out a suitable project and prepare a detailed plan in fifth semester so that it can be executed smoothly in sixth semester. The main characteristic of any project whether small or big is that it requires simultaneous application of various types of skills in the different domains of learning. Moreover, project normally do not have a predefined single solution, in other words for the same problem different students may come up with different but acceptable solutions. Further, in the process of arriving at a particular solution, the student must be required to make a number of decisions after scrutiny of the information s/he has accumulated from experiments, analysis, survey and other sources.

The projects will have a detailed project proposal, which must be executed or implemented within the time allocated, simultaneously maintaining a logbook periodically monitored by the teacher. A detailed project report is to be prepared as project progresses, which has to be submitted after the project is over. For self assessment and reflection students have to also prepare a portfolio of learning.

During the guidance and supervision of the project work, teachers’ should ensure that students acquire following *learning outcomes* (depending upon the nature of the project work some of these learning outcomes may not be applicable):

- Show the attitude of enquiry.
- Identify the problems in the area related to their programme.
- Identify the information suggesting the cause of the problem and possible solutions.
- Assess the feasibility of different solutions and the financial implications.



- e) Collect relevant data from different sources (books/internet/market/suppliers/experts etc. through surveys/interviews).
- f) Prepare required drawings and detailed plan for execution of the work.
- g) Work persistently and participate effectively in group work to achieve the targets.
- h) Work independently for the individual responsibility undertaken.
- i) Ask for help from others including guide, when required.
- j) Prepare portfolio to reflect (*chintan-manan*) on experiences during project work.
- k) Prepare seminar presentations to present findings/features of the project.
- l) Confidently answer the questions asked about the project.
- m) Acknowledge the help rendered by others in success of the project.

If students are able to acquire these *learning outcomes*, then they would be able to acquire the COs as discussed in section 3.

7. Scopes of Projects

Scope of the project work should be decided based on following criteria:

- a) **Relation to diploma programme curriculum:** When students intend to select topics for the project work they need to choose a project which relates well to their curriculum (It may be beyond curriculum, but it should relate to it) and requires implementation of theories already learnt and skills already possessed by them from the previous semesters.
- b) **Abilities possessed by the group of students:** Projects should be chosen so that it can be completed mainly using students' problem solving capabilities and depth of learning. It is natural that highly motivated students or high achievers may come out with projects which are more complex and challenging. Teachers should guide students to choose challenging projects according to the students' ability.
- c) **Resources Available:** Students and Guides should keep in mind the availability of resources while deciding the topic and the scope of the project. Some of the important resources which need consideration are:
 - i. Time available
 - ii. Raw Material/Components required
 - iii. Manufacturing/Fabrication equipment and tools required
 - iv. Testing/Measuring equipment and instruments required
 - v. Access to Journals (Library/Digital)
 - vi. Expertise for theoretical guidance (available in polytechnic, nearby institutes or nearby industries)
 - vii. Expertise and technology required for fabrication (if required)
 - viii. Software required.

An important aspect to be considered is to decide who will choose a project. The best practice is that teacher should guide students about the above factors to be considered for choosing the project and based on these factors students should do the ground work and identify the possible projects and teachers should work as only facilitator and Guide in final selection of the project title and its scope.

d) Suggested Type of Capstone Projects

In general, the projects that the students can take up could be of the following types;

- i. Feasibility studies.
- ii. Design projects
- iii. Market surveys about raw material, components or finished products.
- iv. Prototype (design, make, test and evaluate).
- v. Advanced experimental work requiring the development of existing equipment to be used and developed.
- vi. Field works: This could include surveys, using equipment, charting data and information from visual observation.



- vii. Comparative Studies: Theoretical study of two systems/mechanisms/ processes in detail and comparing them on the basis of cost/energy conservation/impact on environment/technology used etc.
- viii. Application of Emerging technology: Theoretical study of some emerging technology and feasibility of its application in some real life situation in detail.
- ix. Fabrication of some equipment/machine etc.
- x. Construction of some structure.
- xi. Development of software or use of software for solving some broad-based problem.

8. GUIDELINES FOR UNDERTAKING A PROJECT

The selection of the *Capstone Project title* must have emphasis to the Elective courses/ Elective Group taken for the study and exam for 5th and 6th semester. The students will then work on the identified problem/task through a rigorous process of understanding and analyzing the problem, conducting a literature search, deriving, discussing (monitored by the guide every fortnight) and designing the *Semester V 'Project Proposal'* with the following sub-titles:

- a) Rationale (one page)
- b) Introduction
- c) Literature Survey
- d) Problem Definition
- e) Proposed Methodology of solving Identified problem
- f) In-case some prototype has to be fabricated then its tentative design and procedure for making it should be part of the proposal.
- g) Resources and consumables required.
- h) Action Plan (sequential list of activities with probable dates of completion)

As soon as the 'Project Proposal' is approved by the teacher, the student will begin to maintain a dated '*Project Logbook*' for the whole semester. This is a sort of a 'weekly diary' indicating all the activities conducted by the student every week in the semester to complete the project. This '*project logbook*' should be got signed by the teacher at regular intervals for progressive assessment to match the project proposal. If this is maintained sincerely and truthfully by the student, it will be very helpful in compiling the 'Project Report' at the end of the semester by him/her.

9. PORTFOLIO FOR SELF-DIRECTED LEARNING

To ensure that students acquire these outcomes, students should also be guided to prepare a '*Portfolio*', so that they may reflect on their weaknesses/mistakes and learn from them. *Students should also be encouraged to discuss with their guide and record not only technical problems but also problems related to group work, planning, execution, leadership in the team etc., so that students can also identify their weaknesses in affective domain and take remedial actions to overcome the same.* If they wish, the students can also show their portfolio to their teachers (whom they trust) for obtaining teachers' comments on their reflection for pointing out their mistakes so that they can improve their performance.

'*Portfolio*' is the record of the reflection (thinking or *chintan-manan*) on experiences to which students undergo during the different stages of the project. In a portfolio, students record their critical experiences and reflect (think or do *chintan-manan*) on them in writing. This process of reflecting on the experiences make them learn from their mistakes and build on their strengths. To help students in reflection, a Portfolio format with reflective prompts (simple thought provoking questions) for different stages of the project is given as annexure B.

12.1 Purposes of Portfolio Preparation



Reflection by self is important since group work is so complex that it is difficult for teachers to appreciate the real problems amongst the students. In a portfolio, prompts (simple thought provoking questions) are given to trigger reflection on different aspects of project work. Prompts help the students to ask questions from themselves regarding different aspects of the project work and interpersonal relationships. Process of answering these questions forces students to think about behavioral problems and possible remedies/solution to deal with those problems. Portfolio preparation therefore helps in reflection on building the strengths and elimination of the weaknesses of the students pertaining to following qualities which the industry also need.

- a) Plan properly for execution of given work.
- b) Take appropriate decisions.
- c) Arrange resources.
- d) Work as member and leader of team.
- e) Communicate properly.
- f) Resolve the conflicts.
- g) Manage the time well.
- h) Have concern for ethical, societal and environmental issues.
- i) Learn-to-learn from experiences.

It may be seen that these qualities are not directly related with the theoretical subject knowledge and can be developed only through real life experiences. Project work is one such type of experience where opportunity is available to develop all these qualities.

However, even during project work, emphasis of most of the students and teachers remains on development of the technical knowledge and skills while development of above qualities is neglected. Students can develop these qualities if they reflect (do thinking or *Chintan-Manan*) on their experiences from the point of view of these qualities and find out their own weaknesses and strengths. Because if somebody wants to improve his/her abilities then first step for that person is to have self awareness about his/her weaknesses and strengths.

Though portfolio preparation requires considerable time, it is essential, if we want to learn from the experiences and develop these qualities. Writing down reflections helps in better reflection as it is well known that when a person starts writing something he/she becomes more cautious about his/her view and evaluate those views before writing. Thus process of writing improves the quality of reflection or thinking. Moreover, if reflections on different stages of work are written down, over a period of time a large amount of reflection can be generated, and if this reflection is looked back, it may help in identifying some pattern of behaviour in individual which may be improved or rectified latter on as per requirement.

12.2 Guidelines for Portfolio Preparation and assessment

The main purpose of portfolio preparation is learning based on self-assessment and ***portfolio is not to be used for assessment in traditional sense.***

- a) Each student has to prepare his/her portfolio separately. However, he/she can discuss with the group members about certain issues on which he/she wants to write in the portfolio.
- b) For fifth semester and sixth semester, there will be only one portfolio but it will have two separate parts, first part for project planning (having two sections A and B) second part for project execution. (having two sections C and D)
- c) Whatever is written inside the ***portfolio is never to be used for assessment***, because if teachers start giving marks based on whatever is written in the portfolio, then students would hesitate in true self-assessment and would not openly describe their own mistakes or shortcomings.



- d) Some marks are allocated for portfolio, these marks are to be given based on how sincerely portfolio has been prepared and not based on what strengths and weaknesses of the students are mentioned in the portfolio.
- e) Portfolio has to be returned back to the students after assessing it (assessment is only to see that whether portfolio is completed properly or not) by teachers. Because student is the real owner of the portfolio.
- f) Students mainly learn during portfolio preparation, but they can further learn if they read it after a gap. And hence they are supposed to keep the portfolios with them even after completion of the diploma because it is record of their own experiences (it is like diary some people write about their personal experiences), because they can read it again after some time and can revise their learning (about their own qualities)

Even after completion of Diploma programme, students can continue to prepare portfolio related to different experiences in their professional and personal life and by refereeing back to old portfolios after a gap of some years, they can learn that how their personality has evolved over the years. They can also see a pattern of behaviour in their own personality which may be source of their weaknesses or strengths and they can take remedial measures based on this study of their portfolios.

Note

Since some sections of the portfolio are related with interpersonal relationships and student may find it difficult to write these experiences in English. Language should not be the barrier in reflection and hence students should be allowed to prepare the portfolio in their preferred language such as *Marathi* or *Hindi* if they find it difficult to write in English.

The amount and type of mistakes identified by students would not affect the marks received by the students. The total 7 Marks allocated for portfolio (4 marks for PA and 3 for ESE) are only for proper completion of the portfolio.

10. PROJECT REPORT

At the end of fifth Semester, the student will prepare a Semester V 'Project Report' with the following sub-titles:

- Certificate (in the Format given in this document as annexure A)
- Acknowledgements
- Abstract (in one paragraph not more than 150 words)
- Content Page
- Chapter-1 Introduction and background of the Industry or User based Problem
- Chapter-2 Literature Survey for Problem Identification and Specification,
- Chapter-3 Proposed Detailed Methodology of solving the identified problem with action plan
- References and Bibliography

Note: The report should contain relevant diagrams and figures, charts.

11. ASSESSMENT OF CAPSTONE PROJECT – PLANNING

Like other courses, assessment of Project work also has two components, first is progressive assessment, while another is end of the term assessment. The mentor faculty will undertake the progressive assessment to develop the COs in the students. They can give oral informal feedback about their performance and their interpersonal behaviour while guiding them on their project work every week. The following characteristics/ qualities informally or formally should be considered during different phases of the project work which will be assessed thrice as discussed in sub-section.

(A) Initial Phase

- i. **Definition of the Problem**
 - a) Accuracy or specificity



- b) Appropriateness with reference to desired course outcomes.
- ii. **Methodology of Conduction the Project**
 - a) Appropriateness
 - b) Flexibility
 - c) Clarity
- iii. **General Behaviour**
 - a) Initiative
 - b) Resourcefulness
 - c) Reasoning ability
 - d) Imagination/creativity
 - e) Self-reliance

(B) Intermediate Phase

- i. **Performance of Student**
 - a) Ability to follow correct procedure
 - b) Manipulative skills
 - c) Ability to collect relevant information
 - d) Ability to observe, record & interpret
 - e) Ingenuity in the use of material and equipment
 - f) Target achievement
- ii. **General Behaviour**
 - a) Persistence
 - b) Interest
 - c) Commitment
 - d) Confidence
 - e) Problem solving ability
 - f) Decision making ability
 - g) Initiative to act
 - h) Team spirit.
 - i) Sharing of material etc.
 - j) Participation in discussion
 - k) Completion of individual responsibilities

(C) Final Phase

- i. **Quality of Product**
 - a) Dimensions
 - b) Shape
 - c) Tolerance limits
 - d) Cost effectiveness
 - e) Marketability
 - f) Modernity
- ii. **Quality of Report**
 - a) Clarity in presentation and organization
 - b) Styles and language
 - c) Quality of diagrams, drawings and graphs
 - d) Accuracy of conclusion drawn
 - e) Citing of cross references
 - f) Suggestion for further research/project work
- iii. **Quality of presentation**
 - a) Understanding of concepts, design, methodology, results, implications etc
 - b) Communication skills
 - c) Ability to draw conclusions and generalization



12. PROGRESSIVE ASSESSMENT (PA) GUIDELINES

15 Marks are allocated for the formal progressive assessment. However, following points need consideration during the three times of formal progressive assessment of the students at the end of 4th, 12th and 14th week.

- Fortnightly monitoring** by the mentoring teachers is necessary and marks given progressively (even the gradual chapter preparation) so that that students will not copy earlier reports or get things done or reports from the market. The **students should not be awarded marks** if they have not done on their own.
- For progressive assessment at the end of 14th week, students should be asked to give the power point presentation before group of teachers and junior students (so that junior students may also get awareness about the capstone project work they have to carry out in future).
- Although marks for *portfolio preparation* is to be given at the end of 14th week, students should be asked to bring their partly prepared portfolio (relevant sections prepared) also during their assessment at the end of 4th week and 12th week.
- Marks for portfolio preparation should be based only on proper preparation of portfolio by writing answers to most of the prompts (self-questions to students) in the portfolio. These marks should not be based on the mistakes indicated by students in their working (while answering the prompts) and corrective actions taken by them.
- The students would be awarded marks for their efforts (In some cases it may happen that due to some reasons such as unavailability of some material or component or some other resources, students may not be able to complete the project, but they have tried their best, in such cases students would be given appropriate marks if they have done enough efforts.)
- Originality of the report** (written in own words) would be given more importance rather than use of glossy paper or multi-colour printing.

12.1 Progressive Assessment (PA) Criteria

Allocation Criteria of the **25 marks** are for the Progressive Assessment (PA).

S. No.	Criteria	Marks
First Progressive Assessment at the end of 4th week		
1	Problem Identification/Project Title (Innovation /Utility of the Project for industry/ User/Academia) marks to be also given based on (i) Accuracy or specificity of the scope and (ii) Appropriateness of the work with reference to desired course outcomes.	02
2	Industrial Survey and Literature Review: marks to be given based on extent/volume and quality of the survey of Industry / Society / Institutes/Literature/Internet for Problem Identification and possible solutions	02
3	General Behaviour: initiative, resourcefulness, reasoning ability, imagination/creativity, self-reliance to be assessed Note: Oral feedback on general behaviour may also be given whenever relevant/ required during day to day guidance and supervision. Only written feed-back/suggestions	00
Second Progressive Assessment at the end of 12th week		
4	Project Proposal: Marks to be given also based on appropriateness, flexibility, detail and clarity in methods/planning. (In case of working models, detailed design and planning of fabrication/assembly of the prototype has to be also assessed). This proposal should include whole project including work to be done in sixth semester	03



S. No.	Criteria	Marks
5	Execution of Plan in fifth semester (Since project is to be fully completed in sixth semester, the part of the project which is planned to be completed in fifth semester is only to be evaluated: marks to be also given based on ability to collect relevant information, ability to follow correct procedure, manipulative skills, ability to observe, record & interpret, ingenuity in the use of material and equipment, target achievement) In case of working models, quality of workman ship (including accuracy in dimensions, shape, tolerance limits), appropriateness of raw materials/components/ technology being used, functioning of the prototype, cost effectiveness, marketability, modernity etc. has to be also assessed.	02
6	Log book (for work done in fifth semester, detailed and regular entry would be basis of marks)	02
7	General Behaviour (persistence, interest, confidence, problem solving ability, decision making ability, initiative to act, team spirit, sharing of material etc., participation in discussions, completion of individual responsibilities, leadership) Note: Oral feedback on general behaviour should also be given whenever relevant/ required during day to day guidance and supervision. Only written feed-back./suggestions	00
Third Progressive Assessment at the end of 14th week		
8	Portfolio for Self learning and reflection (marks based on amount of reflection and completion of the portfolio for work done in fifth semester)	04
9	Final Report writing including documentation. (marks based on: clarity in presentation and organization; styles and language; quality of diagrams, drawings and graphs; accuracy of conclusion drawn; citing of cross references; suggestion for further research/project work) Report has to be prepared for work done in fifth semester and planning for sixth semester work.	06
10	Presentation (presentation skills including communication skills to be assessed by observing quality of presentations and asking questions during presentation and viva/voce) Report has to be prepared for work done in fifth semester and plan for sixth semester.	02
11	Defence (ability to defend the methods/materials used and technical knowledge, and involvement of individual to be assessed by asking questions during presentation and viva/voce)	02
Total		25

13. END-SEMESTER-EXAMINATION (ESE) ASSESMENT GUIDELINES

The **remaining 25 marks** are for the end-semester-examination (ESE). And marks would be given according to following criteria. Moreover, the suggested evaluation scheme can be changed slightly by the external faculty according to nature of problem / project following University guidelines..

- For each project, the one or two students from the concerned group of students should be asked to present the power point presentation before the external and internal (for about 10 minutes) and then external should ask the questions from each member of the group separately to ascertain the contribution made by each student.
- The students would be awarded marks for their efforts (In some cases it may happen that due to some reasons such as unavailability of some material or component or some other resources, students may not be able to complete the project, but they have tried their best, in such cases students would be given appropriate marks commensurate with their efforts.)



- c) The students would not be awarded marks if they have completed the project by getting done the work from market or some professionals (taking help and guidance is different as compared to getting the work or maximum part of the work completed from others on payment basis).
- d) Originality of the report (written in own words, even if there are grammatical and spelling mistakes) would be given more importance rather than quality of printing and use of glossy paper (and preparing report by copy pasting from other reports).

Note: It is very common that people are not able to complete the project in time despite best of their efforts. (Please recall that how many times people are able to complete in time, personal projects such as building own house or professional projects such as developing the lab in the institute). So if students have put in enough genuine efforts but could not complete the project in time then we should consider it sympathetically and they should be given marks based on their efforts and they should get more marks as compared to students who have got their projects completed by taking major help from others/market.

13.1 End-Semester-Examination (ESE) Assessment Criteria.

Allocation Criteria of the **25 marks** are for the end-semester-examination (ESE)

S. No.	Description	Marks
1	Problem Identification/Project Title (innovation /utility of the project for industry/ user/academia) marks to be also given based on (i) accuracy or specificity of the scope and (ii) appropriateness of the work with reference to desired course outcomes.	02
2	Industrial Survey and Literature Review (marks to be given based on extent/volume and quality of the survey of industry / society / institutes/literature/internet for problem identification and possible solutions)	02
3	Project Proposal: Marks to be given also based on appropriateness, flexibility, detail and clarity in methods/planning. (In case of working models, detailed design and planning of fabrication/assembly of the prototype has to be also assessed). This proposal should include whole project including work to be done in sixth semester.	02
4	Execution of Plan in fifth semester (Since project is to be fully completed in sixth semester, the part of the project which is planned to be completed in fifth semester is only to be evaluated: marks to be also given based on ability to collect relevant information, ability to follow correct procedure, manipulative skills, ability to observe, record & interpret, ingenuity in the use of material and equipment, target achievement) In case of working models, quality of workman ship (including accuracy in dimensions, shape, tolerance limits), appropriateness of raw materials/components/ technology being used, functioning of the prototype, cost effectiveness, marketability, modernity etc. has to be also assessed.	02
5	Log book (for work during fifth semester, marks to be given based on detailed and regular entry	03
6	Portfolio for Self learning and reflection (for work during fifth semester) Marks based on amount of reflection and completion of portfolio.	03
7	Project Report including Documentation (for work during fifth semester and planning for sixth semester) (marks based on: clarity in	04



S. No.	Description	Marks
	presentation and organization; styles and language; quality of diagrams, drawings and graphs; accuracy of conclusion drawn; citing of cross references; suggestion for further research/project work)	
8	Presentation (presentation skills including communication skills to be assessed by observing the quality of presentations and asking questions during presentation and viva/voce) Presentation should be based on work done in fifth semester and planning for sixth semester.	03
9	Defence (ability to defend the methods/materials used and technical knowledge, and involvement of individual to be assessed by asking questions during presentation and viva/voce)	04
Total		25

14. SPECIAL TEACHING STRATEGIES (If any)

- Teacher's should not spoon feed the students and let them try on their own at different stages of the project work and even first let them strive hard and only when efforts of students have failed, then teacher should guide them. Guidance should be in initially in the form of clues or hints rather than complete explanation, detailed explanation should be given only when students are not able to work based on clues/hints. The role of teacher should be limited to guide and facilitator
- Teachers should guide students in selecting a topic which is relevant and challenging (but within capacity) for students according to their abilities.
- Teachers should ensure that students prepare the project plan in as much detail as possible, since this way only they would learn the importance of planning and how to do the detail planning. Teachers should allow students to proceed ahead only when they have detailed plan with them.
- Teachers should motivate students to maintain log book and prepare portfolio. They should explain benefits of these activities to students and also train them in these activities, because most of them may be doing this first time.
- Teachers should also encourage students to openly discuss their weaknesses and shortcomings in portfolio and teachers should develop confidence in students that admitting mistakes and weaknesses helps in improving them and their marks would not be affected by revealing their mistakes. Marks related to portfolio are awarded based only on the sincerity with which it is prepared and not based on strengths and weaknesses of students.
- Teachers should continuously discuss with students about working of group and progress in the project and from this discussion should identify their personal qualities (both strengths and weaknesses) and suggest to them ways for improving those qualities.
- Internal as well as external examiners should reward students for original work and efforts of students even if they are not fully successful or not able to complete the project in comparison to those students who have taken paid help from others to complete their project.



Annexure A**CERTIFICATE**

This is to certify that Mr./Ms.....

FromCollege having Enrolment No:

has completed **Report on the Problem Definition/ Semester V Project Report/ Final Project**

Report having title

individually/ in a group consisting of..... persons under the guidance of the Faculty Guide.

.....
The mentor from the industry for the project

Name:

Telephone:.....

Annexure B**Portfolio for Self Directed Learning for Major Project Work**

Name of Student:.....

Semester:.....**Programme/Branch:**.....

Roll Number:.....

Title of the Project:.....

Name and Designation of Project Guide:.....

Name of Polytechnic:.....

Part A: Selecting the Project and Team (Answers to the following questions to be included in 'Portfolio' as Reflection related to formation of group and finalization of project topic).

Note: This section has to be prepared just after the finalization of the Project topic and formation of the Project Team .

1. How many alternatives we thought before finalizing the project topic?
2. Did we consider all the technical fields related to branch of our diploma programme?
3. Why we found present project topic as most appropriate?
4. Whether all the group members agreed on the present project topic? If not? What were the reasons of their disagreements?
5. Whether the procedure followed in assessing alternatives and finalizing the project topic was correct? If not, discuss the reasons.
6. What were the limitations in other alternatives of project topic?
7. How we formed our team?
8. Whether we faced any problem in forming the team? If yes, then what was the problem and how was it resolved?



9. Am I the leader of our project team? If yes, then why was I chosen? If not, why I could not become the project team leader?
10. Do I feel that present team leader is the best choice available in the group? If yes, then why? If not, then why?
11. According to me who should be the leader of the team and why?
12. Can we achieve the targets set in the project work within the time and cost limits?
13. What are my significant good/ bad sharable experiences while working with my team which provoked me to think? What I learned from these experiences?
14. Any other reflection which I would like to write about formation of team and finalization of project title, if any?

Part B: Reflection related to project planning (Answers to the following questions to be included in 'Portfolio' as reflection on planning)

Note: This section has to be prepared just after the finalization of the 'Project Proposal'.

1. Which activities are having maximum risk and uncertainty in our project plan?
2. What are most important activities in our project plan?
3. Is work distribution is equal for all project group members? If not? What are the reasons? How we can improve work distribution?
4. Is it possible to complete the project in given time? If not what are the reasons for it? How can we ensure that project is completed within time.
5. What extra precaution and care should be taken in executing the activities of high risk and uncertainty? If possible, how such risks and uncertainties can be reduced?
6. Can we reduce the total cost associated with the project? If yes, then describe the ways?
7. For which activities of our project plan, arrangement of resources is not easy and convenient?
8. Did we make enough provisions of extra time/expenditure etc. to carry out such activities?
9. Did we make enough provisions for time delays in our project activity? In which activities there are more chances of delay?
10. In our project schedule, which are the days of more expenditure? What provisions we have made for availability and management of cash?
11. Any other reflection which I would like to write about project planning?



Teacher Evaluation Sheet (ESE) for Capstone Project Planning

Name of Student:

Name of Programme..... Semester:

Course Title and Code:.....

Title of the Capstone Project:

A. POs addressed by the Capstone Project (Mention only those predominant POs)

- a)
- b)
- c)
- d)

B. COs addressed by the Capstone Project (Mention only those predominant POs)

- a)
- b)
- c)
- d)

C. OTHER LEARNING OUTCOMES ACHIEVED THROUGH THIS PROJECT

a) Unit Outcomes (Cognitive Domain)

- i.
- ii.
- iii.
- iv.

b) Practical Outcomes (in Psychomotor Domain)

- i.
- ii.
- iii.
- iv.

c) Affective Domain Outcomes

- i.
- ii.
- iii.
- iv.

D. SUGGESTED RUBRIC FOR ASSESSMENT OF CAPSTONE PROJECT

(please tick below the appropriate rating i.e. poor, average etc., for each characteristic to be assessed and give marks in the respective cell according to performance of student)

S. No.	Characteristic to be assessed	Poor	Average	Good	Excellent	Max. Marks	marks obtained
First Progressive Assessment (at the end of 4 th week)							



S. No.	Characteristic to be assessed	Poor	Average	Good	Excellent	Max. Marks	marks obtained
1	Problem/Task Identification (Project Title)	Relate to very few POs Scope of Problem not clear at all	i. Related to some POs ii. Scope of Problem/Task vague	i. Take care of at-least Three POs ii. Scope of Problem/task not very specific	i. Take care of more than three POs ii. Scope of problem/task very clear	02	
2	Literature Survey /Industrial Survey	Not more than ten sources (primary and secondary), very old reference	At-least 10 relevant sources, at least 5 latest	At –least 15 relevant sources, most latest	About 20 relevant sources, most latest	02	
Second Progressive Assessment (at the end of 12th week)							
3	Project proposal	Methods are not appropriate, All steps not mentioned, Design of prototype not started (if applicable).	Appropriate plan but not in much detail. Plan B for critical activities not mentioned. Time line is not developed. Design of Prototype is not complete. (if applicable)	Appropriate and detailed plan with Plan B for critical activities mentioned, but clarity is not there in methods, time line is given but not appropriate. Design of prototype is not detailed (if applicable)	Appropriate and detailed plan with Plan B for critical activities mentioned, clarity in methods with time line, Detailed design of prototype (if applicable)	02	
4	Execution of Plan in fifth semester (please write by hand about students performance in appropriate column)					02	
5	Log Book	Entries for most weeks are missing. There is no proper sequence and details are not correct.	Entries for some weeks are missing, details are not appropriate, not signed regularly by the guide.	Entries were made every week but are not in detail. Signed and approved by guide every week	Entries were made every week in detail, signed and approved by guide every week	03	
Third progressive Assessment at the end of 14th week							
6	Portfolio Preparation	Answer to only few of the 'questions from self' (prompts)	Answer to only about 50% of the 'questions from self'	Answer to most of the 'questions from self' (prompts) written. Some	Answer to nearly all the 'questions from self' (prompts) written in detail	03	



S. No.	Characteristic to be assessed	Poor	Average	Good	Excellent	Max. Marks	marks obtained
		written. Answers are not in much detail	(prompts) written. Answers are not in much detail	answers are not in much detail			
7	Final Report Preparation	Very short, poor quality sketches, Details about methods, material, precaution and conclusions omitted, some details are wrong Nearly sufficient and correct details about methods, material, precautions and conclusion. but clarity is not there in presentation, not enough graphic description.	Detailed, correct and clear description of methods, materials, precautions and	Conclusions, Sufficient Graphic Description.	Very detailed, correct, clear description of methods, materials, precautions and conclusions. Enough tables, charts and sketches	04	
8	Presentation	Major information is not included, information is not well organized .	Includes major information but not well organized and not presented well	Includes major information and well organized but not presented well	Well organized, includes major information ,well presented	03	
9	Defense	Could not reply to considerable number of question.	Replied to considerable number of questions but not very properly	Replied properly to considerable number of question.	Replied to most of the questions properly	04	
Total marks						25	

Any Other Comment:

.....

.....

Name and designation of the Faculty Member.....

Signature.....



Program Name : Diploma in Civil Engineering/ Computer Engineering /
**Information Technology /Automobile Engineering/ Fashion &
 Clothing Technology / Electrical Engineering Group / Electronics
 Engineering Group**

Program Code : CE/CR/CS/CO/CM/CW/IF/AE/DC/EE/EP/EU/DE/EJ/ET/EN/
 EX/EQ/IE/IS/IC

Semester : Fifth

Course Title : Environmental Studies

Course Code : 22447

1. RATIONALE

The world today is facing the biggest challenge of survival. Degradation of ecosystem, depletion of natural resources, increasing levels of pollution pose major threat to the survival of mankind. The need of the hour, therefore, is to concentrate on the area of environmental aspects, which shall provide an insight into various environment related issues. Environmental studies are an interdisciplinary academic field that integrates physical, chemical and biological sciences, with the study of the environment. It provides an integrated, quantitative, and interdisciplinary approach to the study of environmental system & gives an insight into solutions of environmental problems.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Diagnose and manage environment related issues

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

- Develop Public awareness about environment
- Select alternative energy resources for Engineering Practice
- Conserve Ecosystem and Biodiversity
- Apply techniques to reduce Environmental Pollution
- Manage social issues and Environmental Ethics as lifelong learning

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	-	3	90 Min	70*#	28	30*	00	100	40						

(#) Online Theory Examination.



(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

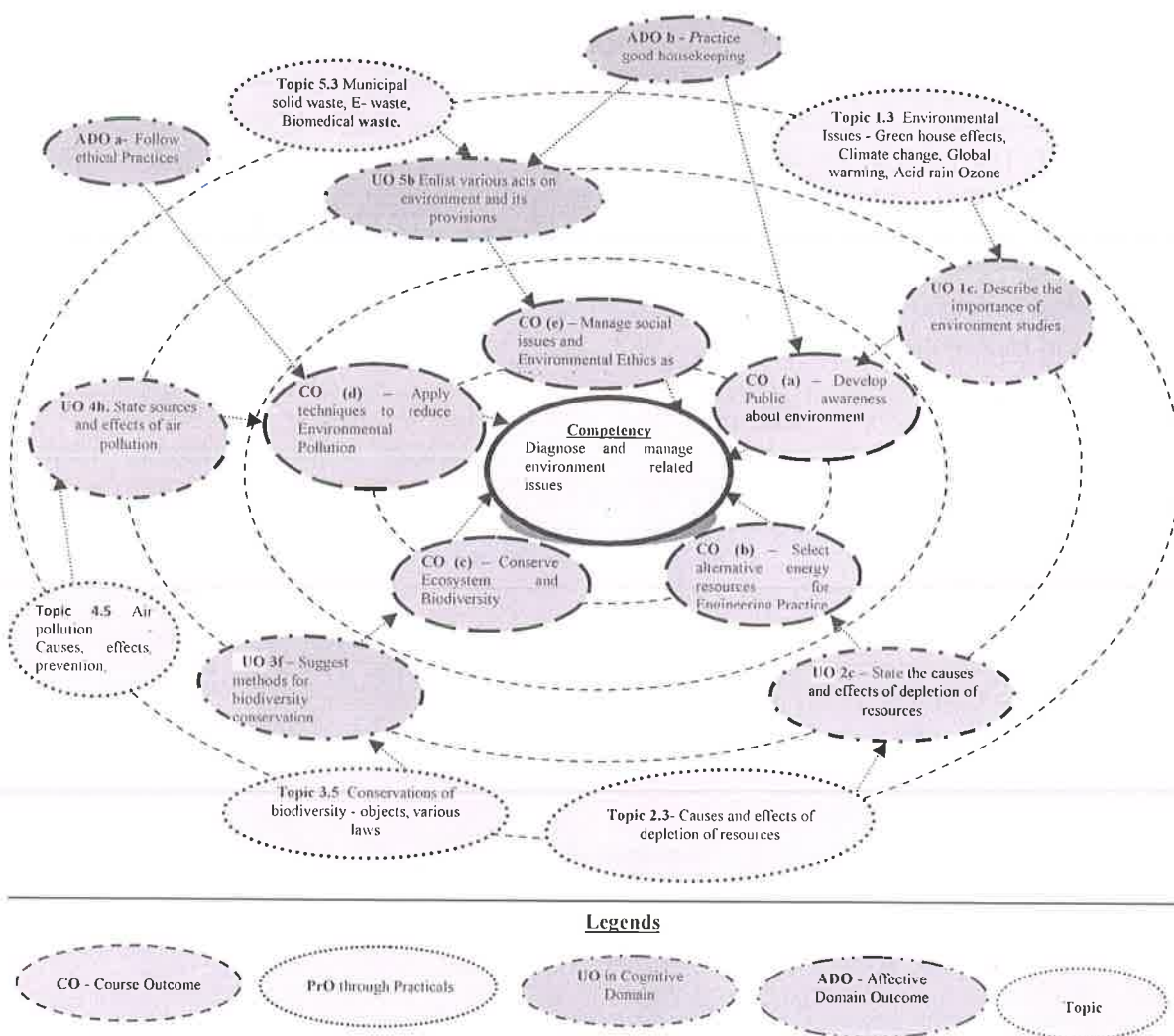


Figure 1 - Course Map

6. SUGGESTED EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency:

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
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S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	NIL		
	Total		

Note

- A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	NIL	
	Total	

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Practice energy conservation.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical Practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	NIL	-

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.



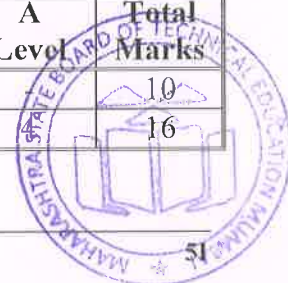
Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Environment	1a. Discuss the scope of Environment. 1b. Describe various types of environment 1c. Describe the importance of environment studies. 1d. Discuss about the need of public awareness about environment. 1e. Describe various environmental issues.	1.1 Definitions, need of environmental studies. 1.2 Segments of environment- Atmosphere, Hydrosphere Lithosphere, Biosphere. 1.3 Environmental Issues - Green house effects, Climate change, Global warming, Acid rain Ozone layer depletion, Nuclear accidents. 1.4 Concept of 4R (Reduce, Reuse, Recycle and Recover), 1.5 Public awareness about environment.
Unit– II Energy Resources	2a. List various natural resources. 2b. Describe Renewable, Nonrenewable and Cyclic resources. 2c. State the causes and effects of depletion of resources. 2d. State advantages and disadvantages of forms of energy. 2e. Select appropriate solutions of efficient use of energy. 2f. State the impacts of overuse of natural resources.	2.1 Natural Resources - Forest Resources, Water Resources, Energy Resources, Land resources, Mineral resources. 2.2 Renewable, Non-renewable and Cyclic Resources. 2.3 Causes and effects of depletion of resources. 2.4 Energy forms (Conventional and non-conventional). 2.5 Present global energy use and future demands. 2.6 Energy conservation. 2.7 Over use of natural resources and its impacts on environment.
Unit- III Ecosystem and Biodiversity	3a. State the aspects and division of ecosystem. 3b. State the general characteristics and function of ecosystem. 3c. List levels of biodiversity. 3d. Enlist the endangered species. 3e. Describe value of biodiversity. 3f. Suggest methods for biodiversity conservation.	3.1 Ecosystem - Definition , Aspects of ecosystem, Division of ecosystem, General characteristics of ecosystem, Functions of ecosystem. 3.2 Biodiversity - Definitions, Levels, Value and loss of biodiversity. 3.3 Biodiversity assessment initiatives in India. 3.4 Threats and Hotspots of biodiversity. 3.5 Conservations of biodiversity - objects, various laws.
Unit– IV Environmental Pollution	4a. Define pollution. 4b. State the sources of pollution. 4c. State the effects of land pollution on environment and lives. 4d. State various units and their functions of water treatment plant. 4e. State the needs of water conservation.	4.1 Definition of pollution, types- Natural & Artificial (Man- made). 4.2 Soil / Land Pollution – Causes and effects on environment and lives , preventive measures. 4.3 Water Pollution - Sources of water (surface and sub surface), sources of water pollution, effects on environment and lives, preventive measures, BIS water quality

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	4f. State the impacts of sewage. 4g. State various units and their functions of sewage treatment plant. 4h. State sources and effects of air pollution. 4i. Describe various methods to prevent air pollution. 4j. State sources and effects of noise pollution. 4k. Describe preventive measures for noise pollution. 4l. State characteristics of solid waste. 4m. State the impacts of solid waste. 4n. Describe incineration, RDF and sanitary landfilling. 4o. State the standards limiting/controlling values of various types of pollution.	standards, flow diagram of water treatment plant, Water conservation. 4.4 Wastewater - Generation(domestic and industrial), Impacts, flow diagram of sewage treatment plant, CPCB norms of sewage discharge. 4.5 Air pollution - Causes, effects, prevention, Ambient air quality standards. 4.6 Noise pollution - Sources, effects, prevention, noise levels at various zones of the city. 4.7 Municipal Solid Waste, Bio-medical waste and E-waste - Sources, generation, characteristics, effects, and methods to manage.
Unit-V Social Issues and Environmental Education	5a. Elaborate article (48-A) and (51-A (g)) 5b. Enlist various acts on environment and its provisions. 5c. State the roles and responsibilities of CPCB. 5d. Define sustainable development, and EIA. 5e. Describe rain water harvesting and groundwater recharge. 5f. Differentiate between formal and non formal education.	5.1 Article (48-A) and (51-A (g)) of Indian Constitution regarding environment, Environmental protection and prevention acts, CPCB and MPCB norms and responsibilities, The role of NGOs. 5.2 Concept of sustainable development, EIA and environmental morality. 5.3 Management Measures - Rain Water harvesting, Ground water recharge, Green Belt Development, Use of Renewable energy, water shed management, interlinking of rivers. 5.4 Role of information technology in environment and human health.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Environment	06	4	6		10
II	Energy Resources	10	4	8		16



Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
III	Ecosystem and Biodiversity	08	4	4	4	12
IV	Environmental Pollution	16	8	8	4	20
V	Social Issues and Environmental Education	08	4	4	4	12
Total		48	24	30	16	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Plant and adopt a tree in your nearby locality/Polytechnic campus and prepare report about its growth and survival after six months with photos.
- Organize seminar on air pollutants of relevant MIDC area/vehicle
- Organize poster exhibition about global warming and ozone depletion.
- Visit a nearest water purification/effluent treatment plant.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Guide student(s) in undertaking micro-projects.
- Use proper equivalent analogy to explain different concepts.
- Use Flash/Animations to explain various topics.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so



that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

- a. Prepare a report on visit to PUC Center.
- b. Visit a near by RO plant and prepare detail technical report.
- c. Prepare report on Household water filtration unit
- d. Prepare a list of polluted natural resources which are responsible for pollution and collect information on how to manage them .
- e. **Collection of Data from Hospital: Collect** everyday information on percentage of solid hazardous and toxic waste for two month
- f. **Visit of Municipal Effluent Treatment Plant:** Visit effluent treatment plant and prepare report on waste management.
- g. **Visit of Water Treatment Plant:** Visit water treatment plant and prepare report on various units of water treatment and its management.
- h. **Preparation of report:** Prepare the chart of solid waste management showing effects on environment.
- i. **And any other relevant topic related to course**

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Basic Environmental Sciences	Michael Allaby	Routledge Publication, 2 nd Edition, 2000, ISBN: 0-415-21176-X
2	Environmental Science	Y. K. Singh	New Age International Publishers, 2006, ISBN: 81-224-2330-2
3	Environmental Studies	Erach Bharucha	University Grants Commission, New Delhi
4	Environmental Studies	Rajagopalan	Third Edition, Oxford University Press, USA, ISBN: 9780199459759, 0199459754
5	A text book of Environmental Science	Arvind Kumar	APH Publishing New Delhi
6	A text book of Environmental Studies	Shashi Chawla	Tata Mc Graw-Hill New Delhi

14. SOFTWARE/LEARNING WEBSITES

- a. www.eco-prayer.org
- b. www.teriin.org
- c. www.cpcb.nic.in



- d. www.indiaenvironmentportal.org.in
- e. www.whatis.techtarget.com
- f. www.sustainabledevelopment.un.org
- g. www.conserve-energy-future.com



Program Name : Electronics Engineering Programme Group
Program Code : DE/EJ/ET/EN/EX/EQ
Semester : Fifth
Course Title : Control Systems and PLC
Course Code : 22531

1. RATIONALE

A control system is a discipline that applies automatic control theory to design systems in such a way as to achieve a desired control of operation of the system. Control engineering has an essential role in a wide range of control systems. It seeks to understand physical systems, using mathematical modeling, in terms of inputs, outputs and various components with different behaviors. This course will facilitate students to use the different control systems used in various range of applications from simple home heating controller using a thermostat to a large Industrial control systems which are used for controlling processes or machines. The course introduces Control system and PLC which is adapted for the control of manufacturing processes.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Maintain electronic automated systems in process and manufacturing industries.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

- Identify different types of control systems.
- Determine the stability of the control system.
- Test the performance of various types of controllers.
- Maintain various components of PLC based process control system.
- Maintain PLC based process control systems.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
4	-	2	6	3	70	28	30*	00	100	40	25@	10	25	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C - Credit
 ESE - End Semester Examination; PA - Progressive Assessment

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels



of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

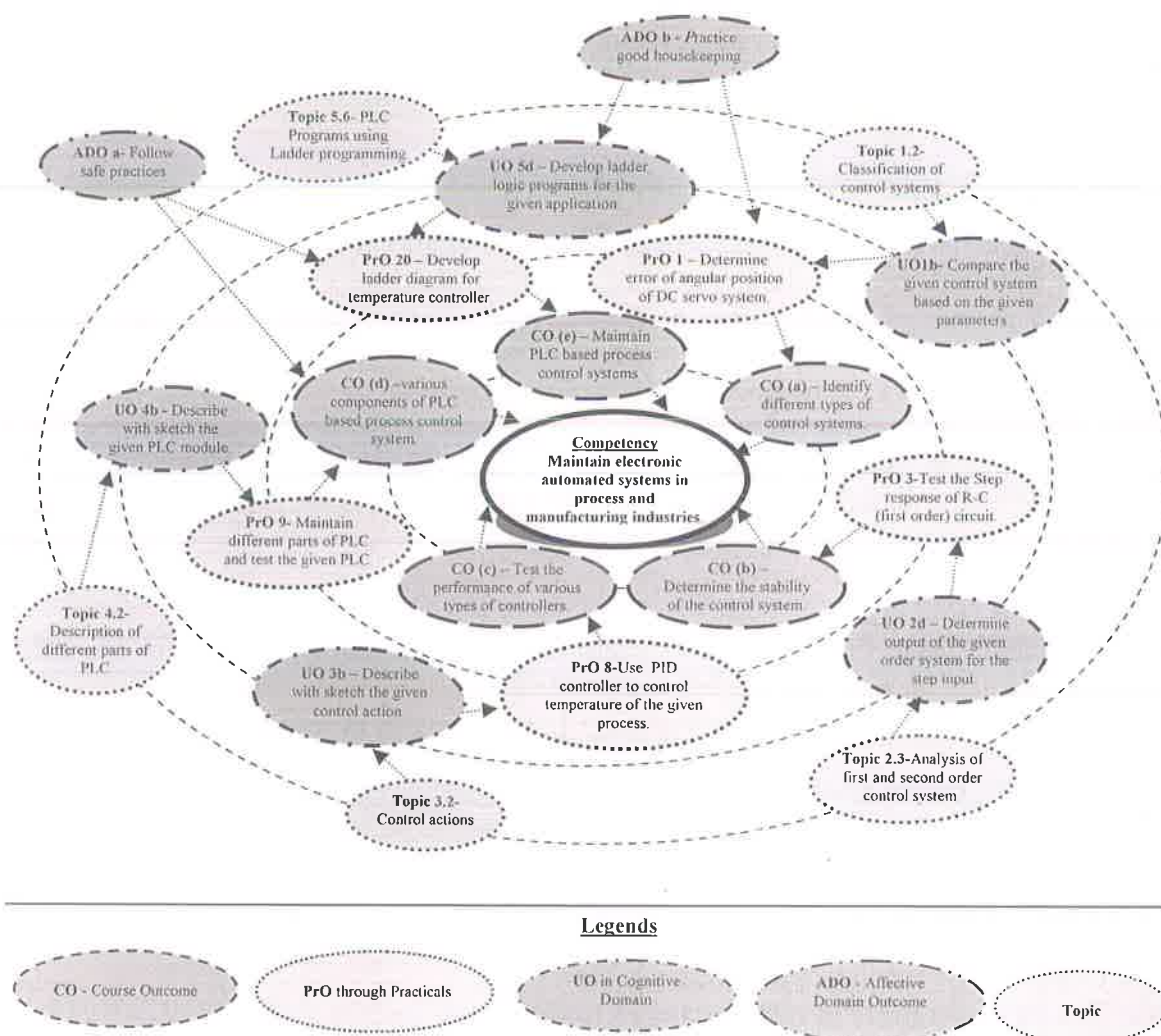


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency:

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Use potentiometer as error detector.	I	02*
2	Determine error of angular position of DC servo system.	I	02
3	Test the Step response of R-C (first order) circuit.	II	02*
4	Test the Step response of R-L-C (second order) circuit.	II	02
5	Test the functionality of temperature control with on-off controller.	III	02*
6	Use PI controller to control temperature of the given process.	III	02
7	Use PD controller to control temperature of the given process.	III	02
8	Use PID controller to control temperature of the given process.	III	02*
9	Identify and test different parts of PLC.	IV	02*
10	Develop ladder diagram to test the functionality of the logic gates.	V	02
11	Develop ladder diagram to test Demorgan's theorem.	V	02*



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
12	Develop the ladder diagram for Adder and Subtractor by using PLC.	V	02
13	Develop ladder diagram for ON and OFF control of lamp using timer and counter.	V	02
14	Develop ladder diagram for traffic light Control system.	V	02
15	Develop ladder diagram for stepper motor control.	V	02*
16	Develop ladder diagram for temperature controller.	V	02*
Total			32

Note

- A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S.No.	Performance Indicators	Weightage in %
a.	Preparation of experimental set up	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Practice energy conservation.
- Work as a leader/a team member.
- Follow ethical Practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

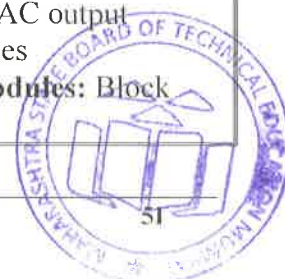
S. No.	Equipment Name with Broad Specifications	PrO. No.
1	Cathode ray oscilloscope: Dual trace 50Mhz	03,04
2	Multimeter 3 1/2: AC/DC,0-200V	01 ,02,06 to 08
3	DC position trainer kit	02
4	Potentiometer trainer kit	01
5	RC kit	03
6	RLC kit	04
7	ON-OFF controller kit	05
8	PID controller trainer kit	06 to 08
9	PLC trainer kit (20 digital I/O points and 2 analog I/O channels)	09 to 16
10	Desktop PC	10 to 16
11	Simulation Software: Picosoft, Scilab, Matlab, Prosim, PSpice, LabVIEW, Electronics Workbench, Win pro ladder	01 to 16

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit– I Basics of control system	1a. Explain with sketches the working of the given type of control systems. 1b. Compare the given control systems based on the given parameters. 1c. Derive transfer function of the given electrical circuits. 1d. Use block diagram reduction rules to determine optimize transfer function of the given system.	1.1 Control system: Basics of control system block diagram and practical examples 1.2 Classification of control systems: Open loop and closed loop systems- block diagram, practical example and comparison, Linear and non -linear systems, Time varying and Time In-varying systems- practical example and comparison servo system - 1.3 Transfer function: Close loop and open loop system RC, LC and RLC circuits-Differential equations and transfer functions and analysis using Laplace transform 1.4 Block diagram reduction technique: Need, reduction rules,
Unit– II Time domain stability analysis	2a. Compare the parameter of given standard test inputs. 2b. Identify poles, zeros, type and order for the given transfer function. 2c. Sketch pole zero plot for the given transfer function. 2d. Determine output of the given order system for the step input.	2.1 Time Response: Transient and steady state response. 2.2 Standard test inputs: Step, ramp, parabolic, impulse and their corresponding Laplace transform 2.3 Analysis of first and second order control system: i. Poles and zeros - S-plane representation Order of system (0, 1, 2)- standard equations, examples and numerical problems ii. First order system -Analysis for unit step input, concept of time constant

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	2e. Calculate time response specifications of the given transfer function. 2f. Calculate error constants of the given type of control system. 2g. Determine stability of the given control system using Routh's stability criteria.	iii. Second order system - Analysis for unit step input (no derivation), concept, definition and effect of damping iv. Time response specifications (no derivations) - T_p , T_s , T_r , T_d , M_p , E_{ss} , numerical problems 2.4 Steady state analysis : Type 0, 1, 2 systems- steady state error and error constants, numerical problems 2.5 Stability : Concept of stability, root locations in S-plane and analysis- stable system, unstable system, critically stable systems, conditionally stable system, relative stability 2.6 Routh's stability criterion : Steps and procedures to find stability by Routh's stability criteria,
Unit –III Process controllers	3a. Explain with sketch the given process control system. 3b. Describe with sketch the given control action. 3c. Compare different electronic controllers on the basis of the given parameters. 3d. Sketch the response of the given controller with respect to error.	3.1 Process Control System : Block diagram, functions of each block 3.2 Control actions : i Discontinuous mode - ON-OFF controllers- equation, neutral zone ii Continuous modes : Proportional Controller - offset, proportional band. Proportional, Integral and Derivative controllers -o/p equation, response, characteristics, 3.3 Composite controllers : PI, PD, PID controllers- o/p equation, response
Unit-IV Fundamentals of PLC	4a. Explain with sketch PLC based automation system. 4b. Describe with sketch the given PLC module. 4c. Identify different devices interfaced with PLC. 4d. Explain the steps for PLC installation.	4.1 PLC -Block diagram, classification, (fixed and modular PLCs), need and benefits of PLC in automation 4.2 Description of different parts of PLC : CPU –function, scanning cycle, speed of execution, Power supply- block diagram and function of each block Memory – function and organization of ROM and RAM Input and output modules- function, different input and output devices of PLC (only name and their uses). 4.3 PLC Installation
Unit-V PLC hardware and programming	5a. Identify and describe the given module of PLC. 5b. Describe the given addressing of PLC. 5c. Use instruction set to perform the given operation. 5d. Develop ladder logic programs for the given	5.1 Discrete input modules : Block diagram, specifications of AC input modules and DC input module. Sinking and sourcing concept in DC input modules 5.2 Discrete output modules : Block diagram description, specifications of AC output module and DC output modules 5.3 Analog input and output modules : Block diagram, specifications



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	application.	5.4 I/O addressing of PLC: Addressing data files, format of logical address, different addressing types 5.5 PLC Instruction set: Relay instructions, timer and counter instructions, data movement instructions, logical and comparison instructions 5.6 PLC Programs using Ladder programming language.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Basics of Control System	10	02	04	06	12
II	Time domain stability analysis	16	04	04	08	16
III	Process Controllers	08	02	04	04	10
IV	Fundamentals of PLC	12	04	04	06	14
V	PLC Hardware and Programming	18	04	06	08	18
Total		64	16	22	32	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare manuals based on practical performed in laboratory.
- Follow the safety precautions.
- Give seminar on relevant topic.
- Library /Internet survey regarding different data books and manuals.
- Prepare power point presentation on PLC.
- Undertake a market survey of different manufacturer of PLC.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.



- b. '**L**' in *item No. 4* does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c. About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- e. Guide student(s) in undertaking micro-projects.
- f. Use Flash/Animations to explain working of control system.
- g. Use open source simulation software modules to perform different applications using PLC.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

- a. Simulate and test the performance of 1st order RC and 2nd order RLC Circuit using simulation software.
- b. Prepare a chart to show the error constants of type 0, 1 and 2 systems for different standard test inputs.
- c. Simulate and test the performance of PI, PD, and PID-control action using simulation software.
- d. Prepare a chart to show characteristics of control actions with respect to error.
- e. Prepare a report on the basis of PLC data sheets of various manufacturers.
- f. Develop/Test a ladder diagram for controlling washing machine operations.(Wash cycle-inlet valve should open for 10 sec. Motor starts running after 10sec. Running time for motor is 20sec. After that motors stops. Then outlet valve opens and water is drained out. Same operations are repeated for rinse cycle. Spin cycle- Motor runs at high speed for 20 sec and outlet valve remains open for the whole period of spin cycle.)
- g. Develop/Test a ladder diagram for automatic cold drink bottle filling system.(When sensor senses a bottle, after 3 sec outlet valve of the container containing cold drink will open . It will be open for 10 sec and then the valve will be closed. The bottle will be moved forward automatically. The process should stop after filling of 25 bottles.)
- h. Develop/Test a ladder diagram for Interlock Control circuit. (The entry/exit of the parking lot is a single lane passage. By controlling the indicators only one car should pass through the entry/exit so as to prevent car accidents between entering and leaving cars.)



- i. Develop/Test a ladder diagram for product mass packaging. (When the photoelectric sensor detects specified number of products, robotic arm will begin to pack up. When the action is completed, robotic arm and counter will be reset.)
- j. Develop/Test a ladder diagram for 24 hour clock operated by 3 counters.
- k. Develop/Test a ladder diagram for sequential delay output i.e starting 3 motors sequentially. (Example- Start the oil pump motor when the start button is pressed. Main motor will be started after 10 sec delay and then the auxiliary motor after 5 sec delay. Also stop all the motors immediately when stop button is pressed.)
- l. Develop/Test a ladder diagram for performing Pulse-Width modulation by changing the set value in the timer.
- m. Develop/Test a ladder diagram for Artificial Fish pond water level monitoring system. (Feeding /Draining water immediately when the water level of the artificial fish pond is not at the normal level. Also enabling the alarm and alarm lamp when the water is above or below the normal level.)
- n. Develop/Test a ladder diagram for Automatic Door Control system. (When someone enters the door should open automatically and if no one enters for about 10sec, door should close automatically. Also if someone enters the sensing field during door closing process, closing action should stop immediately.)
- o. Develop/Test a ladder diagram for Automatic Coffee Making system. (When a coin is inserted paper cup should come out from the outlet. At the same time coffee pours in the mixing container. After 2 sec hot water pours in. After 60 sec readymade coffee will come out from coffee outlet.)
- p. Develop/Test a ladder diagram for automatic control of a machine which is required to direct 6 objects along one path for packaging in a box and then 12 objects along another path for packaging in another box. A deflector plate might be controlled by a photocell sensor gives an output every time an object passes it.

13. SUGGESTED LEARNING RESOURCES

S. No.	Author	Title of Book	Publication
1	Process control instrumentation Technology	Johnson, C. D.	Prentice Hall, 8th edition, United States of America, 2014 ISBN: 978-0131194571
2	Intro. To Programmable logic control	Dunning, Gary	Cenage Learning, United States of America, 2005 ISBN: 9781401884260
3	Control System Engineering	Nagrath, J.J. ; Gopal, M.	Anshan Publishers (2008) ISBN: 9781848290037
4	Modern control Engineering	Ogata, K.	PHI , 5th Edition, NEW DELHI, 2010 ISBN: 978812034010
5	Programmable logic controllers and industrial automation an introduction	Mitra, Madhuchhanda ; Gupta, Samarjit Sen	Penram, 1st Edition, Mumbai, 2007 ISBN: 9788187972174
6	Programmable logic controllers	Petruzella, F.D.	Tata- McGraw Hill, 3 rd Edition, 2010 ISBN: 9780071067386

14. SOFTWARE/LEARNING WEBSITES

- a. www.scilab.org



- b. www.openplc.fossee.in
- c. [www.github.com/FOSSEE/OpenPLC](https://github.com/FOSSEE/OpenPLC)
- d. [www.youtube.com /plc](https://www.youtube.com/plc)
- e. [www.dreamtechpress.com /ebooks](http://www.dreamtechpress.com/ebooks)
- f. www.nptelvideos.com/control_systems/
- g. www.in.mathworks.com/solutions/control-systems.html?s_tid=srchtitle
- h. www.edx.org/course?subject=Engineering&course=all&language=English
- i. www.plcs.net
- j. www.ab.rockwellautomation.com › Allen-Bradley
- k. www.plc-training-rslogix-simulator.soft32.com/free-download/





Program Name : Electronics Engineering Programme Group
Program Code : DE/EJ/ET/EN/EX/EQ/IS/IC
Semester : Fifth
Course Title : Embedded Systems (Elective for IS/IC)
Course Code : 22532

1. RATIONALE

In the rapidly growing digital world, role of embedded systems is increasingly vital in various domains such as industrial and home automation, entertainment systems, medical equipments and many more. The core of all such system is powered by electronic hardware and associated software. It is therefore evident to impart the knowledge of the related technology and hands on skills to develop and maintain electronics hardware based embedded systems.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Maintain Embedded Systems.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

- Select the relevant microcontrollers for various industrial applications.
- Use 'Embedded C' programming language to maintain embedded systems.
- Interpret the communication standards of embedded systems.
- Develop basic applications using embedded systems.
- Interpret features of Real Time Operating System.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25#	10	25	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment

5. COURSE MAP (with sample COs, ProOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the



course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

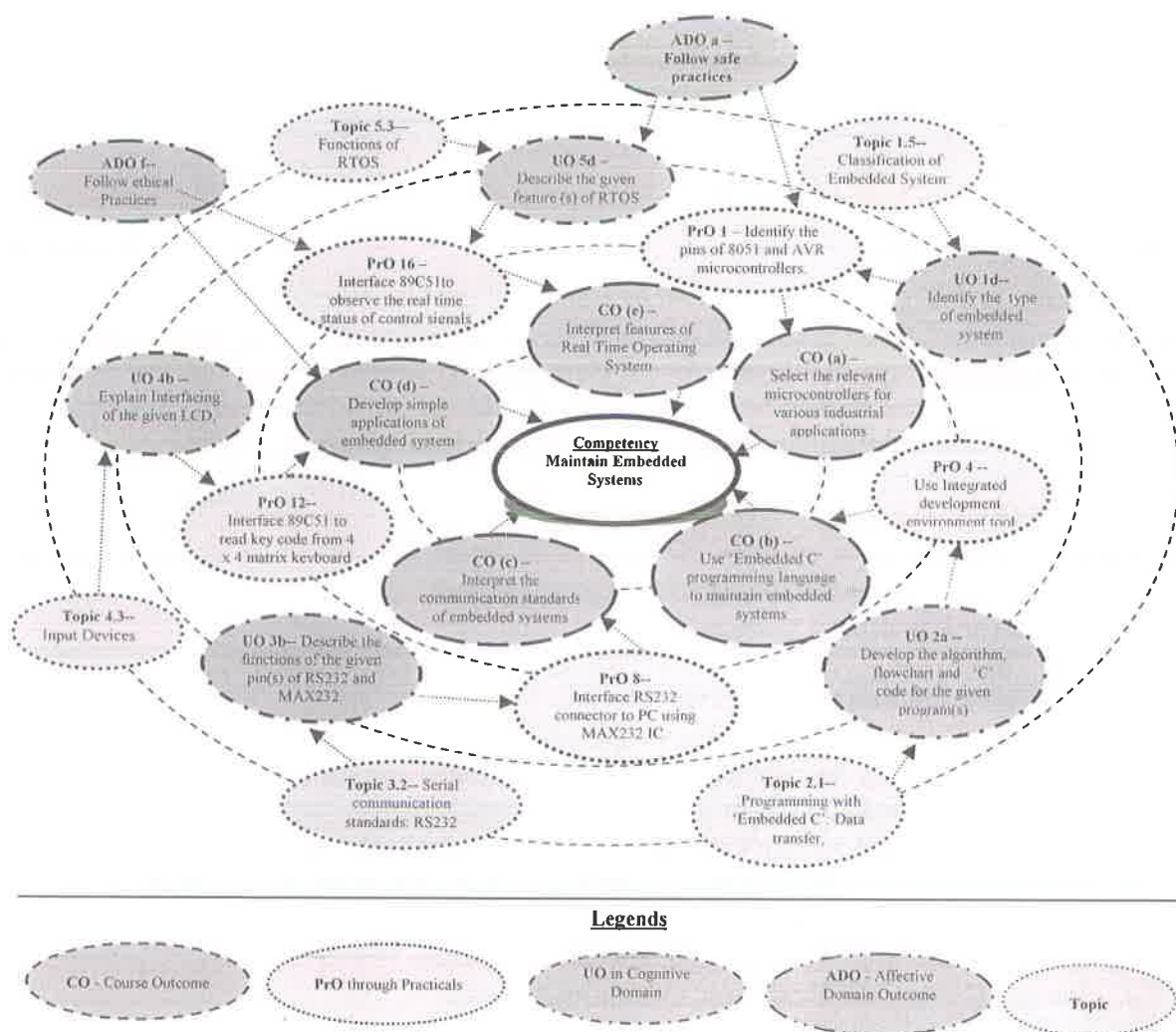


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency:

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Identify the pins of 8051 and AVR microcontrollers.	I	2*
2	Identify the pins and features of PIC microcontrollers.	I	2
3	Identify the features of ARM microcontroller on the basis of IC number.	I	2
4	Use Integrated development environment tool for developing embedded 'C' programs (Using MicroProC/ Keil).	II	2*
5	Execute the 'C' program to perform following arithmetic operations on 8-bit data: addition, subtraction, multiplication and division.	II	2*
6	Develop and Test the 'C' program to perform following arithmetic operations on 16-bit data: addition, subtraction.	II	2



Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
7	Develop and Test the 'C' program to perform data transfer from source to destination (Use internal data memory locations).	II	2*
8	Interface RS232 connector to PC using MAX232 IC.	III	2
9	Develop and test the 'C' program to turn on LED (S) with key (S) press.	IV	2*
10	Interface 89C51/AVR microcontroller and write the 'C' program to display numbers from 0 to 9 on 7-segment display with specified delay.	IV	2
11	Interface 89C51/AVR microcontroller and write C program to display string on given 16 x 2 LCD.	IV	2*
12	Interface 89C51/AVR microcontroller and write 'C' language program to read key code from 4 x 4 matrix keyboard and LCD display .	IV	2*
13	Interface 89C51/AVR microcontroller and write C program to convert analog signal into digital form using given 8 bit ADC and store the converted digital data in memory.	IV	2*
14	Interface 89C51 and write C program to generate square and sawtooth waveforms using given 8 bit DAC.	IV	2*
15	Interface 89C51 /AVR microcontroller and write C program to rotate stepper motor with different speeds in clockwise and counter clockwise direction.	IV	2*
16	Interface 89C51 and write C program to observe the real time status of the triangular waveform generated using DAC (Use IDE tool MicroProC / Keil).	V	2
Total			32

Note

- A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

Sr. No.	Performance Indicators	Weightage in %
a.	Preparation of experimental set up	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		100



The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- a. Follow safety practices.
- b. Practice good housekeeping.
- c. Practice energy conservation.
- d. Work as a leader/a team member.
- e. Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisitions of the ADOs take place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

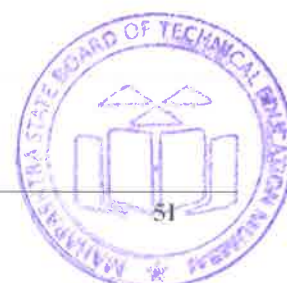
7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

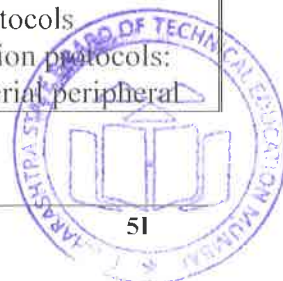
Sr. No.	Equipment Name with Broad Specifications	PrO. No.
1	Microcontroller kit (8051,AVR/PIC/ARM): Single board systems with minimum 8K RAM,ROM memory with battery back up,16X4, LCD display,7-segment Display, PC keyboard interfacing facility, 4X4 matrix keyboard, cross c-compiler, USB, interfacing facility with built in power supply.	All
2	Arduino Board with AVR microcontroller	All
3	Desktop PC with Integrated Development Environment (MicroPro C/ Keil / Proteus).	All
4	Stepper Motor- 50/100 RPM (or any relevant).	15
5	CRO- Bandwidth AC 10Hz ~ 20MHz (-3dB). DC ~ 20MHz (-3dB), X10 Probe.	13,14,
6	ADC (0808) trainer board.	13
7	DAC (0808) trainer board.	14
8	Add on cards.	9
9	Digital Multimeter : 3 1/2 digit display, 9999 counts digital multimeter measures: V_{ac} , V_{dc} (1000V max) , A_{dc} , A_{ac} (10 amp max) , Resistance (0 - 100 M Ω) , Capacitance and Temperature measurement	13,14, 15,16

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.



Unit	Unit Outcomes (UOs) (In cognitive domain)	Topics and Sub-topics
Unit– I Introducti on to Embedded systems	1a. Describe the given component (s) of the given embedded system. 1b. Describe with the help of block diagram, the architecture of the given processor. 1c. Describe the given characteristic (s) of the specified embedded systems. 1d. Identify with justification the type of embedded systems used for the given application. 1e. Select with justification the relevant microcontroller from the existing microcontroller families for the given application.	1.1 Block diagram of embedded system with hardware components 1.2 Harvard and Von-Neumann architecture, RISC and CISC processors 1.3 Features of 89C51, PIC, AVR and ARM microcontrollers with their applications 1.4 Characteristics of embedded system: Processor power, memory, operating system, reliability, performance, power consumption, NRE cost, unit cost, size, flexibility, time-to-prototype, time-to-market, maintainability, correctness and safety 1.5 Classification of embedded system: small scale, medium scale, sophisticated, stand-alone, reactive/real time (soft and hard real time).
Unit– II Programm ing using Embedded C	2a. Develop the algorithm, flowchart and 'C' program (s) for the given microcontroller to perform the given operation. (data transfer, arithmetic /logical, decision control and looping operations). 2b. Develop the algorithm, flowchart and 'C' code for the given delay using timer/counter with microcontroller. 2c. Develop the algorithm, flowchart and 'C' code for the given data transfer through serial communication port. 2d. Develop the algorithm, flowchart and 'C' code to control the given interrupt.	2.1 Programming with 'Embedded C': arithmetic and logical operations, data transfer with memory and port, decision control & looping 2.2 Timer/Counter program using 'embedded C' for given microcontroller 2.3 Serial communication program using 'embedded C' for given microcontroller 2.4 Interrupt control program with 'embedded C' for given microcontroller
Unit-III Communi cation standards and protocols.	3a. Describe the given mode (s) of communication. 3b. Describe the functions of the given pin(s) of RS232 and MAX232 with suitable sketch. 3c. Describe the given communication protocol (s) with relevant sketch. 3d. Describe the given advanced serial communication interface.	3.1 Modes of data communication: serial parallel, synchronous and asynchronous communication 3.2 Serial communication standards: RS232 3.3 MAX232 as a bidirectional level converter 3.4 Communication protocols i. Serial communication protocols: I ² C, CAN, USB, serial peripheral



Unit	Unit Outcomes (UOs) (In cognitive domain)	Topics and Sub-topics
		interface (SPI), synchronous serial protocol (SSP) ii. Parallel communication protocols: PCI, PCI-X 3.5 Features of advanced serial protocol: IrDA, bluetooth, zigbee
Unit –IV Interfacing Input and Output devices	4a. Explain the steps for interfacing of the given basic input/output device (s) to the given microcontroller with embedded 'C' 'program. 4b. Explain the steps for interfacing of the given LCD, matrix key board, multiplexed 7-segment display, sensor to the given microcontroller with embedded 'C' program. 4c. Explain interfacing of DC motor to the given microcontroller to rotate in the given direction using embedded 'C' program. 4d. Explain the steps for interfacing of given stepper motor with the microcontroller to rotate in given direction, angle of rotation, with half step/full step with embedded 'C' program. 4e. Explain interfacing steps of the given ADC/DAC to convert data with the given microcontroller with embedded C program.	4.1 Interface the various input, output and special devices to the microcontroller 89C51/AVR 4.2 Output Devices : LED, LCD, relays, 7-segment displays, multiplex 7-Segment display 4.3 Input Devices : key, matrix keyboard 4.4 Motor : stepper motor, DC motor 4.5 ADC/DAC: 8 bit ADC/DAC (0808/09) 4.6 Sensor :Temperature sensor (LM35)
Unit-V Real Time Operating Systems	5a. Describe the given functions of the specified operating system with suitable sketch. 5b. Compare the given characteristics of RTOS and General OS. 5c. Explain deadlock condition in RTOS with suitable sketch. 5d. Explain the given features of RTOS with suitable sketch.	5.1 Operating system: general and real time operating system 5.2 Characteristics of real time operating system: consistency, reliability, scalability, performance, predictability 5.3 Functions of RTOS: i. Task management: inter task communication and multitasking ii. Scheduling: scheduling algorithms. iii. Resource allocation and interrupt handling 5.4 Features of RTOS: watchdog timer, semaphore 5.5 Deadlock: i. Reason of occurrence ii. Handling of deadlock, detection, prevention, ignoring



Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to embedded systems	08	04	04	04	12
II	Programming using embedded 'C'	12	02	06	08	16
III	Communication standards and protocols	08	02	04	06	12
IV	Interfacing input and output devices	12	04	06	08	18
V	Real Time Operating Systems	08	02	04	06	12
Total		48	14	24	32	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Download the data sheets of all the components used in the practical.
- Prepare a documentation of all the components and devices along with their specifications.
- Deliver seminar on relevant topic.
- Library / Web survey regarding different data books and manuals.
- Prepare power point presentation on applications of microcontroller.
- Undertake a market survey of different microcontrollers.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- '**L**' in **item No. 4** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).



- d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
- e. Guide student(s) in undertaking micro-projects.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be *individually* undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

- a. Prepare a chart of various features using data sheets of 8051, PIC, AVR, ARM microcontroller and its derivatives.
- b. Prepare a chart of various features and operations of temperature sensors, devices using data sheets.
- c. Prepare a chart of various types of LCDs to display its features, pin functions and steps of operations using data sheets.
- d. Interface potentiometer with development board (Arduino) and write a program to generate LED pattern on it.
- e. Programming of an Arduino (Arduino ISP) Interfacing Motor through L293D Driver with Arduino
- f. Interfacing Accelerometer with Arduino Interfacing of Relay Driver ULN2803 with Arduino
- g. Build a flashing display to flash advertisement of Mobile shop.
- h. Build a system to display department name using rolling display.
- i. Build a buzzer system for rapid fire quiz competition.
- j. Build a two digit counter.
- k. Build a class period bell as per the given time table which includes 7 teaching periods and lunch hour.
- l. Build a temperature monitoring system to maintain temperature in given range.
- m. Build a pollution monitoring system to observe the level of CO₂.
- n. Build automated door control system to open and close the door.
- o. Build traffic light controller for traffic signals as per specified delay.
- p. Build a water level controller for given water levels.

Note: Use appropriate software for programming. Build the circuit on PCB or use development board such as Arduino.



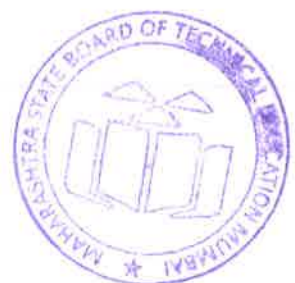
13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	8051 Microcontroller Architecture, Programming and Application	Ayala, Kenneth	Cenage learning, 3 rd edition, New Delhi, 2007, ISBN: 978-8131502006
2	The 8051 Microcontroller and Embedded system	Mazidi, Mohmad Ali; Janice, Gelispe and Mckinlay, Roline D.	Pearson, 2 nd edition, Delhi, 2008, ISBN: 9788177589030
3	Microcontroller Principle and Application	Pal, Ajit	PHI, New Delhi, 2014, ISBN: 9788120343924
4	Microcontroller Theory and Application	Deshmukh, Ajay	McGraw Hill Education, New Delhi, 2011, ISBN: 9780070585959
5	Microcontroller Architecture Programming, Interfacing and System Design	Rajkamal	Pearson Education India, Delhi, 2012, ISBN: 9788131759905
6	The Embedded Software Primer	David E. Simon	Addison-Wesley, Delhi ISBN: 9780201615692

14. SOFTWARE/LEARNING WEBSITES

- a. Simulation Software :- www.keil.com
- b. <https://www.arduino.cc>
- c. <https://scilab-arduino.fossee.in>
- d. www.nptel.ac.in/courses/Webcourse-contents/IITKANPUR/microcontrollers/micro/ui/Course_home2_5.html
- e. www.nptelvideos.in/2012/11/real-time-systems.html
- f. RTOS:- <https://www.youtube.com/watch?v=rpdygqOI9mM>
- g. www.intorobotics.com/8051-microcontroller-programming-tutorials-simulators-compilers-and-programmers
- h. www.electrofriends.com/articles/electronics/microcontroller-electronics-articles/8051-8951/80518951-microcontroller-instruction-set
- i. www.ikalogic.com/part-1-introduction-to-8051-microcontrollers
- j. www.binaryupdates.com/switch-with-8051-microcontroller
- k. www.mikroe.com/chapters/view/64/chapter-1-introduction-to-microcontrollers
- l. www.8051projects.net/download-c4-8051-projects.html
- m. <https://www.elprocus.com/difference-between-avr-arm-8051-and-pic-microcontroller>





Program Name : Electronics Engineering Programme Group
Program Code : DE/EJ/ET/EN/EX/EQ
Semester : Fifth
Course Title : Mobile and Wireless Communication
Course Code : 22533

1. RATIONALE

In this world of connectivity and collaborative work environment, it is necessary to connect to the network from anywhere, with anybody, at anytime. Wireless communication provides connectivity with mobility, flexibility and convenience. Wireless devices are used across the various industries like Healthcare, Education, Automation, Renewable energy sector, Automobile etc. Effective use of Social networking has become possible due to high end wireless devices. This course will help the students to develop skills to handle wireless and mobile communication systems.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Maintain mobile communication systems.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above-mentioned competency:

- Troubleshoot mobile handsets.
- Assess cellular systems capacity.
- Assess performance of standards of different cellular mobile systems.
- Select relevant wireless technology suitable for various applications.
- Test the performance of various wireless protocols.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
4	-	4	8	3	70	28	30*	00	100	40	50#	20	50	20	100	40

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C - Credit
 ESE - End Semester Examination; PA - Progressive Assessment

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)



This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

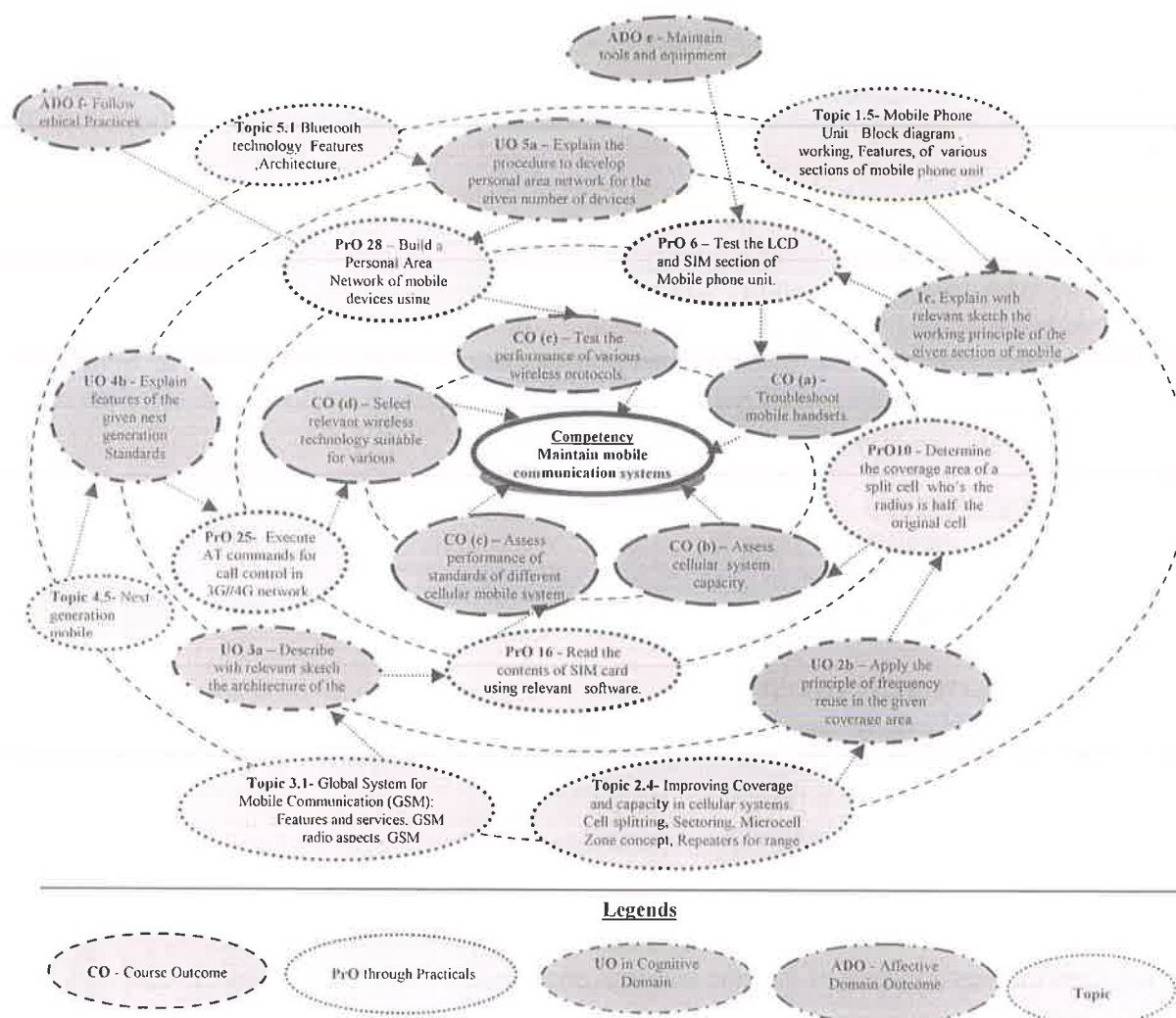


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency:

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Identify different sections and components of mobile phone such as ringer section, dialer section, receiver section and transmitter section, camera, microphone, speaker, flash light.	1	02*
2	Identify the inbuilt sensors of mobile handset and test their performance.	1	02
3	Perform cold test of different sections of mobile phone unit.	1	02*
4	Test the supply of the Transmitter /Receiver section of mobile phone unit.	1	02*
5	Test the Battery charger section and power management unit of	1	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	mobile phone unit.		
6	Test the LCD and SIM section of mobile phone unit.	I	02
7	Test the user Interface section (Keyboard Buzzer, Vibrator, LED, Mic, and Speaker) of Mobile phone unit.	I	02*
8	Troubleshoot the Battery charger section, LCD section and SIM card section of the mobile handset.	I	02*
9	Troubleshoot the speaker problem, Ringer problem, Microphone problem, vibrator problem (User Interface section).	I	02
10	Determine the coverage area of a split cell which has radius half the radius of original cell.	II	02*
11	Determine the channel capacity of a cellular system service area comprised of 4/7/12 microcells with 8/12/16 channels per microcell.	II	02*
12	Determine the channel capacity if each microcell in the above lab exercise split into 4 minicells and each minicell is further split into 4 microcells.	II	02
13	For the 7- cell cluster and 168-voice channels cellular system, determine the assignment of voice channel to each cell if Omni-directional antenna is used at the cell site.	II	02*
14	For the 7- cell cluster, 168-voice channels cellular system, determine the assignment of voice channel to each sector if 3-sector 120° and 6 -sector 60° directional antenna are used at the cell site.	II	02*
15	Perform installation, registration, activation and authentication of mobile applications on mobile handset.	III,IV	02
16	Read/Retrieve the contents of SIM card using relevant software.	III,IV	02*
17	Execute call control commands using relevant software.	III,IV	02*
18	Execute Network service commands using relevant software.	III,IV	02
19	Execute Security commands using relevant software.	III,IV	02
20	Execute Phone book commands using relevant software.	III,IV	02*
21	Execute Short message commands using relevant software.	III,IV	02*
22	Execute Data commands using relevant software.	III,IV	02
23	Execute Specific AT commands using relevant software.	III,IV	02
24	Execute AT commands for call control in 3G/4G network.	IV	02*
25	Execute AT commands for Video call and Phone camera related commands in 3G/4G network.	IV	02
26	Execute AT commands for Microphone and Loudspeaker volume control related commands in 3G/4G network.	IV	02
27	Build a Personal Area Network of mobile devices using Bluetooth.	V	02*
28	Test the hard reset function, hotspot and other networking functions of the given smart phone.	V	02
	Total		56

Note

i. A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 24 or more practicals need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student

reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.

ii. The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S.No.	Performance Indicators	Weightage in %
a.	Preparation of experimental set up	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Practice energy conservation.
- Work as a leader/a team member.
- Follow ethical Practices.

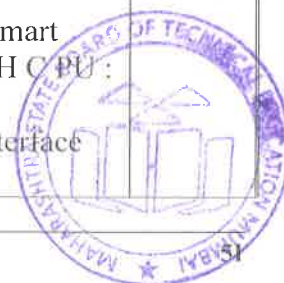
The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No	Equipment Name with Broad Specifications	PrO. No.
1	Mobile Phone Trainer kit: Cellular System : EGSM/GSM 900/ 1800 MHz (3G Dualband), Rx frequency band (Downlink): EGSM 900 : 925-960 MHz GSM 900 : 935- 960 MHz GSM 1800 : 1805-1880MHz Tx frequency band (Uplink) : EGSM 900 : 880- 890MHz GSM 900 : 890- 915 MHz GSM 1800 : 1710-1785MHz Output power : +5, +33 dBm / 3.2 mW , Channel spacing : 200 KHz Display : TFT, 256 K colours, 128X 160 Pixels, 2.0", SIM support : Smart Dual SIM, Dual stand by (both GSM), Battery type : Li-Ion 1000m AH CPU : 208 MHz, Sound : Speaker and Earphone Jack (3.5 mm) On board sections : Keypad, Dual SIM, Charging Circuit, Clock, User interface such as Buzzer, Vibrator, LEDs. Test points: 50 nos. (Gold plated)	1, 2 to 8,



S. No	Equipment Name with Broad Specifications	PrO. No.
	Features that can be set :Screen savers, Ring tones, Logos, SMS	
2	3G GSM Mobile Phone trainer: GSM capability: GSM 900 /1800, E-GSM GSM data services: Asynchronous, Transparent & Non Transparent modes. 14.4 K bits/s, SIM Interface : 3 V RF , Transmitter : Maximum output power : 33 dBm +/- 23dB,(EGSM) Maximum output power : 30 dBm +/- 2 dB (DCS) Minimum output power : 5 dBm +/- 5 dB (EGSM) Minimum output power : 0 dBm +/- 5 dB (DCS1800)	2,4,5,6
3	Spectrum Analyzer: 9Khz to 1.5 GHz frequency range, Typical 135dBm Displayed average noise level(DANL) 80dBc/Hz @ 10KHz offset, phase noise Total amplitude Uncertainty < 1.5dB, 100Hz Minimum Resolution Bandwidth (RBW), Frequency Resolution 1Hz, Frequency span range 0 Hz, 100 Hz to maximum Frequency of instrument, Video bandwidth (-3db) 1Hz to 3 MHz in 1-3-10 sequence	2 to 08
4	Digital Multimeter (¾ Digital Multimeter): 4000 counts large LCD display with auto/manual range, No Power OFF under natural operation ,Data Hold, Max/Min value Hold Capacitance, Frequency/Duty Cycle	2 to 8
5	CRO: Bandwidth : DC-30 MHz (-3 dB)] Rise time : 12 ns approx Accuracy : ± 3 % Input Impedance : 1 MΩ 30 pF approx Sensitivity : Internal 5 mm, Ext 0.8 V approx Deflection coefficients : Micro-controller based 12 calibrated steps 5mV/Div – 20V/Div 1-2-5 sequence X-Y mode : Component Testing	2to 8
6	Digital Storage Oscilloscope : 100 MHz with 64K color TFT, 16kbps memory, FFT function, alternate triggering, Roll Mode, Math Function, digital filter, waveform recorder,20 automatic measurements, Standard USB host, USB device with waveform analysis software	2to 12
7	SIM Card Reader: Trainer for SIM card reader, USB SIM card reader, store, read and save the SIM card data	2 to 09
8	Fast Battery charger: 5 to 20 V,100W,1Amp or 2 Amp.	8 to 09
9	Mobile handset Tools:- Tools to repair any smart phone or mobile phone include - soldering iron, soldering station, solder wire, solder paste, liquid flux, paste flux, jumper wire, tweezers, screwdriver, multimeter, dc power supply, ESD-Safe antistatic wrist strap, mat, apron, hand gloves, LCD tester, Battery tester, PCB holder, PCB Cleaner	2 to 09
10	Computer system with 3G/4G modem	14 to 27

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.



Unit	Unit Outcomes (Uos) (in cognitive domain)	Topics and Sub-topics
Unit– I Wireless Communication System	1a. Explain the features of the given mobile radio standards. 1b. Describe with relevant sketch the working of the specified application of the mobile/ fixed wireless communication system. 1c. Explain with relevant sketch the working principle of the given section of mobile handset unit. 1d. Describe with relevant sketch the working of the given fixed wireless network system. 1e. Describe step-by-step trouble shooting procedure for the given section of mobile phone.	1.1 Wireless network generations 1.2 Mobile Radio standards- AMPS, N-AMPS, IS -95, GSM, UMTS, CDMA 2000 1.3 Mobile wireless systems : Cordless Telephone system and Cellular telephone system 1.4 Fixed wireless networks : Wireless Local Loop (WLL) & Local Multipoint Distribution System (LMDS) 1.5 Mobile Phone Unit : Block diagram , working, features, of transmitter, and receiver section, Frequency Synthesizer, Control unit and Logic Unit of Mobile phone, sensors: speakers, camera, touch screen, motion sensors and other common sensors
Unit– II Fundamentals of Cellular System	2a. Explain the given terms, with respect to Cellular systems. 2b. Apply the principle of frequency reuse for the given coverage area. 2c. Choose the handoff mechanism for the given situation with justification. 2d. Explain the effect of the given interference on cellular system performance. 2e. Select the relevant method to improve coverage and system capacity of the given cellular system with justification. 2f. Calculate number of traffic channels and control channels for the given frequency spectrum and the given frequency reuse ratio.	2.1 Cellular concept fundamentals: Cell, cell structure, Cluster, Reuse factor, minimum reuse distance, basic cellular system : mobile station, base station, Traffic channel (Forward and Reverse) , Control channel (Forward and Reverse), Frequency reuse, channel assignment strategies 2.2 Handoff strategies: Concept of handoff, Types of Handoffs: Hard, Soft, Queued, delayed, MAHO (Mobile Assisted Handoff) , Proper and Improper Handoff, Umbrella cell approach 2.3 Interference and system capacity: Co-Channel interference, Adjacent Channel Interference, Channel Planning for wireless systems 2.4 Improving Coverage and capacity in cellular systems: Cell splitting, Sectoring, Microcell Zone concept, Repeaters for range extension
Unit-III Digital Cellular Mobile Standards	3a. Describe with relevant sketch the architecture of the given 3G cellular standard. 3b. Explain features, of the given mobile communication standard. 3c. Describe with relevant sketch call	3.1 Global System for Mobile Communication (GSM): Features and services, GSM radio aspects, GSM architecture, GSM channel types, Security aspects 3.2 GSM call routing : Mobile terminated call and mobile

Unit	Unit Outcomes (Uos) (in cognitive domain)	Topics and Sub-topics
	<p>processing stages in the given cellular standard.</p> <p>3d. Describe with relevant sketch the layered architecture of the given SS7 protocol.</p> <p>3e. Explain the features of the services and performance of the given type of signaling system.</p>	<p>originated call sequence , stages of call processing in GSM</p> <p>3.3 IS-95/CDMA One: features, Radio aspects, comparison with GSM standards</p> <p>3.4 Signaling System No.7 (SS7): Network services part(NSP) , Message transfer Part (MTP), Signaling Correction Control part (SCCP), Services and performance of SS7</p>
Unit –IV Advance Wireless Standards	<p>4a. Explain compatibility requirements of the given wireless standard.</p> <p>4b. Explain features of the given next generation wireless standard.</p> <p>4c. Describe with relevant sketch the functions of the given section of UMTS network architecture.</p> <p>4d. Compare features of two given next generation mobile communication standards.</p> <p>4e. Select the relevant wireless technology for the given application.</p>	<p>4.1 Need for 3G and 4G technology</p> <p>4.2 IMT-2000 global standards: Vision, Compatibility, service and spectrum requirements</p> <p>4.3 UMTS /W-CDMA standard: Features, architecture, UMTS Air-interface specification, security procedure</p> <p>4.4 CDMA 2000, features and advanced versions, advantages of CDMA 2000 over 3G- GSM standards</p> <p>4.5 Next generation mobile standards: Features of 4G & 4G LTE, VoLTE, 4.5G, 5G</p>
Unit-V Wireless Network Technologies	<p>5a. Explain the procedure to develop personal area network for the given number of devices using Bluetooth.</p> <p>5b. Describe with relevant sketch given IEEE protocol standard for wireless communication networks</p> <p>5c. Classify RFID tags on the basis of the given type of parameters.</p> <p>5d. Compare the performance of given wireless network technologies based on given parameters.</p> <p>5e. Describe with relevant sketch the given type of wireless networking technologies applications.</p>	<p>5.1 Bluetooth technology: Features, architecture, frequency band , IEEE 802.15.1 and other wireless protocol, applications , personal area network(PAN)</p> <p>5.2 RFID: Concept, frequency band, classification of RFID tags, applications</p> <p>5.3 WLAN technology: IEEE 802.11, WLAN system architecture, radio spectrum</p> <p>5.4 WMAN /Wi-max/ :IEEE 802.16 WMAN and IEEE 802.16a Wimax</p> <p>5.5 Mobile Ad-hoc networks (MANET's): MANET topologies, applications.</p>

Note: To attain the Cos and competency, above listed Uos need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'



9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Wireless Communication System	10	04	04	04	12
II	Fundamental of Cellular System	12	04	04	04	12
III	Digital Cellular Mobile Standards	12	04	06	06	16
IV	Advance Wireless Standards	18	04	04	10	18
V	Wireless Network Technologies	12	02	04	06	12
Total		64	18	22	30	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of Uos. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Visit nearby MTNL/BSNL exchange and prepare detail report of entire setup of their cellular system.
- Visit nearby CDMA based cellular switching center and prepare details of the entire setup of their cellular system
- Demonstrate the general steps to repair Mobile handset.
- Prepare a detail list of equipment and software required to troubleshoot the mobile handset.
- Interpret the IS code 15040:2010 CISPR 25:2008. (Radio Disturbance Characteristics for Protection of receivers Used on Board Vehicles, Boats and Internal Combustion Engines – Limits and Methods of Measurement)

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the Cos through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Guide student(s) in undertaking micro-projects.
- Correlate subtopics with Electronics communication and Digital communication(like: modulation ,wave propagation, Frequency modulation, multiplexing).



- g. Use proper equivalent analogy to explain different concepts.
- h. Use Flash /Animations to explain functions of mobile handset.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more Cos which are in fact, an integration of PrOs, Uos and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented Cos.

A suggestive list of micro-projects is given here. The concerned faculty could add similar micro-projects:

- a. Compare the specifications/ features / technology of different types of mobile phones available in the market (Min 12 specifications).
- b. Collect the information regarding the special services provided by various mobile service providers (Min 4) in your area.
- c. Prepare a report on TRAI regulations related to mobile communication.(spectrum allocation)
- d. Prepare a report on FCC regulations for spectrum allocation/interference/ Qos for mobile communication.
- e. Prepare a brief report on how radiations from BTS and handsets affect Human beings.
- f. Market survey on various wireless devices available in the market.(wireless hands free, wireless speaker, wireless charger)
- g. Prepare a short report on Li-Fi (light fidelity) technology.
- h. Collect detailed information on various wireless technologies based on IEEE standard, frequency band, speed, range, advantages and disadvantages and submit the brief report of it.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Mobile Cellular Telecommunications System	Lee, C. Y. William	Mcgraw Hill Education, New Delhi, 2017 ISBN-13: 978-0070635999
2	Wireless communication- Principles and practice	Rappaport, S.Theodore	Pearson publication New Delhi, 2005 ISBN: 978-81-317-3186-4
3	Wireless Communication	Singal, T. L.	McGraw Hill Education Private Limited, New Delhi, 2010, ISBN: 978-0-07-068178-1
4	Wireless and mobile network Architectures	Lin Yi-Bang Clamtac Imrich	John Wiley& sons, New Delhi,2001 ISBN : 978-81-265-1560-8

14. SOFTWARE/LEARNING WEBSITES

- a. eBook:-
www.philadelphia.edu.jo/newlibrary/.../file101fc6e5c77f4675b2958dc10a8c99c9.pdf
- b. Mobile network standards:- <https://gallucci.net/blog/gsm-cdma-and-lte-a-guide-to-mobile-network.../3/4>
- c. Mobile phone repairing tools and equipments : -
www.mobilecellphonerepairing.com › Mobile Phone Repairing Tools
- d. Bluetooth technology:- www.radio-electronics.com/info/wireless/Bluetooth/bluetooth_overview.php
- e. VoLTE:- [/www.gsma.com/futurenetworks/wp-content/uploads/2014/.../FCM.01-v1.1.pdf](http://www.gsma.com/futurenetworks/wp-content/uploads/2014/.../FCM.01-v1.1.pdf)
- f. The Evolution of mobile technologies: - <https://www.qualcomm.com/.../the-evolution-of-mobile-technologies-1g-to-2g-to-3g->
- g. Wireless tutorials:-
https://www.octoscope.com/English/.../octoScope_WirelessTutorial_20090209.pdf
- h. 5G Wireless Technology:- <https://www.qualcomm.com/invention/5g/technologies>
- i. Wireless Networks : NPTEL Video lectures :-
https://www.youtube.com/watch?v=Eu_mTZxPofI
- j. TRAI official website: www.trai.gov.in/



Program Name : Electronics Engineering Programme Group
Program Code : DE/EJ/ET/EN/EX/EQ/IS/IC
Semester : Fifth
Course Title : Industrial Automation (Elective for DE/EJ/ET/EN/EX/EQ)
Course Code : 22534

1. RATIONALE

In the present global scenario of manufacturing, industries are moving towards complete automation. Small and medium scale industries are in the phase of switching to PLC and SCADA technology for the data acquisition and control. Therefore, it is necessary for Electronics/Instrumentation engineers to have knowledge of both PLC and SCADA technology. This course attempts to provide basic knowledge of these technologies to develop operational competency. Hence this course is foundation for the engineers who want to further specialize in the Industrial automation field.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Maintain Industrial Automation systems.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

- Identify different components of an automation system.
- Interface the given I/O device with appropriate PLC module.
- Prepare a PLC ladder program for the given application.
- Select the suitable motor drives for the specified application.
- Prepare a simple SCADA application.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme														
L	T	P		Theory								Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total			
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min		
3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20		

*Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs. **Legends:** L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment*

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the



course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

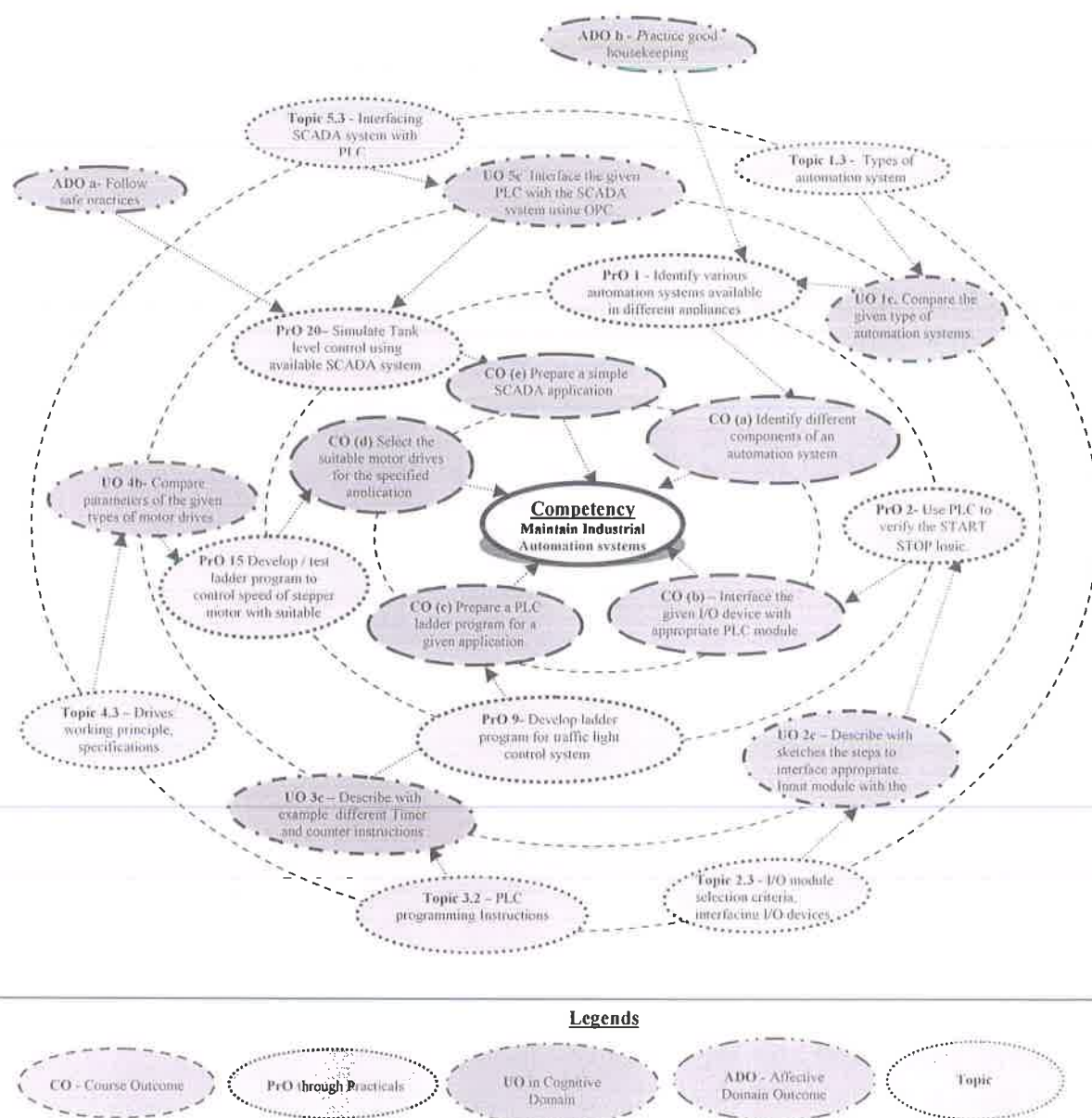
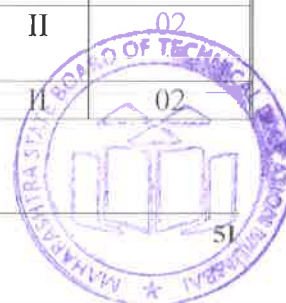


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency:

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Identify various automation systems available in different appliances/devices/machines in day-to-day use.	I	02
2	Identify various parts and front panel status indicators of the given PLC.	II	02
3	Use PLC to test the START STOP logic for two inputs and one	II	02



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	output system.		
4	Develop/Execute a ladder program for the given application using following:- timer, counter, comparison, logical, arithmetic instructions.	II,III	02
5	Use PLC to control the following devices : lamp, motor, push button switches, proximity sensor	II,III	02
6	Measure temperature of the given liquid using RTD or Thermocouple and PLC.	II,III	02
7	Develop/test ladder program to blink LED/lamp.	III	02
8	Develop and test the Ladder program for sequential control application of lamps/ DC motors.	III	02
9	Develop and test ladder program for traffic light control system.	III	02
10	Develop and test ladder program for pulse counting using limit switch /Proximity sensor.	III	02
11	Develop /test ladder program for automated car parking system.	III	02
12	Develop / test ladder program for automated elevator control.	III	02
13	Develop / test ladder program for rotating stepper motor in forward and reverse direction at constant speed.	III	02
14	Develop /test ladder program for tank water level control.	III	02
15	Develop / test ladder program to control speed of stepper motor with suitable drivers.	IV	02
16	a. Identify various front panel controls of Variable Frequency Drive (VFD) (smart drive). b. Control speed of AC/DC motor using VFD.	IV	02
17	Use various functions of SCADA simulation editors to develop simple project.	V	02
18	Develop a SCADA mimic diagram for Tank level control.	V	02
19	Develop SCADA mimic diagram for Flow control of the given system.	V	02
20	Simulate Tank level control using available SCADA system.	V	02
	Total		40

Note

- A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S.No.	Performance Indicators	Weightage in %
a.	Preparation of experimental set up	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10



S.No.	Performance Indicators	Weightage in %
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Practice energy conservation.
- Work as a leader/a team member.
- Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	IEC 1131-3 compatible PLC with programming Software and interfacing hardware, user manual, (complete PLC Trainer system)	1
2	Input and Output devices for PLC: like Lamp, DC Motor, Proximity sensors, Thermocouple/RTD, Red, green, yellow LEDs, Stepper Motor, limit switches, push button	2,3,6
3	Nano PLC, Mini PLC, Micro PLC with analog and Digital I/O, memory, peripheral interfaces	1-16
4	Ladder logic simulator, Pico soft Simulator, Logixpro simulator, Simple EDA tools(open source)	1-13
5	Servomotor, DC motor, AC motor, stepper motor	14,15,16
6	Motor drives, drivers for special motors (VFD)	14,15,16
7	SCADA software: like Ellipse/FTVSE/Wonderware	14-16
8	Digital Multimeter ($\frac{3}{4}$ Digital Multimeter): 4000 counts large LCD display with auto/manual range, No Power OFF under natural operation, Data Hold, Max/Min value Hold Capacitance, Frequency/Duty Cycle	3 to 6

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit– I Introduction to Industrial Automation	1a. Describe the benefits of the given Industrial automation system. 1b. Describe functions of the given components of automation system. 1c. Compare the characteristics of the given type of automation systems. 1d. Describe applications of the given automation system.	1.1 Need and benefits of Industrial Automation 1.2 Automation Hierarchy, Basic components of automation system, description of each component 1.3 Types of automation system:- Fixed, programmable, flexible 1.4 Different systems for Industrial automation: PLC, HMI, SCADA, DCS, Drives
Unit– II PLC Fundamentals	2a. Explain with sketches the redundancy concept for the given PLC. 2b. Identify the specified parts of the given PLC along with its function. 2c. Describe with sketches the steps to interface appropriate Input module of the given PLC with the given input device. 2d. Explain the criteria to select appropriate module for the given I/O devices. 2e. Describe with sketches the steps to interface appropriate output device with the given output module of the given PLC.	2.1 Building blocks of PLC: CPU, Memory organization, Input-output modules (discrete and analog), Special I/O Modules, Power supply 2.2 Fixed and Modular PLC and their types, Redundancy in PLC module 2.3 I/O module selection criteria Interfacing different I/O devices with appropriate I/O modules
Unit-III PLC Programming and Applications	3a. Specify the proper I/O addressing format of the given PLC. 3b. Explain the use of different relay type instructions for the given operation. 3c. Use timer and counter instructions to write a program to perform the given operation. 3d. Use Logical and Comparison instruction to write a program to perform the given operation. 3e. Describe with example the given type of data handling instructions. 3f. Describe the given elements of different programming languages used to program PLC. 3g. Develop PLC ladder program for the given simple application. 3h. Describe a PLC ladder program	3.1 PLC I/O addressing 3.2 PLC programming Instructions : Relay type instructions, timer instructions: On delay, off delay, retentive, Counter instructions, Up, Down, High speed, Logical instructions, Comparison Instructions, Data handling Instructions, Arithmetic instructions 3.3 PLC programming language– Functional Block Diagram (FBD), Instruction List, Structured text, Sequential Function Chart (SFC), Ladder Programming 3.4 Simple Programming examples using ladder logic: Language based on relay, timer counter.



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	for the given industrial application.	logical, comparison, arithmetic and data handling instructions 3.5 PLC based applications: Motor sequence control, Traffic light control, elevator control, Tank level control, conveyor system, Stepper motor control, reactor control
Unit – IV Electric Drives and Special Machines	4a. Describe with sketches the working of the given type of drive(s). 4b. State the functions of the given type of V/F converter. 4c. Compare given parameters of the specified type of motor drives. 4d. Describe the application of the given type of drive(s).	4.1 Electric drives: Types, functions, characteristics, four quadrant operation 4.2 DC and AC drive controls: V/F control, Parameters, direct torque control 4.3 Drives: working principle, specifications, parameters, types and applications 4.4 Applications- Speed control of AC motor /DC Motor
Unit-V Supervisory Control and Data Acquisition System	5a. Describe the function of the given element of SCADA. 5b. Describe the steps to develop a simple SCADA screen for the given application. 5c. Interface the given PLC with the SCADA system using OPC. 5d. Describe the steps to develop SCADA system for the given industrial application.	5.1 Introduction to SCADA, typical SCADA architecture/block diagram, benefits of SCADA 5.2 Various editors of SCADA 5.3 Interfacing SCADA system with PLC: Typical connection diagram, Object linking and embedding for Process Control(OPC) architecture, Steps in Creating SCADA Screen for simple object, Steps for Linking SCADA object (defining Tags and items) with PLC ladder program using OPC 5.4 Applications of SCADA: Traffic light control, water distribution, pipeline control

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to Industrial Automation	04	02	04	-	06
II	PLC Fundamentals	12	04	06	08	18

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
III	PLC Programming and Applications	16	04	06	12	22
IV	Electric Drives and Special Machines	08	02	04	06	12
V	Supervisory Control and Data Acquisition System	08	02	04	06	12
Total		48	14	24	32	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Do the internet survey and make a list of leading manufactures of the PLC, SCADA, DCS, HMI and other industrial automation tools with their brand name.
- Refer operating manual of the PLCs of reputed Manufactures and prepare a step by step procedure to use PLC for the specified application.
- Prepare a Power point presentation on the troubleshooting techniques of PLC.
- Prepare the safety precautions list to be followed for installation of PLC system.
- Download animated videos from the internet for any theory topic and make presentation on it.
- Prepare a list of available analog input /output devices, digital input /output devices available in the market.
- Guide the students for steps to be followed to configure available SCADA software.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Guide student(s) in undertaking micro-projects.
- Students can participate in the online industrial automation forums.



12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project is group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

- Automatic street light controller:** Prepare a PLC based system to control the street light as per the intensity of natural light.
- Automatic agriculture irrigation system:** Prepare a PLC based system to control drip irrigation.
- Railway gate automation:** Prepare a PLC and SCADA based system to open or close the proto type railway gate automatically.
- Home automation:** Implement the versatile automation system for home that can automate any three home appliances.
- Bottle filling station:** Prepare a PLC and SCADA based system for proto type bottle filling station.
- Troubleshoot the Faulty Equipment/Kit available in automation Laboratory.**

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Programmable Logic Controller	Jadhav, V. R.	Khanna publishers, New Delhi, 2017, ISBN : 9788174092281
2	Programmable logic controllers	Petruzella, F.D.	Tata – McGraw Hill India, New Delhi, Fourth edition, 2010, ISBN: 9780071067386
3	Programmable logic controllers and Industrial automation An introduction	Mitra, Madhuchandra; Sengupta, Samarjit	Penram International Publication, New Delhi, 2015, Fifth reprint, ISBN: 9788187972174
4	Introduction to Programmable logic controllers	Dunning, G.	Thomson /Delmar learning, New Delhi, 2005, ISBN 13 : 9781401884260
5	Supervisory control and Data acquisition	Boyar, S. A.	ISA Publication New Dxelhi (4 th edition) ISBN: 978-1936007097
6	Programmable logic controllers	Hackworth, John; Hackworth, Federic	PHI Learning, New Delhi, 2003 ISBN : 9780130607188



S. No.	Title of Book	Author	Publication
7	Industrial automation and Process control	Stenerson, Jon	PHI Learning, New Delhi, ISBN : 9780130618900
8	Practical SCADA for Industry	Bailey, David ; Wright, Edwin	Newnes (an imprint of Elsevier)international edition, 2003 ISBN: 0750658053

14. SOFTWARE/LEARNING WEBSITES

- a. Software:- www.fossee.com
- b. Software:- www.logixpro.com
- c. Software:- www.plctutor.com
- d. Software;-www.ellipse.com
- e. PLC lecture:- <https://www.youtube.com/watch?v=pPiXEfBO2qo>
- f. PLC tutorial:-http://users.isr.ist.utl.pt/~jag/aulas/api13/docs/API_I_C3_3_ST.pdf





Program Name : Diploma in Digital Electronics /Electronics Engineering
Programme Group
Program Code : DE/EJ/ET/EN/EX/EQ
Semester : Fifth
Course Title : Microwave and RADAR
Course Code : 22535

1. RATIONALE

Microwave communication is the back bone of terrestrial communication and also the sole of mobile communication. To provide communication at difficult geographical locations and for specific task microwave links and RADAR are the established telecommunication solution. This course has been designed to develop skills in the diploma engineers to maintain microwave and RADAR based telecommunication systems.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Maintain microwave and RADAR based communication systems.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

- Use specified waveguides in microwave communication system.
- Maintain passive microwave components and devices.
- Maintain active microwave components and devices.
- Interpret RADAR based systems for range detection.
- Maintain various types of RADAR system for the specified application.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the



course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

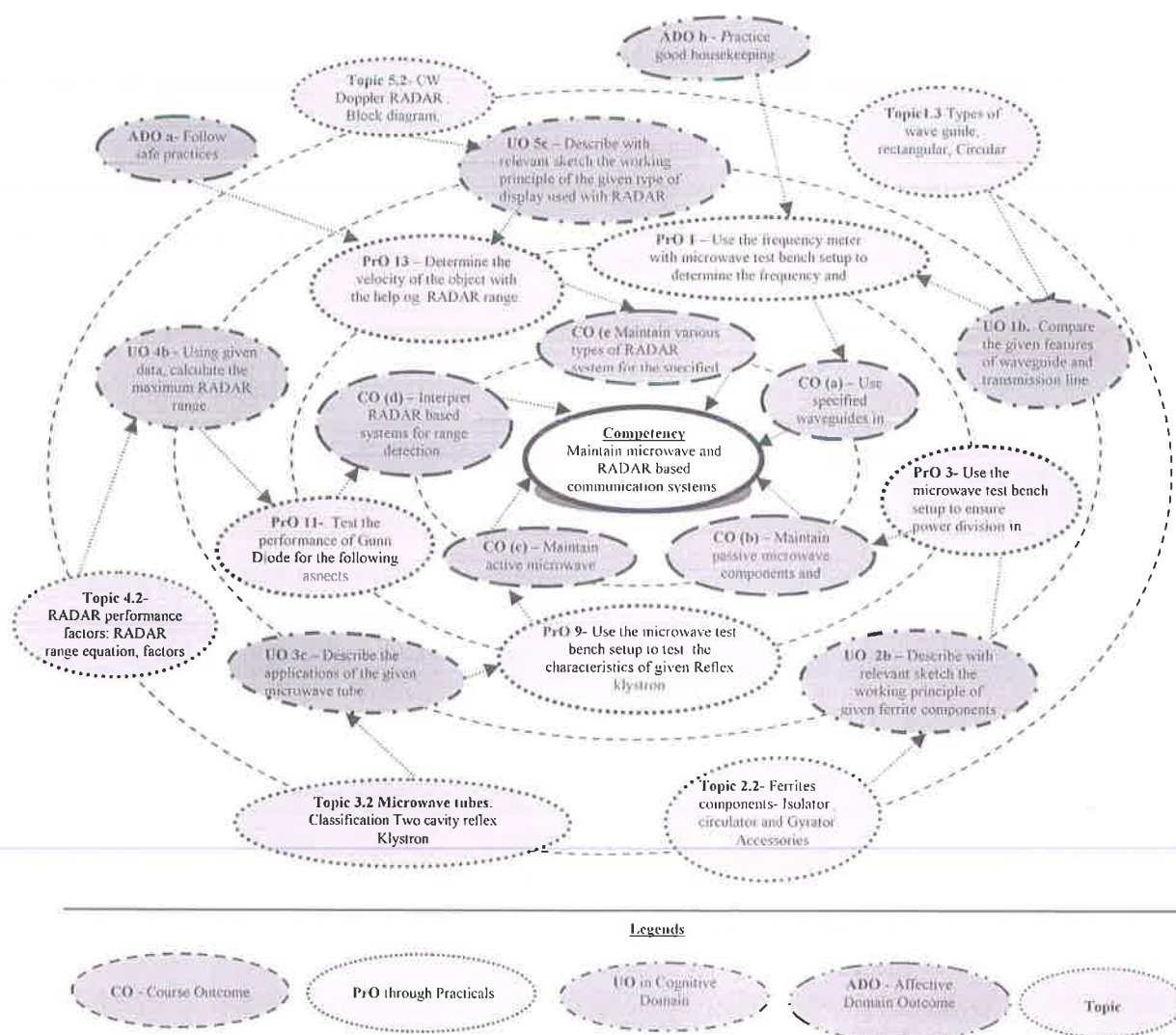
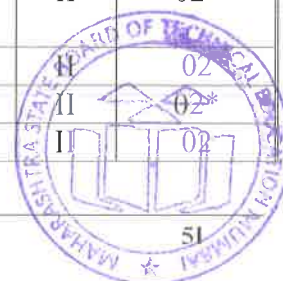


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency:

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Use the frequency meter with microwave test bench setup to determine the frequency and wavelength of waveguide for TE ₁₀ mode.	I	02*
2	Use freeware/open source simulation tools to perform Practicals related to microwave waveguide .	I	02
3	Use the microwave test bench setup to ensure power division in microwave tees E-plane, H-plane and E-H plane.	II	02*
4	Determine coupling factor and insertion loss for the given circulator.	II	02*
5	Measure VSWR for the given Microwave load.	II	02*
6	Measure attenuation of the given attenuator.	II	02*



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
7	Determine the directivity, insertion loss and coupling factor for the given Multi- Hole Directional Coupler.	II	02
8	Use given microwave test bench setup to measure the gain of the horn antenna.	II	02
9	Use the microwave test bench setup to test the performance of the given Reflex Klystron tube.	III	02*
10	Test the performance parameter of the given type of microwave active components on freeware/open source simulation tools.	IV	02
11	Test the performance of Gunn Diode for the following aspects i. V-I characteristics ii. Output power and frequency as a function of voltage	IV	02*
12	Use Doppler RADAR to detect the maximum range .	V	02*
13	Determine the velocity of the moving object with the help of RADAR range.	V	02
14	Use RADAR system to measure the distance traveled by any object.	V	02
15	Use freeware/open source simulation tools to performance Practical related to RADAR communication.	V	02
Total			30

Note

- A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S.No.	Performance Indicators	Weightage in %
a.	Preparation of experimental set up	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Practice energy conservation.
- Work as a leader/a team member.
- Follow ethical practices.



The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	Microwave Test Bench –X Band (Klystron based) / or any other equivalent, Klystron Power Supply, Klystron tube with Klystron mounts, Frequency meter, Variable attenuator, Detector mount, Wave guide stand, SWR meter and oscilloscope, E Plane Tee, H Plane Tee and Magic Tee Isolator and Circulator, Directional Coupler, Horn Antenna proto type	1 To 10
2	Microwave test bench –X Band (GUNN Diode based)/ or any other equivalent, Gunn oscillator, Gun power supply, PIN modulator, Isolator, Frequency meter, Variable attenuator, Detector mount, Wave guide stands, SWR Meter, Cables and accessories	11
3	RADAR Trainer (X Band)/or any other equivalent Technical Specifications: Transmitting Frequency : 10 GHz, Output Power : 10 to 15mW, Operating Voltage : 8.6V or adjustable, Antenna : Horn and parabolic dish with LNA and mounting IF Output : Audio range, Power Supply : 230V \pm 10%, 50Hz	12,13, 14
4	List of Software/Learning Websites List of software RF Tool box: MATLAB and SIMULINK or any other open source software. EZNEC, HFSS-CST, VSim, Microwave office	15

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit- I Fundamentals of Microwave communication and Waveguides	1a. Summarize the range and applications of the given microwave frequency bands. 1b. Compare the given parameters of waveguide and transmission line. 1c. Explain the properties of the given parameters for the circular waveguide with example. 1d. Calculate the cut off wavelength, cut off frequency, group and phase velocity of the given rectangular waveguide. 1e. Describe with relevant sketch the field pattern of the given mode of rectangular waveguide. 1f. Compare the features of circular and rectangular waveguide for the given parameters.	1.1 Microwave frequency spectrum , band designations and applications of microwave in various fields 1.2 Comparison of wave guide with Transmission line 1.3 Types of Waveguides: Rectangular ,Circular , Propagation of waves in rectangular waveguides Reflection of waves from a conducting plane, dominant mode, The parallel plane waveguide, cut off wavelength, cut off frequency, group and phase velocity (Simple numerical) 1.4 Rectangular waveguide modes: TE ,TM TEM, field patterns of TE _{1,0} ,TE _{2,0} ,TE _{1,1} modes 1.5 Circular waveguide: Advantages, disadvantages and applications of circular waveguide
Unit- II Microwave Passive Components	2a. Describe with relevant sketch operation of the given microwave passive component. 2b. Describe with relevant sketch the working principle of given ferrite components. 2c. Describe the procedure to built/prepare the microwave test bench setup with the help of given microwave accessories and components 2d. Explain functions of the given parameters for a directional coupler.	2.1 Multiple Junctions : Working principle and applications of - E plane, H- plane , Magic Tee and Rat race ring 2.2 Ferrites components- Isolator , circulator and Gyrator Accessories: Flanges, Rotating coupling, Bends and corners, Taper and Twist 2.3 Directional couplers : Two hole directional coupler- Working principle and applications , directivity, coupling factor and isolation 2.4 Basic microwave antenna (Horn and Dish)
Unit-III Microwave Active Components	3a. Describe with relevant sketch the concept of velocity modulation and bunching effect for the given microwave tube. 3b. Prepare/Draw the apple gate diagram for the given parameters of the microwave tube. 3c. Describe the applications of the given microwave tube. 3d. Compare the performance of	3.1 Microwave tubes Classification Two cavity ,Reflex klystron i. Construction ii. Modulation iii. Bunching process iv. Principle of operation v. Magnetron: construction , operating principle and applications 3.2 Slow wave devices: Helix TWT construction and principle of operation and applications



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	<p>Klystron, Magnetron and TWT on the given parameters.</p> <p>3e. Describe with relevant sketch the transfer electron effect for the given energy level diagram of Gunn Diode.</p> <p>3f. Describe with relevant sketch the operation of the given active microwave component.</p>	<p>3.3 Compare the performance of Klystron, Magnetron and TWT.</p> <p>3.4 TED (Transferred Electron Devices): Gunn diode – construction, operation principle, modes and application of Gunn diode as an oscillator</p> <p>Avalanche transient time device:</p> <p>3.5 IMPATT diode - construction, operation and applications</p> <p>3.6 PIN diode-. construction, operation and applications</p> <p>Esaki diode: Tunnel diode –V-I Characteristics, equivalent circuit, application as an oscillator and as an amplifier</p>
Unit-IV RADAR Fundamentals	<p>4a. Describe with relevant sketch functions of the given component of the RADAR system.</p> <p>4b. Calculate the maximum RADAR range for the given data.</p> <p>4c. State the affect on the RADAR range for the given the parameters.</p> <p>4d. Explain with relevant sketch the given type of scanning and tracking methods used for RADAR communication.</p> <p>4e. Describe with relevant sketch the construction and working of the given microwave antenna.</p>	<p>4.1 Basic block diagram of RADAR system</p> <p>4.2 RADAR performance factors: RADAR range equation, factors influencing range, effect of noise</p> <p>4.3 Basic pulse RADAR system: Block diagram and description, applications</p> <p>4.4 Antenna Scanning (types and principle): Horizontal, vertical, helical and spiral. Antenna Tracking (types and principle): Sequential, conical and mono pulse</p> <p>4.5 Antenna feed Mechanism: horn and cassegrain feed antenna</p>
Unit –V RADAR Systems	<p>5a. Explain with relevant sketch working principle of the given type of RADAR.</p> <p>5b. Describe the applications of the given type of RADAR.</p> <p>5c. Describe with relevant sketch the working principle of the given type of display used with RADAR system.</p> <p>5d. Compare CW and Pulsed RADAR for the given parameters.</p> <p>5e. Describe with relevant sketch</p>	<p>5.1 Doppler effect</p> <p>5.2 CW Doppler RADAR : Block diagram, operation and application</p> <p>FM CW RADAR: Block diagram, operation and application</p> <p>5.3 MTI: Block diagram, operation concept of blind speed, application, Automatic target detection RADAR</p> <p>5.4 Display Methods: A-Scope, PPI Beacons</p> <p>5.5 SONAR system :working principle and applications</p>



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	the applications of the given SONAR system.	

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Fundamentals of Microwave communication and Waveguides	08	04	04	06	14
II	Microwave Passive Components	08	04	04	04	12
III	Microwave Active components	16	06	08	06	20
IV	RADAR Fundamentals	08	04	04	04	12
V	RADAR Systems	08	04	04	04	12
Total		48	22	24	24	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare chart showing various microwave components.
- Prepare /download an animation and share with the class to illustrate the working principle of the following
 - Microwave Tubes
 - EM wave propagation.
- Visit a place where waveguides are used for microwave communication (such as earth Station, Radio station, telephone exchange, airport, TV broadcast, navigation center) and prepare the report.
- Conduct a Library /Internet based survey of microwave components.
- Interpret the various BIS Code for microwave communication.
- Compare specifications of at least two different types of RADAR system.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.



- b. '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c. About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- e. Guide student(s) in undertaking micro-projects.
- f. Use proper equivalent analogy to explain different concepts.
- g. Use Flash/Animations to explain various microwave components, tubes and RADAR systems.
- h. Use open source /MATLAB models to explain different concepts of microwave devices.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

- a. Market survey of consumer microwave equipments with respect to working principle, manufacturer, technical specification and submit the detail report of it.
- b. Prepare survey report on mobile van used for live telecast of any event.
- c. Prepare a report on the applications of RADAR for Defense and Air navigation.
- d. Prepare power point presentation to explain working of various microwave components and Microwave tubes.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	RADAR systems and radio aids to navigation	Sen, A. K. and Bhattacharya, A. B.	Mercury Learning & Information. PVT.LTD. New Delhi, 2017,ISBN: 978-1683921189
2	Microwave Engineering	Das, Annapurna and Das, S. K.	Mc Graw Hill, New Delhi(3 rd edition 2017, ISBN: 978-9332902879
3	Microwave Engineering	Gupta, Sanjeev	Khanna Publication, Nai sadak Delhi (3rd edition,2015, ISBN: 9788174090878
4	Microwave and RADAR Engineering	Gautam, A. K.	S K Kataria Publications, New Delhi 2012, ISBN: 978-9330141519
5	Fundamentals of	Sharma, K.K.	S.Chand and Company PVT.LTD.



S. No.	Title of Book	Author	Publication
	Microwave and RADAR Engineering		New Delhi, 2011, ISBN: 9788121935371
6	Electronics Communication System	Kennedy, George; Davis, Brendan; Prasanna, Srm	Mc Graw Hill, New Delhi, 5 th edition, 2011, ISBN: 978-0071077828
7	Microwave devices and circuits	Liao Samuel Y	PHI Learning, New Delhi, (Latest Edition), ISBN: 978-8131762288
8	Microwave and RADAR Engineering	Kulkarni, M.	Umesh Publications, New Delhi, 2009, ISBN 978-8188114009

14. SOFTWARE/LEARNING WEBSITES

- a. Microwave components:- [www.youtube.com /microwave components and devices](http://www.youtube.com/microwave%20components%20and%20devices)
- b. RADAR:- [www.youtube.com /RADARs](http://www.youtube.com/RADARs)
- c. Microwave fundamentals:- [www.nptelvideos.in/microwave engineering](http://www.nptelvideos.in/microwave%20engineering)
- d. Microwave:- www.learnerstv.com/free-engineering
- e. Rectangular Waveguides:- www.ece.uprm.edu/ppt/rectangularwave
- f. Waveguide:- www.academia.edu/waveguide
- g. Microwave engineering Book:- monitor.westernfriend.org/microwave-engineering-by-sanjeev-gupta.pdf







Maharashtra State Board of Technical Education, Mumbai

Teaching and Examination Scheme for Post S.S.C. Diploma Courses

Program Name : Diploma in Civil Engineering / Diploma in Civil and Rural Engineering / Diploma in Construction Technology

Program Code : CE/CR/ CS

With Effect From Academic Year: 2017 - 18

Duration of Program : 6 Semesters

Duration : 16 Weeks

Semester : Sixth

Scheme - I

Semester : Sixth																						
S. N.	Course Title	Course Abbreviation	Course Code	Teaching Scheme			Credit (L+T+P)	Examination Scheme													Grand Total	
				L	T	P		Theory							Practical							
								Exam Duration in Hrs.	ESE		PA		Total		ESE		PA		Total			
									Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks		
1	Management	MAN	22509	3	-	-	3	90 Min	70*#	28	30*	00	100	40	--	--	--	--	--	--	100	
2	Contracts and Accounts	CAA	22601	3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150	
3	Maintenance and Repairs of Structures	MRS	22602	4	-	2	6	3	70	28	30*	00	100	40	25#	10	25	10	50	20	150	
4	Emerging Trends in Civil Engineering	ETC	22603	3	-	-	3	90 Min	70*#	28	30*	00	100	40	--	--	--	--	--	--	100	
Elective – II (Select Any One)																						
5	Building Services	BSE	22604	3	-	2	5	3	70	28	30*	00	100	40	25#	10	25	10	50	20	150	
	Solid Waste Management	SWM	22605	3	-	2	5	3	70	28	30*	00	100	40	25#	10	25	10	50	20	150	
	Earthquake Resistant Buildings	ERB	22606	3	-	2	5	3	70	28	30*	00	100	40	25#	10	25	10	50	20	150	
	Advanced Design of Structures	ADE	22607	3	-	2	5	4	70	28	30*	00	100	40	25#	10	25	10	50	20	150	
6	Capstone Project - Execution & Report Writing	CPE	22060	-	-	4	4	--	--	--	--	--	--	--	50#	20	50~	20	100	40	100	
7	Construction Management	CMA	22061	1	-	2	3	--	--	--	--	--	--	--	25@	10	25~	10	50	20	50	
8	Entrepreneurs Development	EDP	22032	2	-	2	4	--	--	--	--	--	--	--	50@	20	50~	20	100	40	100	
Total				19	-	14	33	--	350	--	150	--	500	--	200	--	200	--	400	--	900	





Student Contact Hours Per Week: 33 Hrs.
 Medium of Instruction: English
 Total Marks : 900
 Abbreviations: ESE- End Semester Exam, PA- Progressive Assessment, L - Lectures, T - Tutorial, P - Practical
 @ Internal Assessment, # External Assessment, * On Line Examination, @ Computer Based Assessment
 * Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain LOs required for the attainment of the COs.
 ~ For the courses having ONLY Practical Examination, the PA marks Practical Part - with 60% weightage and Micro-Project Part with 40% weightage
 ➤ If Candidate not securing minimum marks for passing in the "PA" part of practical of any course of any semester then the candidate shall be declared as "Detained" for that semester.

Program Name : Diploma in Automobile Engineering / Civil Engineering Group /
Electronics Engineering Group / Diploma in Plastic Engineering /
Diploma in Production Engineering / Diploma in Fashion &
Clothing Technology/ Computer Engineering Group

Program Code : AE/CE/CR/CS/ DE/EJ/ET/EN/EX/EQ/IS/IC/IE/PG/PT/DC/
CO/CM/CW/IF

Semester : Sixth

Course Title : Management

Course Code : 22509

1. RATIONALE

An engineer has to work in industry with human capital and machines. Therefore, managerial skills are essential for enhancing their employability and career growth. This course is therefore designed to provide the basic concepts in management principles, safety aspects and Industrial Acts.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Use relevant managerial skills for ensuring efficient and effective management.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

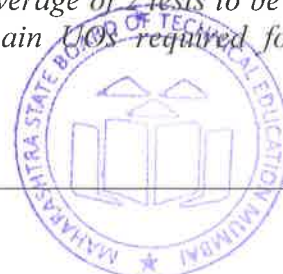
- Use basic management principles to execute daily activities.
- Use principles of planning and organising for accomplishment of tasks.
- Use principles of directing and controlling for implementing the plans.
- Apply principles of safety management in all activities.
- Understand various provisions of industrial acts.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	--	--	3	90 Min	70*#	28	30*	00	100	40	--	--	--	--	--	--

(*#) Online Theory Examination.

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the Cos. (*#): Online examination



Legends: *L*-Lecture; *T* – Tutorial/Teacher Guided Theory Practice; *P* - Practical; *C* – Credit, *ESE* - End Semester Examination; *PA* - Progressive Assessment

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

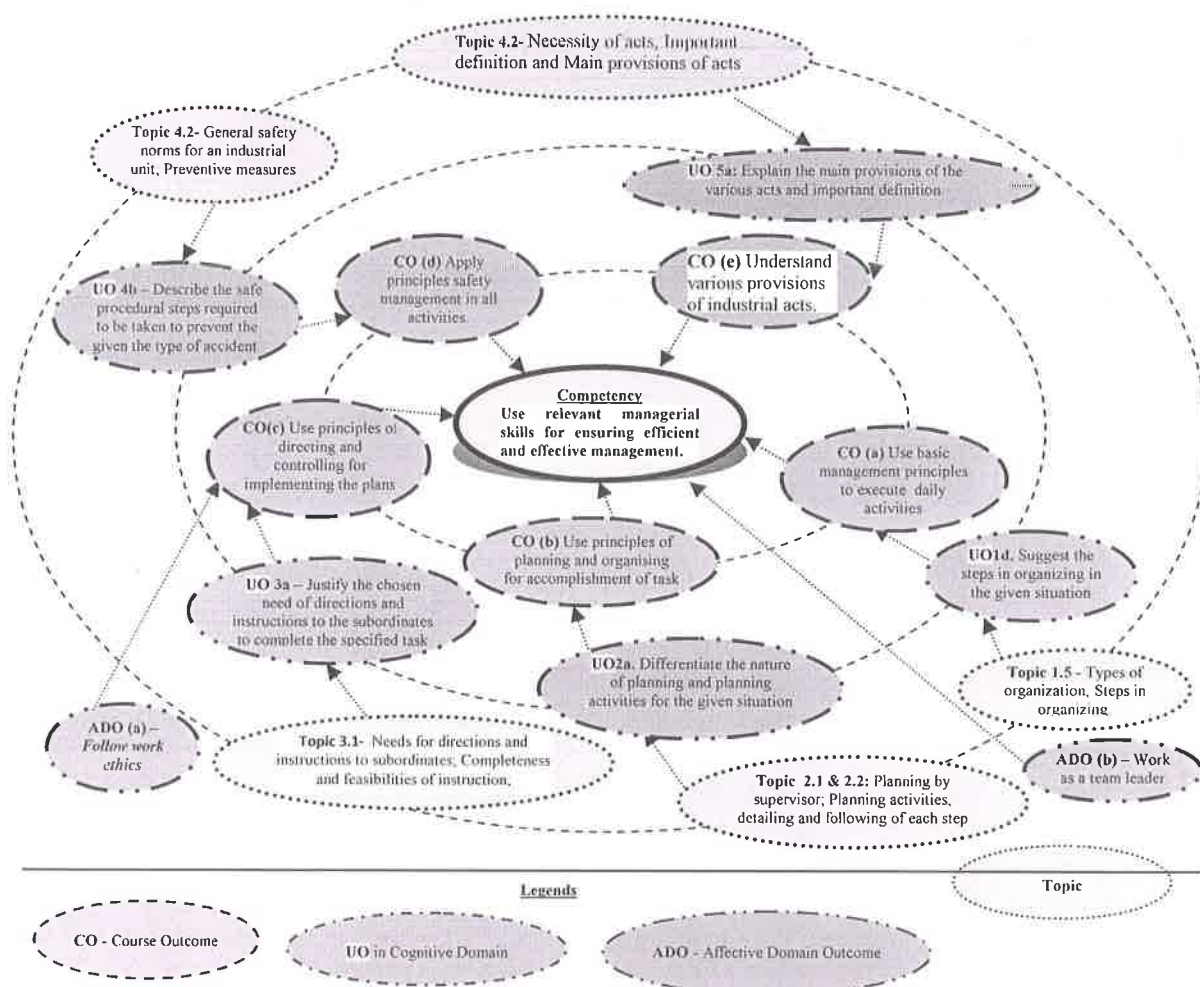


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

- Not applicable -

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

- Not applicable -

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Introduction to management concepts and managerial skills	1a. Differentiate the concept and principles of management for the given situation. 1b. Explain functions of management for given situation. 1c. Compare the features of the given types of planning 1d. Suggest the steps in organizing in the given situation. 1e. Suggest suitable type of organization for the given example. 1f. Identify the functional areas of management for the given situation 1g. Suggest suitable managerial skills for given situation with justification	1.1 Definitions of management, role and importance of management. 1.2 Management characteristics and principles, levels of management and their functions; management, administration and organization, relation between management and administration. 1.3 Functions of management: planning, organizing, leading/directing, staffing and controlling. 1.4 Types of planning and steps in planning 1.5 Types of organization, Steps in organizing 1.6 Functional areas of management. 1.7 Managerial skills.
Unit – II Planning and organizing at supervisory level	2a. Differentiate the nature of planning and planning activities for the given situation. 2b. Suggest the step wise procedure to complete the given activity in the shop floor. 2c. Prepare materials and manpower budget for the given production activity. 2d. Describe with block diagrams the organization of the physical resources required for the given situation. 2e. Describe the human needs to satisfy the job needs for the specified situation. 2f. List the tasks to be done by the concerned individuals for completing the given activity.	Planning at supervisory level 2.1 Planning by supervisor. 2.2 Planning activities, detailing and following of each step. 2.3 Prescribing standard forms for various activities. 2.4 Budgeting for materials and manpower. Organizing at supervisory level 2.5 Organizing the physical resources. 2.6 Matching human need with job needs. 2.7 Allotment of tasks to individuals and establishing relationship among persons working in a group
Unit– III Directing and Controlling at supervisory level	3a. Justify the chosen need of directions and instructions to the subordinates to complete the specified task. 3b. Select the feasible set of instructions to complete the given simple task, with justification 3c. Predict the possible mistakes for completing the given simple activity. 3d. Describe the managerial control	Directing at supervisory level 3.1 Needs for directions and instructions to subordinates; Completeness and feasibilities of instructions 3.2 Personal counselling advanced predictions of possible mistakes. 3.3 Elaborating decisions, laying disciplinary standards in overall working Controlling at supervisory level



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	actions and remedial measures required to be taken for completing the given task successfully.	3.4 Managerial control; Understanding team and link between various departments in respect of process and quality standards; Steps in control process 3.5 Controlling methods; Control over the performance in respect of quality, quantity of production, time and cost. Measuring performance, comparing with standards, correcting unfavorable deviations.
Unit – IV Safety Management	4a. State the general safety norms required to be taken in the given case. 4b. Suggest preventive measures of plant activities in the given situation. 4c. Describe the safe procedural steps required to be taken to prevent the given the type of accident. 4d. Prepare a work permit in to conduct the given maintenance activity. 4e. Explain the causes of the specified type of accident in the given situation. 4f. Prepare the specifications of the firefighting equipment required for the given type of fire.	4.1 Need for safety management measures 4.2 General safety norms for an industrial unit; Preventive measures. 4.3 Definition of accident, types of industrial accident; Causes of accidents; 4.4 Fire hazards; Fire drill. 4.5 Safety procedure 4.6 Work permits.
Unit – V Legislative Acts	5a. Explain the purpose of the act 5b. Explain the main provisions of the various acts and important definition.	5.1 Necessity of acts, Important definition and Main provisions of acts. 5.2 Industrial Acts: a. Indian Factory Act b. Industrial Dispute Act c. Workman Compensation Act d. Minimum Wages Act

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to management	12	06	06	04	16

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
	concepts and managerial skills					
II	Planning and organizing at supervisory level	08	04	06	04	14
III	Directing and controlling at supervisory level	08	04	06	04	14
IV	Safety Management	08	04	06	04	14
V	Legislative Acts	12	02	06	04	12
Total		48	20	30	20	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Write assignments based on the theory taught in classrooms. Assignments consist of ten questions having long answers including charts, symbols, drawing, observations etc.
- Prepare/Download information about various industrial acts.
- Visit to any Manufacturing industry and prepare a report consisting of:
 - Organization structure of the organization/ Dept.
 - Safety measures taken in organization.
 - Mechanism to handle the disputes.
 - Any specific observation you have noticed.
- Give seminar on relevant topic.
- Undertake micro-projects.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Guide student(s) in undertaking micro-projects.
- Demonstrate students thoroughly before they start doing the practice.



- g. Encourage students to refer different websites to have deeper understanding of the subject.
- h. Observe continuously and monitor the performance of students in Lab.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

- a. Study of management principles applied to a small scale industry.
- b. Study of management principles applied to a medium scale industry.
- c. Study of management principles applied to a large scale industry.
- d. Prepare case studies of Safety measures followed in different types of organization.
- e. Study of measures to be taken for ensuring cyber security.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Management and entrepreneurship	Veerabhadrapa, Havinal	New age international publishers, New Delhi, 2014: ISBN: 978-81-224-2602-1
2	Principles of management	Chaudhry omvir Singh prakash	New Age international publishers, 2012, New Delhi ISBN: 978-81-224-3039-4
3	Industrial Engineering and management	Dr. O. P. Khanna	Dhanpath ray and sons, New Delhi
4	Industrial Engineering and management	Banga and Sharma	Khanna Publication, New Delhi

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

- a. <https://www.versesolutions.com/>
- b. <https://www.books.google.co.in/books?isbn=817758412X>
- c. <https://www.educba.com> › Courses › Business › Management



Program Name : Civil Engineering Program Group
Program Code : CE/CR/CS
Semester : Sixth
Course Title : Contracts and Accounts
Course Code : 22601

1. RATIONALE

For infrastructure development various construction projects are required to be undertaken. These projects are to be executed by entering into a legal contract. The diploma student shall have adequate knowledge of different types of contract and accounting procedures of organization about the projects are to be executed by entering in to legal contract. The procedure of execution of work by various organizations will be useful while working as an engineer in organization to execute various works. Concept of Tender and knowledge about preparation of tender documents, writing specification for different items of work will be helpful to prepare actual Tender papers and contract documents which are required before execution of construction. The information on procedures and different types of forms used by department will be useful to prepare bills and different modes of payment to contractors. This Course will help the student in implementing actual field practices, which will make student further more competent in the execution of civil engineering works.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Prepare tender documents for civil engineering projects.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following **industry oriented** COs associated with the above mentioned competency:

- Execute the method of PWD for initiating the works.
- Execute the contract for civil engineering works.
- Prepare the tender documents for civil engineering work.
- Use the relevant type of form used in PWD to pay the bill of the executed work
- Prepare the detailed specification for various items of construction.
- Justify the rent fixation of civil structures.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20

(*): Under the theory PA; Out of 30 marks, 10 marks of theory PA are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment.



5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

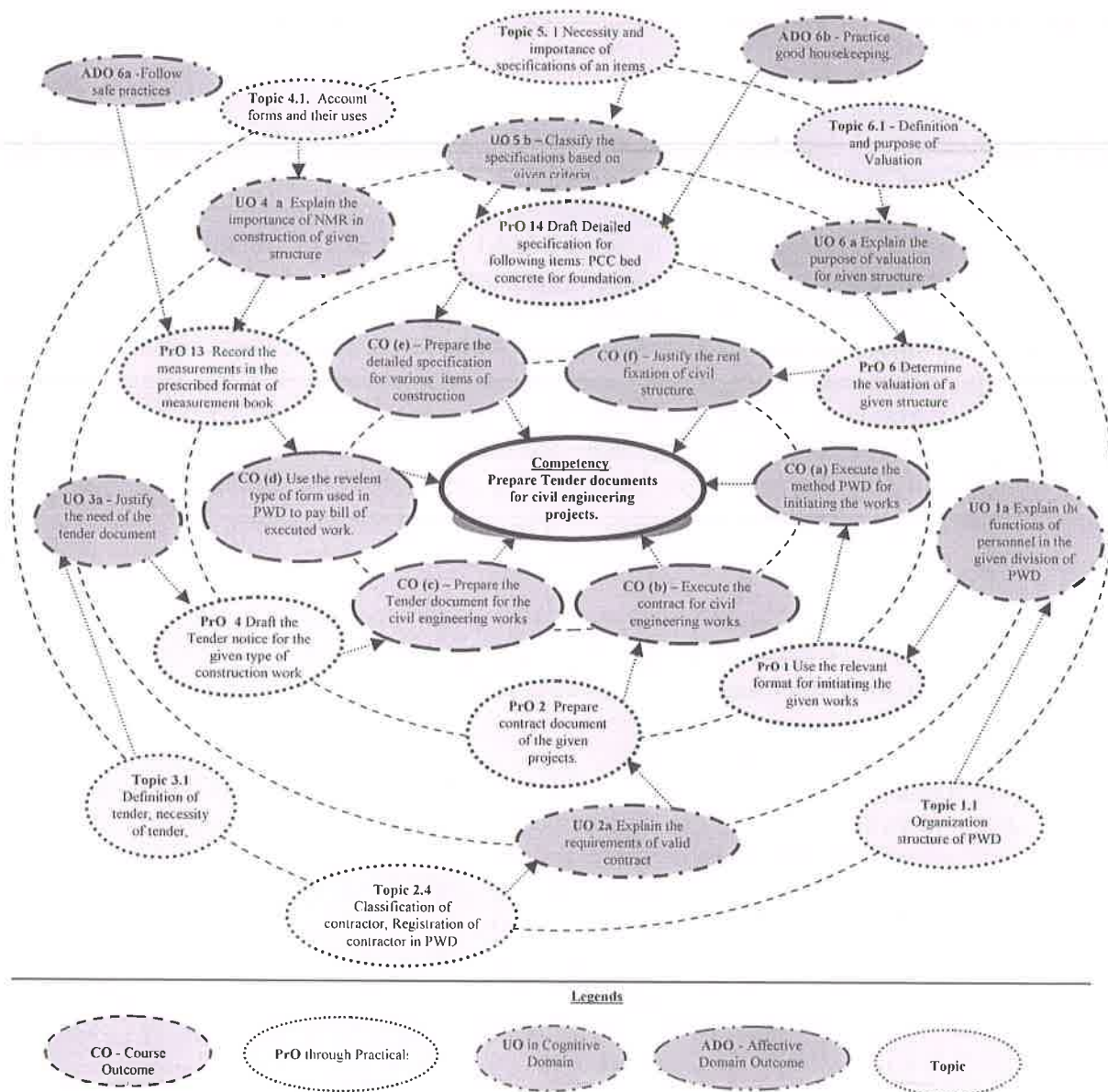


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Use the relevant format for initiating the given works	I	02*
2	Prepare contract documents of the given project.	II	02*
3	Examine any five tender notices published in news papers to write your comments with reference to various constituents of tender notice.	III	02*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
4	Draft the Tender notice for the given type of construction work.	III	02*
5	Draft the Tender notice for the given type of construction work to be executed by adopting the process of E-tendering.	III	02*
6	Interpret the given set of tender document to comment on the components reflected in it.	III	02*
7	Interpret the conditions and data furnished for E-tendering of the given project.	III	02*
8	Prepare a power point presentation on the topic, “ E-Tendering and its Evaluation”	III	02
9	Prepare Tender document for the given civil engineering structure in a group of five students on the basis of detailed estimate provided/collected by teacher/student.(Part 1)	III	02*
10	Prepare Tender document for the given civil engineering structure in a group of five students on the basis of detailed estimate provided/collected by teacher/student.(Part 2)	III	02
11	Prepare Tender document for the given civil engineering structure in a group of five students on the basis of detailed estimate provided/collected by teacher/student.(Part 3)	III	02
12	Interpret the given case study on, ‘Contract litigation resolution through arbitration’ and submit your comments.	III	02
13	Record the measurements in the prescribed format of measurement book for the given items of works with abstract, completion certificate for payment.	IV	02*
14	Draft Detailed specification for following items – a) P.C.C. bed concrete for foundation b) U.C.R.masonry in foundation and plinth c) Burnt brick masonry in CM in superstructure. d) RCC work M20 grade. e) Internal plaster in CM .	V	02*
15	Draft Detailed specification for one item from each of the following system : a) Irrigation Engineering. b) Transportation engineering. c) P. H. Engineering.	V	02
16	Determine the valuation of a given structure and submits the valuation report in prescribed formats	VI	02*
17	Determine the monthly rent of the given building/quarter as per PWD method/norms.	VI	02*
Total			34

Note

- A suggestive list of **PrOs** is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical UOs/tutorials need to be performed, out of which, the practicals marked as ‘*’ are compulsory, so that the student reaches the ‘Precision Level’ of Dave’s ‘Psychomotor Domain Taxonomy’ as generally required by the industry.
- The ‘Process’ and ‘Product’ related skills associated with each PrO is to be assessed according to a suggested sample given below:
-



S. No.	Performance Indicators	Weightage in %
1	Collection of data.	30
2	Analysis of data	20
3	Preparation of report.	30
4	Answer to sample questions	10
5	Submit report in time	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Practice good housekeeping.
- Work as a leader/a team member.
- Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year.
- 'Organization Level' in 2nd year.
- 'Characterization Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by administrators.

S. No.	Equipment Name with Broad Specifications	PrO S. No.
1.1	Computer systems with internet connection	02,06,07,08,13

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs in cognitive domain for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I PWD Procedure to execute the work	1a. Explain the functions of personnel in the given division of PWD. 1b. Explain the procedure adopted by the given government department for the construction of the given civil work. 1c. Explain the specified method used in PWD to carry out the given work. 1d. Select the relevant method of	1.1 Organization structure of Public Works Department (PWD). 1.2 Functions of their personnel, Financial powers if any. 1.3 PWD Procedure of initiating the work 1.4 Administrative approval, Technical sanction, budget provision, Expenditure sanction. 1.5 Methods used in PWD for carrying out works- contract method, departmental method -rate list method, piece work method, day's work method, employing

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	contracting for the given type of work with justification.	labours on daily wages basis.
Unit -II Contracts	2a. Explain the requirements of valid contract in the given situation. 2b. Classify the civil engineering Contracts based on the given criteria. 2c. Select the type of contract for the given type of work with justification. 2d. Outline the Registration process of contractor in Public Works Department (PWD) in the given type of division office. 2e. Justify the importance of Built operate transfer (BOT) contract in the given situation. 2f. Explain the provisions of FIDIC contract relevant to the given situation.	2.1 Definition of contract, Objects of contract, requirements of valid contract, Overview of Indian Contract Act 1872. 2.2 Types of engineering contract with advantages , disadvantages and their suitabilities- Lump sum contract, item rate contract, percentage rate contract, cost plus percentage, cost plus fixed fee, cost plus variable percentage and cost plus variable fee contract, labour contract, demolition contract, target contract, negotiated contract, All in contract, Engineering Procurement Construction Contract (EPC), Annuity Contract. 2.3 Introduction of FIDIC Conditions of contract. 2.4 Classification of contractor on basis of financial limits, Requirement of documents for registration of contractor in Public Works Department (PWD). 2.5 Built operate transfer (BOT) Project: Objectives, scope, advantages, Disadvantages, Nature of agreement, mode of payment, examples.
Unit-III Tender and Tender Documents	3a. Justify the need of the tender document for the given situation. 3b. Draft tender notice for the given type of work. 3c. Explain the relevant provision of contract in the given situation as per Contract act 1872. 3d. Justify the provision of liability period in tender document of the given work. 3e. Explain the process of arbitration used in the given case of dispute. 3f. Justify the necessity of E-Tendering system for the given type of civil work.	3.1 Definition of tender, necessity of tender, Types of tender-local, Global, open Limited and negotiated tender 3.2 Notice to invite Tender (NIT)- Points to be included while drafting tender notice, Drafting of tender notice. 3.3 Meaning of terms: - Earnest money Deposit (EMD), Security deposit, Additional Performance Security Deposit, Validity period, right to reject one or all tenders, corrigendum to tender notice and its necessity. 3.4 Tender documents – Index, tender notice, general instructions, special instructions, schedule A, Schedule B, schedule C, Terms related to tender documents – contract conditions- time limit, time extension, penalty, defective material and workmanship, termination of contract, suspension of work, subletting of contract, extra items, , price variation clause(escalation), defect liability Period, liquidated and un-liquidated Damages. 3.5 Arbitration- Meaning, Qualification of

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		<p>an arbitrator, appointment, Causes and Settlement of disputes, Powers and duties of Arbitrator, Award of result.</p> <p>3.6 Procedure of submitting filled tender Document (Two envelope system), procedure of opening tender, comparative statement, scrutiny of tenders ,award of contract, acceptance letter and work order.</p> <p>3.7 E -Tendering System – Online procedure of Submission of Tender in PWD.</p> <p>3.8 Unbalanced tender, ring formation.</p>
Unit –IV Accounts in PWD	<p>4a. Explain the importance of Nominal Muster Role (NMR) in the construction of the given structure.</p> <p>4b. Record the measurements in the measurement book for the given items of works for payment.</p> <p>4c. Explain the specified terms used in interim payment of the given civil work.</p> <p>4d. Select the criteria for granting advances to the Contractor in the given situation with justification.</p> <p>4e. Select the relevant bill form in the given situation with justification.</p>	<p>4.1 Various account forms and their uses – Measurement Books, E- Measurement book(E-MB) ,Nominal Muster Roll(NMR), imprest Cash, Indent, Invoice, Bill, Vouchers, Hand receipt Cash Book, Temporary Advance. Heads of Accounts.</p> <p>4.2 Mode of Payment to the contractor and its necessity -Interim Payment, Advance Payment, Secured Advance, Petty advance, Mobilization advance, First And Final, Final bill, Running account bill ,Retention money, Reduced rate payment, E- Payment.</p>
Unit –V Specifications	<p>5a. Draft the specifications for the given type of an item.</p> <p>5b. Classify the specifications based on the given criteria.</p> <p>5c. Propose the specifications for the construction of the given item of work.</p> <p>5d. Formulate the detailed specifications for the given item of irrigation work.</p> <p>5e. Draft a detailed specification for a given items of transportation engineering work.</p>	<p>5.1 Necessity and importance of specifications of an items, points to be observed in framing specifications of an item,</p> <p>5.2 Types of specification - Brief and Detailed, Standard and Manufacturers Specification.</p> <p>5.3 Preparing Detailed Specifications of items in civil engineering works from each of following- Building construction, Irrigation Engineering ,Transportation Engineering , Public health Engineering</p>
Unit –VI Valuations	<p>6a. Explain the purpose of valuation of the given structure in the given situation.</p> <p>6b. Classify the value of the given structure based on the given</p>	<p>6.1 Definition and purpose of Valuation, role of valuer. Define - Cost, Price and Value, Characteristics of Value, Factors Affecting Value.</p> <p>6.2 Types of Value - Book Value, Scrap Value, Salvage Value, Speculative Value,</p>

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	criteria. 6c. Calculate depreciation of the given structure using relevant method for the given data. 6d. Classify the term, 'outgoings' in the given situation. 6e. Calculate monthly rent of the given building from the given data as per PWD norms.	Distress Value, Market Value, monopoly Value, Sentimental Value. Factors affecting value. 6.3 Depreciation, Obsolescence, Sinking Fund. Methods of Calculation of Depreciation – Straight Line Method, Sinking Fund Method, Constant Percentage Method. 6.4 Computation of capitalized value, Gross income, Outgoings, Net Income, Year Purchase, Types of outgoings. 6.5 Fixation of rent as per PWD Practice. 6.6 Lease – types of lease, lease hold property and free hold property, Mortgage – Mortgage deed, precautions to be taken while making mortgage.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	PWD Procedure to execute the work	04	-	04	04	08
II	Contracts	12	02,02	04	04	12
III	Tender and Tender Documents	12	02	06	04,04	16
IV	Accounts in PWD	04	02	08	-	10
V	Specification	06	04	-	06	10
VI	Valuations	10	02	06	06	14
Total		48	14	28	28	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare journals based on practical performed in laboratory.
- Give seminar on relevant topic.
- Undertake micro-projects.
- Write a brief summary on procedure of opening of tenders.
- Write a brief summary on procedure of filling online tender.



- f) Preparing report on BOT type contract works executed at nearby location.
- g) Preparing report on procedure of registration as a contractor in different organizations.
- h) Preparing report on procedure of Indent and Invoice at the site.
- i) Preparing report on GST procedure in construction project.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- a) Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- b) '**L**' in **item No. 4** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c) About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d) With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- e) Guide student(s) in undertaking micro-projects.
- f) Procure various materials required for practical exercises.
- g) Arrange visit to nearby industries and workshops for understanding various construction materials.
- h) Use video/animation films to explain various processes like Manufacturing of construction materials, concrete mixing, and base preparation for painting, mortar laying, carpentry work, false ceiling.
- i) Use different instructional strategies in classroom teaching.
- j) Collect different samples of various construction materials like Stone, aggregate of different sizes, timber, lime, bitumen, Bricks, tiles, precast concrete products, Water proofing material, Termite proofing material, Thermal insulating material, plaster of Paris, paints, distemper, and varnishes.
- k) Display various technical brochures of recent building materials.
- l) Visit the PWD office to demonstrate the procedure adopted for the payment of the work to the contractor and present the report on PWD Account forms with details of measurement book (M.B.), cash book, indent, RA bill, first and final bill, and final bill.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

- a) Compare the tender documents of three different organizations.



- b) Refer different websites related E- tendering and prepare report on it.
- c) Draft detailed specification for different items of work other than PWD.
- d) Prepare the report on online bids/auction through internet.
- e) Prepare valuation report of any residential.
- f) Collect relevant information about the software used in preparation of tender documents and write report on it.
- g) Visit to ongoing project and study various aspects related to contracts and tender document.
- h) Visit to ongoing project and study various aspects related to accounting process (MB, RA bill, various advances).

13. SUGGESTED LEARNING RESOURCES :

S. No.	Title of Book	Author	Publication
1	Estimating and Costing in Civil engineering	Datta, B.N.	UBS Publishers Pvt. Ltd. New Delhi. ISBN:9788174767295
2	Construction Management and Contract Practices	Raina, V. K.	Shroff Publishers & Distributers Pvt. Ltd. New Delhi ISBN: 9788184047875,
3	Estimating and Costing	Rangawala, S.C.	Charotar Publishing House PVT. LTD., Anand (Gujrat) Reprint -2011
4	Estimating and Costing	Birdie,G.S.	Dhanpat Rai. New Delhi 2016 ISBN : 978-93-84378-13-4
5	Civil Engineering Contracts and Estimates	Patil, B.S.	Orient Longman, Mumbai, Ed.2010 ISBN: 9788173715594, 8173715599
6	Estimating and costing, specification and valuation in civil engineering	Chakraborti, M.	Monojit Chakraborti, Kolkata ISBN: 818530436.

14. SOFTWARE/LEARNING WEBSITES

- a) www.mahapwd.com
- b) <https://mahatenders.gov.in>
- c) http://cpwd.gov.in/cpwde_tender.aspx
- d) <https://gem.gov.in>



Program Name : Civil Engineering Program Group
Program Code : CE/CR/CS
Semester : Sixth
Course Title : Maintenance and Repairs of Structures
Course Code : 22602

1. RATIONALE

It is absolutely necessary to maintain the building structure in order to preserve the assets and protect the building the building occupants. Normally, the external parts of a building get weathered quickly being exposed to the natural environment. Overlooked dilapidation and inadequate maintenance in the building lead to loose mortar, tiles and bricks of external walls, spalled concrete and thereby threaten public safety. Proper building maintenance ensures that the building and the environment remain healthy, clean and a safe place to work or reside. The strengthening of elements for sustaining loads in future enhances the life, use and raise the value of structures. Regular inspection and maintenance is therefore necessary for timely identification of deteriorated building elements. However, this requires a scientific approach through the investigation of failure pattern. The civil engineering technologists are required to prevent the deterioration of different types of buildings and also to repair the damages in the building. This course is therefore designed to develop the competency to do all these activities.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Maintain different types of building structures.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Select the relevant method of maintaining different building structures.
- Test the structures to predict its stability
- Select the relevant materials for repair of structures.
- Apply the relevant methods of repair for the masonry structures.
- Restore the damages of building structural elements using suitable method of repair.
- Prepare the structural audit and budget for the maintenance of structures.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme													
L	T	P		Theory								Practical					
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
4	-	2	6	3	70	28	30*	00	100	40	25#	10	25	10	50	20	

(*): Under the theory PA; Out of 30 marks, 10 marks of theory PA are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.



Legends: *L* - Lecture; *T* - Tutorial/Teacher Guided Theory Practice; *P* - Practical; *C* - Credit, *ESE* - End Semester Examination; *PA* - Progressive Assessment.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

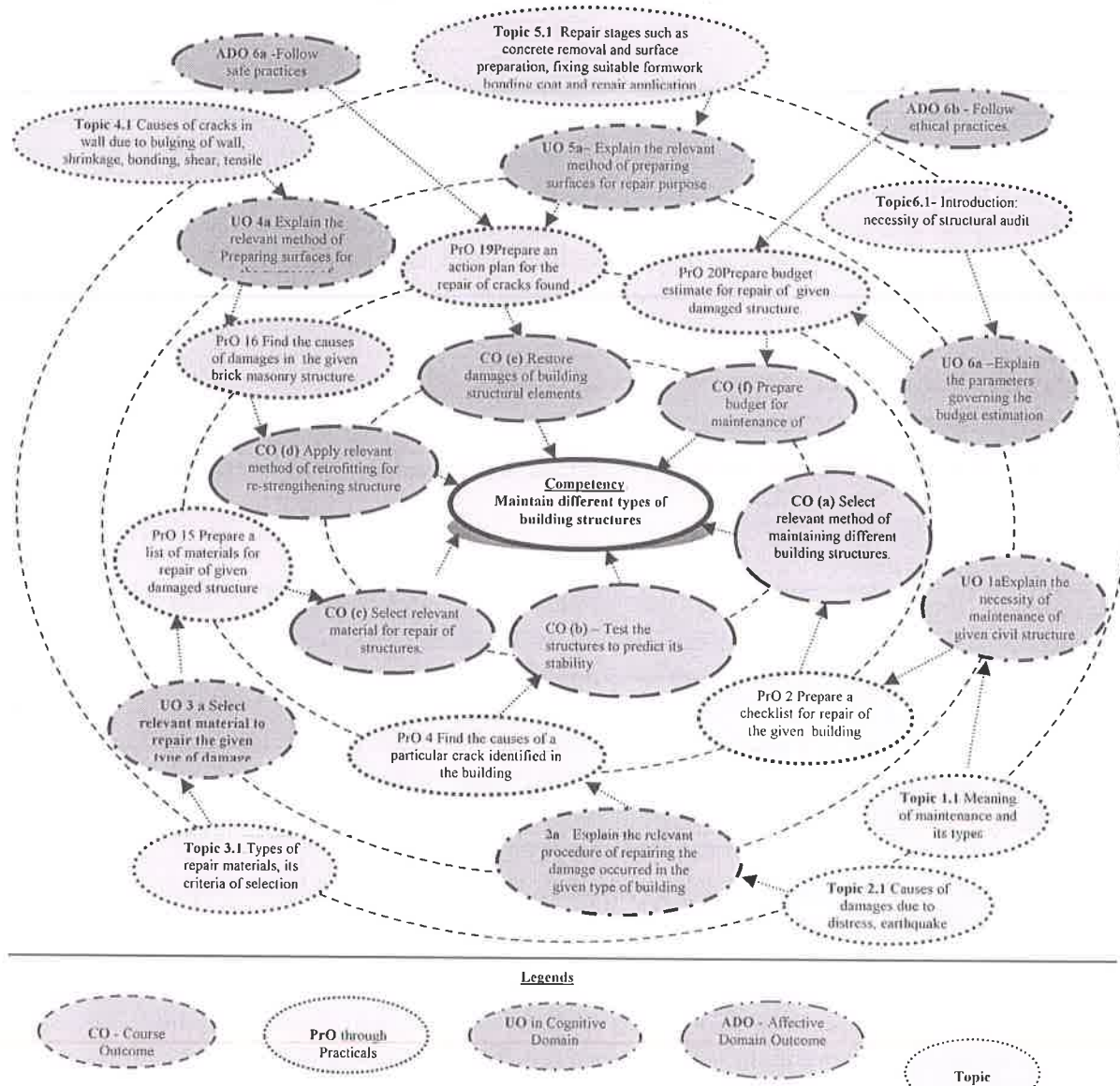


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

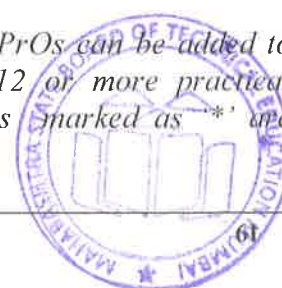
The practical's in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Find the causes of damages for the given building elements.	I	02*
2	Prepare the check list for materials required for repair of load bearing building and framed building.	I	02
3	Prepare a check list for repair of a load bearing building and framed building.	I & II	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
4	Determine the compressive strength of any two structural elements such as column, beam, slab etc for damaged or undamaged structure using Rebound Hammer .	II	04*
5	Determine the extent of efflorescence in masonry or concrete for damaged or undamaged structure.	II	02*
6	Determine the crack nature of any two structural elements such as column, beam, slab etc. for damaged structure using Ultrasonic Pulse Velocity test .	II	02
7	Determine the bond strength of any one structural element such as column, beam, and slab etc. using pull out test .	II	02
8	Determine the size, depth and location of reinforcing bar using Rebar locator of any two structural elements such as column, beam, slab etc. for damaged or undamaged structure.	II	02
9	Determine Maximum Chloride content in concrete in percent by weight of cement using Rapid Chloride Test of any one structural element such as column, beam, slab etc for undamaged structure.	II	02*
10	Determine the depth of carbonation of concrete using phenolphthalein indicator of any two structural elements such as column, beam, slab etc. for undamaged structure.	II	02*
11	Determine the moisture content using Moisture Meter of any two structural elements such as column, beam, slab etc. for damaged or undamaged structure.	II	02
12	Determine the corrosion of reinforcing bar using Half-cell Potentiometer of any two structural elements such as column, beam, slab etc for damaged or undamaged structure.	II	02
13	Determine the compressive strength of extractor core using Compression Testing Machine of any one structural element such as column, beam, slab etc. for damaged or undamaged structure.	II	02
14	Prepare a list of material requirements and check list for repair of wall cracks as per the damages found.	III	02
15	Prepare a report on damage assessment of non-residential structures such as dams, bridges, industrial buildings etc.	IV	02*
16	Prepare a check list for repair and material requirement for flooring of given structure.	IV	02
17	Prepare a check list for materials required and resources for repair of sanitary unit of the building.	IV	02
18	Repair the cracks for a damaged plane concrete member of size of 100×100×500 mm or 150×150×750 mm	V	02
19	Prepare a budget estimation considering materials, task force, equipment's and methodology for the given damaged structure.	VI	02*
20	Determine the flexural strength of repaired beam in practical no 18.	IV & V	02
	Total		40

Note

- i. A suggestive list of **PrOs** is given in the above table. More such **PrOs** can be added to attain the **COs** and competency. A judicious mix of minimum 12 or more practical **UOs/tutorials** need to be performed, out of which, the practicals marked as '*' are



compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.

- ii. *The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:*

S. No.	Performance Indicators	Weightage in %
1	Interpretation of given data and its presentation.	10
2	Selection of materials /Process of repairing of the given structural non structural components /writing of visit report.	30
3	Precision in check list for material list/equipment list and report and its neatness, cleanliness.	30
4	Individual work and working in groups	20
5	Submission of assigned work in time	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Work as a leader/a team member.
- Follow ethical practices.

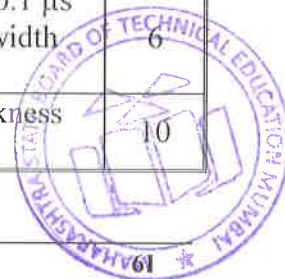
The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year.
- 'Organization Level' in 2nd year.
- 'Characterization Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specifications mentioned here to retain uniformity in conduct of experiments, as well as aid to procure equipment by administrators

S. No.	Equipment Name with Broad Specifications	PrO. S. No.
1	Universal Testing machine of capacity 400kN,600 kN/1000kN, analog type/digital type with all attachments and accessories.	4,7, 20
2	Compression testing machine of capacity 2000KN, analog /digital type having facility to measure deformation with all attachments and accessories.	4,13
3	Rebound Hammer: Manual Test Hammer of W-M-250, BS-1881-202, weight: 2.7 kg, size: 127 x 76 x 355 mm, shipping weight: 2.7 kg and minimum verifiable strength is 10 MPa to 62 MPa.	8
4	Ultrasonic Pulse Velocity test apparatus: range 0.1-7930 μ s, resolution: 0.1 μ s to 1 μ s, display 7", color 800 x 480, pulse voltage 100 – 450 Vpp, bandwidth 20 – 500 kHz	6
5	Cover gauge: concrete thickness gauge model of CTG-2 (Concrete Thickness Gauges), battery powered, ASTM Standard, frequency resolution 10Hz,	10



S. No.	Equipment Name with Broad Specifications	PrO. S. No.
	thickness range 81 mm to 50.8 cm in standard mode.	
6	Rapid chloride test apparatus: RCPT Apparatus is as per ASTM C 1202-05. 4 Port (230~250V AC power supply), plexi-glass chambers - 4 pairs, 500mm vacuum desiccator, consumables - good for 1 doz	9
7	Crack detection microscope: magnification = x 35, measuring Range = 4 mm, divisions = 0.02mm, weight including battery and box = 560gm, box dimensions = 150 x 100 50mm deep	6
8	Rebar locator: Model: GMS 120 professional, weight: 0.27 KG, detection depth for steel max : 120 mm and for copper max 80 mm	8
9	Moisture meter: as per IS 12175 code practices	11
10	Half-cell potentiometer; voltage 220, electric power source, frequency 50 Hz, corrosion monitoring technique standardized by ASTM	12
11	Water permeability meter: as per IS 5529(Part 2):2006 in-situ permeability test, two versions available: with gaskets for 150 mm cube specimens as 55-C0246/3 three place model and 55-C0246/6 six place model, air compressor, max. working pressure 8 bar.	15
12	Extensometer with least count 0.01mm, maximum extension 25 mm with single dial gauge/ digital display suitable for various gauge length	13,14

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs in cognitive domain for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Basics of maintenance and repairs	1a. Explain the necessity of maintenance and repairs of the civil structure. 1b. Know the factors that influence on maintenance of given structure with justification. 1c. Explain the concept of retrofitting, re-strengthening, rehabilitation, and restoration 1d. Know the periodical maintenance and its manual, monsoon maintenance, maintenance history sheet.	1.1. Maintenance and its classifications, repair, retrofitting, re-strengthening, rehabilitation and restoration. 1.2. Necessity, objectives and importance of maintenance and repairs. 1.3. Factors influencing the maintenance and repairs 1.4. Advantages and limitations of maintenance and repairs. 1.5. Approach of effective management for maintenance and repairs. 1.6. Periodical maintenance, maintenance manual containing building plan, reinforcement details, material sources, maintenance frequency, pre and post monsoon maintenance.
Unit– II Causes and detection of damages	2a Explain the causes of damages occurred in the given structures. 2b Know the systematic approach of damages	2.1 Causes of damages due to distress, earthquake, wind, flood, dampness, corrosion, fire, dilapidation, termites 2.2 Systematic approach of damages detection, various aspects of visual

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	detection 2c Explain non-destructive test with respect to the given damaged structural elements 2d Explain the procedure of non-destructive test used to detect the damages.	observations for detection of damages. 2.3 Tests on damaged structures: rebound hammer, ultrasonic pulse velocity, rebar locator, cover gauge, crack detection microscope, chloride test, sulphate attack, pH measurement, half-cell potential meter.
Unit III- Materials for maintenance and repairs	3a. Select the relevant materials to repair the given type of damages with justification. 3b. Explain the suitable materials for the anti-corrosion, adhesives and mortar repairs. 3c. Explain the relevant materials for waterproofing, and joint sealants for the repairing of given structure. 3d. Explain the relevant materials for surfacing coating and grout for the repairing of given structure. 3e. Choose the relevant materials for the repair of damaged structures with justification.	3.1 Factors influencing the material selection for maintenance and repairs. 3.2 Anti-corrosion coating materials: cement slurry mortar, polymer modified cement slurry and epoxy zinc. 3.3 Adhesives materials: solvent free adhesives: epoxy adhesive, polyester adhesive, acrylic adhesive and water borne adhesives: polyvinyl acetate and vinyl acetate co-polymer. 3.4 Mortar repair materials: cementitious mortar, polymer modified cementitious mortar and resin mortar. 3.5 Joint sealants materials: oleo resinous mastics, bitumen/rubber based sealants and acrylic resin sealant. 3.6 Grout materials: cement grout, cement sand grout, cement sand grout with additives, polymer modified cement grout and normal epoxies. 3.7 Waterproofing roof materials: polyisobutylene (PIP) sheet, glass fiber reinforced plastics, bitumen and bituminous emulsion and latex cement coating. 3.8 Surface coating materials for concrete protection: bituminous cutbacks, chlorinated rubber coating, Vinyl coatings, epoxy coating and coal tar epoxy. 3.9 Additional repairing materials: plastic or aluminum nipples, polyester putty or 1:3 cement sand mortar and galvanized steel wire fabrics & clamping rods.
Unit –IV Maintenance and repair methods for masonry	4a. Explain the various causes of wall cracks and their probable locations 4b. Select the relevant repair techniques for the damages in the given civil structures with justification. 4c. Explain the repairing	4.1 Causes of wall cracks due to bulging of wall, shrinkage, bonding, shear and tension, differential settlement of foundation, thermal movement and vegetation. 4.2 Probable crack location such as junction of main & cross wall, junction of RCC column & wall, junction of slab & wall,



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	<p>methods for the different crack types for the given structure.</p> <p>4d. Explain the damping effect and its repair techniques</p> <p>4e. Explain the various methods of improving the bearing capacity of foundation</p>	<p>cracks in masonry joints.</p> <p>4.3 Stages of repair: material removal and surface preparation, fixing suitable formwork, bonding/passivating coat and repair applications.</p> <p>4.4 Repair techniques: grouting, patch spalling replacement or delaminating and epoxy bonded mortar.</p> <p>4.5 Repairing methods for minor & medium cracks include epoxy injection, grooving & sealing, shotcrete, stitching, grouting and gunting.</p> <p>4.6 Repairing methods for major cracks (width more than 5mm) include fixing mesh across cracks, dowel bars, RCC band and installing ferro-cement plates at corners and propping.</p> <p>4.7 Effects of dampness in wall, damping repair techniques such as replacement or inserting DPC in brick wall, bituminous painting, painting using water proof solution and cement with adhesive gum.</p> <p>4.8 Causes and remedies of foundation settlement, improvement techniques by compaction, intruding sand piles, stone columns and grouting cement slurry.</p>
Unit –V Maintenance and repair methods for RCC	<p>5a. Explain the probable crack location in RCC and causes of RCC failure</p> <p>5b. Explain the causes of dampness in roof slab and its various repair techniques</p> <p>5c. Know the repair methods for the cracked RCC elements</p> <p>5d. Explain the relevant repair methods for cracks in RCC structures</p> <p>5e. Know the repair of corroded RCC elements, honeycomb and large voids in the given structure</p>	<p>5.1 Probable location of cracks in RCC elements, various causes of RCC failure.</p> <p>5.2 Causes of dampness in roof slab and its repair techniques such as mud phuska with brick tile topping, lime concrete terracing, ferro-cement topping and brick coba.</p> <p>5.3 Repair methods for cracks in RCC structures such as epoxy injection, grooving & sealing, stitching, rebaring, grouting, spalling replacement, jacketing, shotcrete and gunitting.</p> <p>5.4 Repair of corroded RCC element: exposing and undercutting rebar, cleaning reinforcing steel, compensating reinforcement and protective coating.</p> <p>5.5 Repair methods for honeycomb and larger voids.</p>
Unit –VI Structural audit and Budget	<p>6a. Explain the necessity and importance of structural audit & budget estimation</p> <p>6b. Explain the procedure involved in structural audit and budget estimation</p>	<p>6.1 Necessity and importance of structural audit and budget estimation</p> <p>6.2 Distress survey, detailed inspection, recommendations for budget estimation.</p> <p>6.3 Steps involved in structural audit and budget estimation.</p>

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	6c. Explain the step-by-step procedure for maintenance of the given structure. 6d. Know the formats preparation for the process of structural audit and budget preparation 6e. Explain the rules & regulations of structural audit and budget estimation as recommended by competent authority.	6.4 Format preparation for structural audit including general information of building, building data, complain reported by users, inspection of internal and external areas of building. 6.5 Overview on rules and regulations of structural audit and budget estimation as recommended by competent authority such as Public Work Department.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Basics of maintenance and repairs	06	04	04	0	08
II	Causes and detection of damages	10	02	04	04	10
III	Materials for maintenance and repairs	10	02	08	04	14
IV	Maintenance and repair methods for masonry	12	02	04	06	12
V	Maintenance and repair methods for RCC	14	02	06	06	14
VI	Structural audit and budget	12	02	04	06	12
Total		64	14	30	26	70

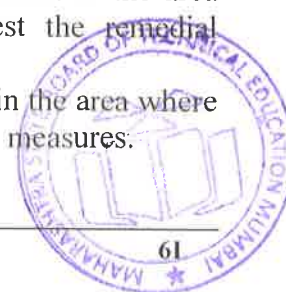
Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Collect six photographs of different types of damages in Masonry works in the area where student resides. Do the diagnosis of the ailments, suggest the remedial measures.
- Collect six photographs of different types of damages in RCC works in the area where student resides. Do the diagnosis of the ailments, suggest the remedial measures.



- c) Collect the brand names and uses of repair materials available in the market in the area where student resides.
- d) Download the videos related to the repairs of water leakages of RCC water tank, plumbing works, sanitary works, flooring repairs, door and window frames/panels repairs.
- e) Prepare a power point presentation on the activity (d)
- f) Carrying a Repairing work of spalling of plaster from a ceiling.
- g) Analyzing light and ventilation of a room having common walls and suggesting remedies.
- h) Prepare journals based on practical performed in laboratory.
- i) Give seminar on relevant topic.
- j) Undertake micro-projects.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- a) Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- b) '**L**' in *item No. 4* does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c) About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d) With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- e) Guide student(s) in undertaking micro-projects.
- f) Demonstrate students thoroughly before they start doing the practice.
- g) Encourage students to refer different websites to have deeper understanding of the subject.
- h) Observe continuously and monitor the performance of students in Lab.
- i) Demonstrate students thoroughly before they start doing the practice.
- j) Encourage students to refer different websites to have deeper understanding of subject.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty

- a) Collect the information of various materials used in actual practice for repairs of cracks.



- b) Collect the details of various types of the agencies working for repairs and maintenance of structures in actual practice.
- c) Collect the details of new techniques used for repair.
- d) Compare damages caused by various natural hazards.
- e) Prepare a budget with respect to material, task force, equipment's and methodology for the historical structure in your vicinity.
- f) Prepare collection of photographs showing various types of cracks in damaged structures.
- g) Carry out market survey for at least five materials used for repairs with respect specification, supplier, packaging and costing.
- h) Cast three RCC beams and three plain concrete beams and find the various types of cracks by applying one point load, two point loads etc. and find the flexural strength.
- i) Repair the above beams and find out the strength regained by the beams.
- j) Suggest the repair material and methods for the above beam as per type of crack developed.
- k) Micro projects relevant on topics as per the guidance subject teacher.

13. SUGGESTED LEARNING RESOURCES :

S. No.	Title of Book	Author	Publication
1	Building Repair and maintenance management	Gahlot, P. S. Sharma, Sanjay	CBS Publishers & Distributors Pvt. Ltd. New Delhi, ISBN: 81-239-1243-9
2	Maintenance Engineering for civil Engineers	Nayak B. S.	Khanna Publication, New Delhi ISBN: 978-81-7409-051-7
3	Maintenance and Repairs of Buildings	Guha, P. K.	New Central book Agencies, New Delhi, ISBN 10: 8173810737 ISBN: 9788173810732
4	Maintenance and Repairs of Buildings	Hutchin Son, BD	Newnes-Butterworth, London (UK) ISBN : 0408001917

14. SOFTWARE/LEARNING WEBSITES

- a) <https://www.youtube.com/watch?v=7ypSU6ZDJlwhttps://www.youtube.com/watch?v=zX8HNbHmToM>
- b) <https://www.youtube.com/watch?v=zZsstKuFl4s>
- c) <https://www.youtube.com/watch?v=zXglx8BXR-Y>
- d) <https://www.youtube.com/watch?v=EmmzpQd5I0E>
- e) <https://www.youtube.com/watch?v=ANORiqAJ7kc>
- f) https://www.youtube.com/watch?v=Zp4f_ReeSO0
- g) <https://www.youtube.com/watch?v=wPBq0yVLEa8>
- h) <https://www.youtube.com/watch?v=lqwtoHpWgbU>
- i) <https://www.youtube.com/watch?v=y1rOtvvxRzY>
- j) https://www.youtube.com/watch?v=q_JeGja1Yb4
- k) <https://www.youtube.com/watch?v=tztOejzcGEO>
- l) <https://www.youtube.com/watch?v=eEXAWukRfD4>
- m) <https://www.youtube.com/watch?v=CJUDJk1fFb0>
- n) https://i.ytimg.com/an_webp/reuxFdNJcLk/mqdefault_6s.webp?du=3000&sqp=CILn4ewF&rs=AO4CLC_MQ_GI3_HKKE-zVEilBfG0gSwFA



Program Name : Civil Engineering Program Group
Program Code : CE/CR/CS
Semester : Sixth
Course Title : Emerging Trends in Civil Engineering
Course Code : 22603

1. RATIONALE

Civil Engineering sector has completed number of projects with conventional techniques to meet the needs of the society. But, in recent two decades, various new innovative techniques are being used worldwide, which our practicing engineers, are also partially using to achieve their goals. The emerging trends in Civil Engineering help to complete the undertaken projects within prescribed schedule, saves the natural resources and to make the projects eco-friendly. This subject helps to make awareness about soft computing techniques, new materials, advanced machineries, sustainable resource management and advancement in Civil Engineering.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Recommend emerging techniques in civil engineering.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented COs* associated with the above mentioned competency:

- Reveal different applications of software's for planning, designing and execution of projects.
- Suggest the advanced materials as per site condition.
- Recommend the suitable tools and equipments for the given situation.
- Suggest the advanced resource management techniques for the given project.
- Use the feasible advance techniques for various civil engineering projects.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	-	3	90 Min	70*#	28	30*	00	100	40	--	--	--	--	--	--

(*#): Under the theory ESE; Total 70 marks of **online exam** will be conducted.

(*): Under the theory PA; Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 mark is the average of 2 tests (**MCQ type**) to be taken during the semester for the assessment of the UOs required for the attainment of the COs.



Legends: *L*-Lecture; *T* – Tutorial/Teacher Guided Theory Practice; *P* - Practical; *C* – Credit, *ESE* - End Semester Examination; *PA* - Progressive Assessment.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

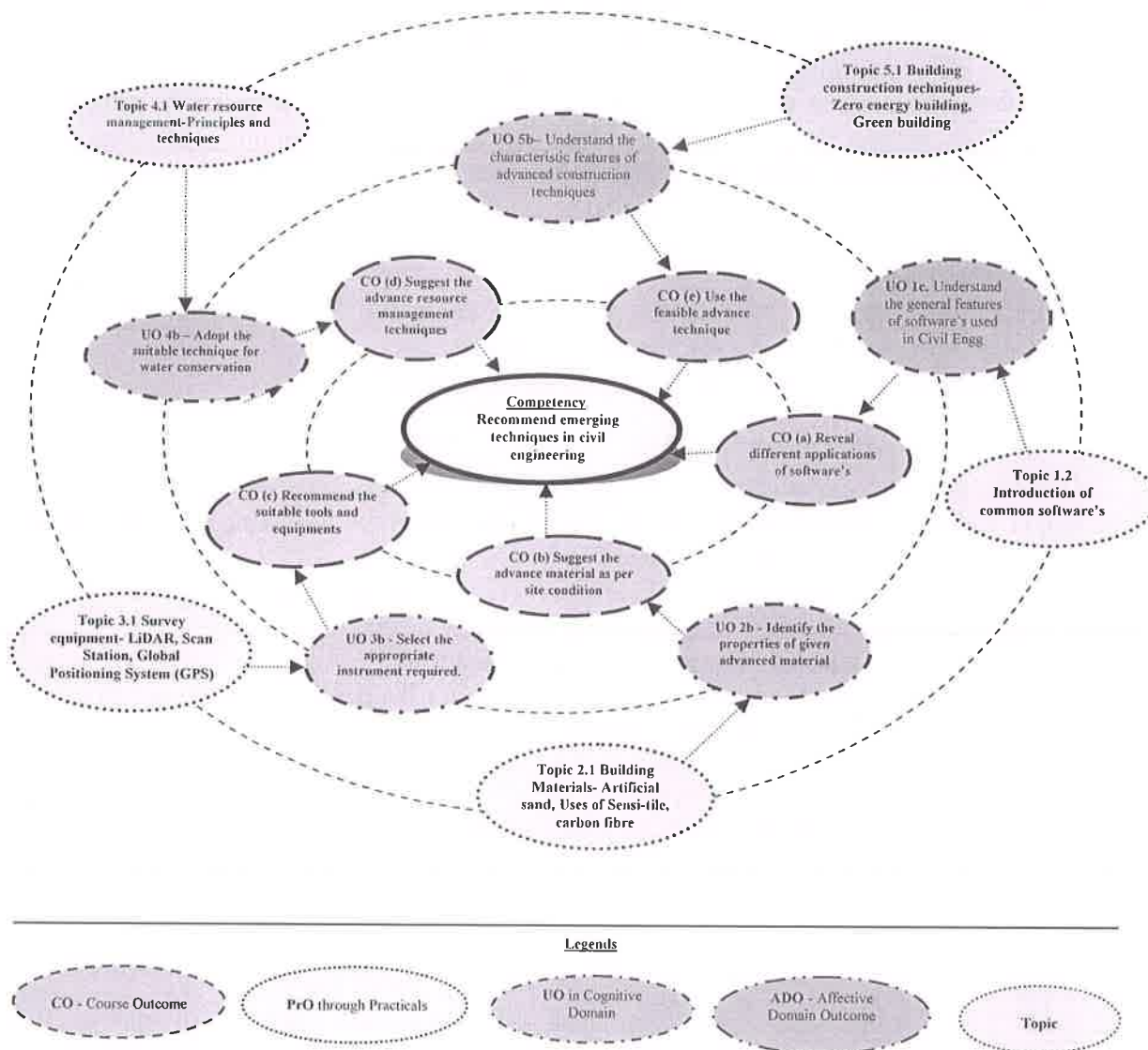


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1.	Not Applicable		

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of theory.

S. No.	Equipment Name with Broad Specifications	UOs. S. No.
1.1	Computer system (Any computer system with basic configuration)	All
1.2	LCD Projector with accessories	All

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs in cognitive domain for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Soft Computing Techniques	1a. Enlist the characteristic uses of soft computing techniques in civil engineering. 1b. Identify merits and demerits of soft computing techniques. 1c. Understand the general features of software's used in Civil Engg 1d. Suggest the suitable software/s for the given construction activity.	1.1 Introduction of soft computing techniques and its types, Merits and demerits of soft computing technique, Graphical User Interface Software (GUI) . 1.2 Introduction, salient features and applications of software's - REVIT, ETAB, 3D Architect Home, Build-Master, HEC-RAS, STRAP, WaterGEMS, Tekla, ArcGIS, QuikGrid, STAAD.Pro, SAFE, RISA-Connection, Civil 3D, Site 3D, SkyCiv Structural 3D, SAP 2000, MIDAS, LUSAS, BricsCAD, Estimate Master, ProEst, WinEst, Clear Estimate, Procore, Buildertrend, Building Management System (BMS), Plant Design and Management System (PDMS), Building Information Modeling (BIM), Primavera Pro, Microsoft Project (MSP)
Unit– II Recent Construction Materials	2a. List the advanced construction materials for given construction project. 2b. Identify the properties of given advanced material. 2c. Enumerate the applications of given form of material/s in civil engineering.	2.1 Building Materials- Artificial sand, Sensi tile, carbon fibre, Bricks made up of cigarette butts, 3D printed bricks, Translucent wood, laminated timber, 3D Tiles 2.2 Road Materials- Geo-synthetics, Noise-reducing asphalt, Porous Pavement, Plastic Roads, solar roads,

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	2d. Identify the situations to use the given material. 2e. Justify the use of given material for given site condition.	Anti Icing Roads, Piezoelectric roads 2.3 Concrete Materials- Portland Pozzolana Cement, Portland Slag Cement, New admixtures – Masterglanium, Polycarboxylic Ether, Self Healing Concrete, Fibre-Reinforced Concrete, High Strength concrete, High Performance Concrete, Nano concrete, Light transmitting concrete. 2.4 Sustainable Materials- Ground Granulated Glass Blast-furnace Slag (GGBS) concrete, Aero-gel insulation, Cooling bricks, Green concrete, Timbercrete, Ferrock
Unit III- Latest Tools and Equipments	3a. Identify the correct use/s of given advanced tool/equipment. 3b. Select the appropriate instrument required for the given construction activity. 3c. Identify the situation for the use of given advance equipment/instrument.	3.1 Survey equipment- LiDAR, Scan Station, Global Positioning System (GPS), Geographical Information System (GIS), Photogrammetry, Drones, Direct Reading Grade Rods, 3D Laser scanning, laser level 3.2 Construction Equipment- Earth moving equipment-Skid and crawler loaders, trenchers, scrappers, wheeled loading shovels, advanced plastering machine, Bridge launcher. 3.3 Material handling equipment- Cranes, conveyors, hoists, forklifts, mobile concrete mixer, paver, road header, tunnel boring machine.
Unit-IV Sustainable Resource Management	4a. Elaborate the principle of water resource management. 4b. Adopt the suitable technique for water conservation. 4c. Justify the need of 4R principle in waste management. 4d. Recommend the use of waste for the given civil construction work. 4e. Suggest the appropriate safety technique for given site condition.	4.1 Water resource management- Principles and techniques 4.2 4R's in waste management-Reduce, Reuse, Recycle and Recover, Concept of Zero Waste 4.3 Reuse of waste in construction-Fly Ash, Slag and Plastic 4.4 Renewable energy sources-solar energy, biomass, wind energy, ocean wave energy, Geo thermal energy and hybrid power system. 4.5 Energy Audit-Necessity and methods. 4.6 Natural disaster management- Flood , Earthquake, Tsunami, Volcanic Eruption, Hurricanes, Landslides. 4.7 Site Safety-necessity, principles, tools, techniques, laws, rules and regulations.
Unit –V	5a. Select the appropriate	5.1 Building construction techniques-

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Advancement in Construction	advanced techniques for the given construction project. 5b. Understand the characteristic features of advanced construction techniques 5c. Recommend the use of appropriate construction techniques as per site condition. 5d. Identify the application of given construction technique	Zero energy building, Green building, Mass housing-precast housing, prefab homes, pre-engineering building, Solar Paints, Building Integrated Photovoltaic (BIPV), Earthquake Resisting Controls-Isolation and Dissipation. 5.2 Road construction techniques- 3D Printing, Road Printer, smart roads 5.3 Coastal construction techniques- Sound Proofing walls, water resistant roofs, high performance doors and windows, air and moisture barriers. 5.4 Ground improvement techniques- Advanced piling techniques - Stone Column, Vibro Floatation, Micro Piles, Soil Nailing, Vertical drains-Sand Drains, Pre-Fabricated Vertical Drains, Thermal Methods- soil heating and soil freezing.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Soft Computing Techniques	08	06	04	02	12
II	Recent Construction Materials	10	04	06	04	14
III	Latest Tools and Equipments	10	06	04	04	14
IV	Sustainable Resource Management	08	04	06	02	12
V	Advancement in Construction	12	06	08	04	18
Total		48	26	28	16	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare



reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- a. Visit the appropriate website and observe the relevant videos and other related learning material.
- b. Group discussion on sustainable resource management.
- c. Undertake micro-projects.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- a. Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- b. '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c. About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- e. Guide student(s) in undertaking micro-projects.
- f. Demonstrate the particular situation before undertaking the task in practice.
- g. Show video clips of emerging trends in civil engineering and undertake the discussion.
- h. Show picture clips/photographs of advance construction techniques available online.
- i. Arrange expert lectures of various practicing engineers from various construction sites.
- j. Arrange the brain storming sessions on recent modifications in construction methodology, projects undertaken, innovative materials etc.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. **In special situations** where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

- a. Prepare the chart showing software and their applications.
- b. Prepare a model of any one construction material or machinery used in recent days.



- c. Prepare a report on advanced machinery and materials.
- d. Elaborate the process of mass housing, pre-engineered buildings etc.
- e. Make posters showing site safety and its awareness.
- f. Prepare the charts showing different types of safety rules and regulations of site.

13. SUGGESTED LEARNING RESOURCES :

S. No.	Title of Book	Author	Publication
1	Emerging Materials for Civil Infrastructure: State of the Art	Roberto Lopez-Anido, Tarun Naik	American Society of Civil Engineers (31 July 2000), ISBN-13: 978-0784405383
2	Sustainable Construction Materials	Ravindra K. Dhir OBE Jorge de Brito Rui Silva Chao Qun Lye	Woodhead Publishing, 9th January 2019, eBook ISBN: 9780081009918 Hardcover ISBN: 9780081009857
3	Learning Manual on "Emerging Trends in Civil Engineering"	MSBTE, Mumbai.	--

14. SOFTWARE/LEARNING WEBSITES

- a. <https://www.engineeringcivil.com/software>.
- b. <https://www.nbmcmw.com/tech-articles/concrete/3725-new-construction-materials-for-modern-projects.html>
- c. <https://geniebelt.com/blog/10-innovative-construction-materials>
- d. <https://www.viatechnik.com/blog/modern-construction-machines-theyre-used/>
- e. https://www.academia.edu/28172313/ADVANCED_BUILDING_CONSTRUCTION_EQUIPMENT
- f. <https://theconstructor.org/construction/sustainability-construction-civil-engineering/9492/>
- g. https://www.designingbuildings.co.uk/wiki/Advanced_construction_technology
- h. <https://www.constructionjunkie.com/blog/2018/1/7/the-16-most-interesting-advances-in-construction-technology-of-2017>
- i. https://mysubs.in/buy/recent-trends-in-civil-engineering-and-technology-journal-subscription?gclid=Cj0KCQjw6lfoBRCiARIsAF6q06scZ5teDlexIYz_j85yy2ZH_v1kiQcytNvYf3AelfE3LcZndTbhrOwaAqv2EALw_wcB
- j. <https://www.flatworldsolutions.com/engineering/articles/6-latest-trends-in-civil-engineering.php>.



Program Name : Civil Engineering Program Group
Program Code : CE/CR/CS
Semester : Sixth
Course Title : Building Services (Elective-II)
Course Code : 22604

1. RATIONALE

Buildings serve several societal needs – primarily as shelter from weather, security, living space, privacy, to store belongings, and to comfortably live and work. Building services are the systems installed in buildings to make them comfortable, functional, efficient and safe. They can include fire safety, HVAC (heating, ventilation and air conditioning), lighting, plumbing, ICT (information and communications technology), and so on. Building Services Engineers are the people who make this happen. The knowledge of building services is necessary to maintain the functional requirements of the building by a civil technologists. As buildings are becoming more complex and more modern, it is essential to include the same in the Civil Engineering curriculum. This course is designed to enhance the employability with the skills required for building service industries.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Execute the building services for creating human comfort in the buildings.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

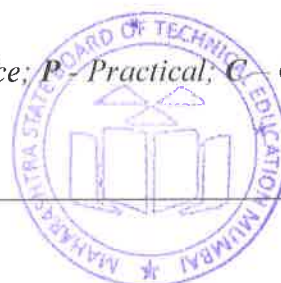
- Identify the building services for the requisite functional requirements.
- Estimate the space requirements for vertical communication services.
- Propose the fire safety requirements for multi-storeyed buildings.
- Devise the water supply and sanitation system for buildings.
- Evaluate the potential of rain water harvesting and solar water heater system for the buildings.
- Execute the relevant system of lighting, ventilation and acoustics for buildings.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme													
L	T	P		Theory								Practical					
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
3	-	2	5	3	70	28	30*	00	100	40	25#	10	25	10	50	20	

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate attainment of COs and the remaining 20 marks for tests and assignments given by the teacher.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P- Practical; C- Credit, ESE - End Semester Examination; PA - Progressive Assessment



5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and Topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the Course, in all domains of learning in terms of the industry/employer identified competency depicted at the center of this map.

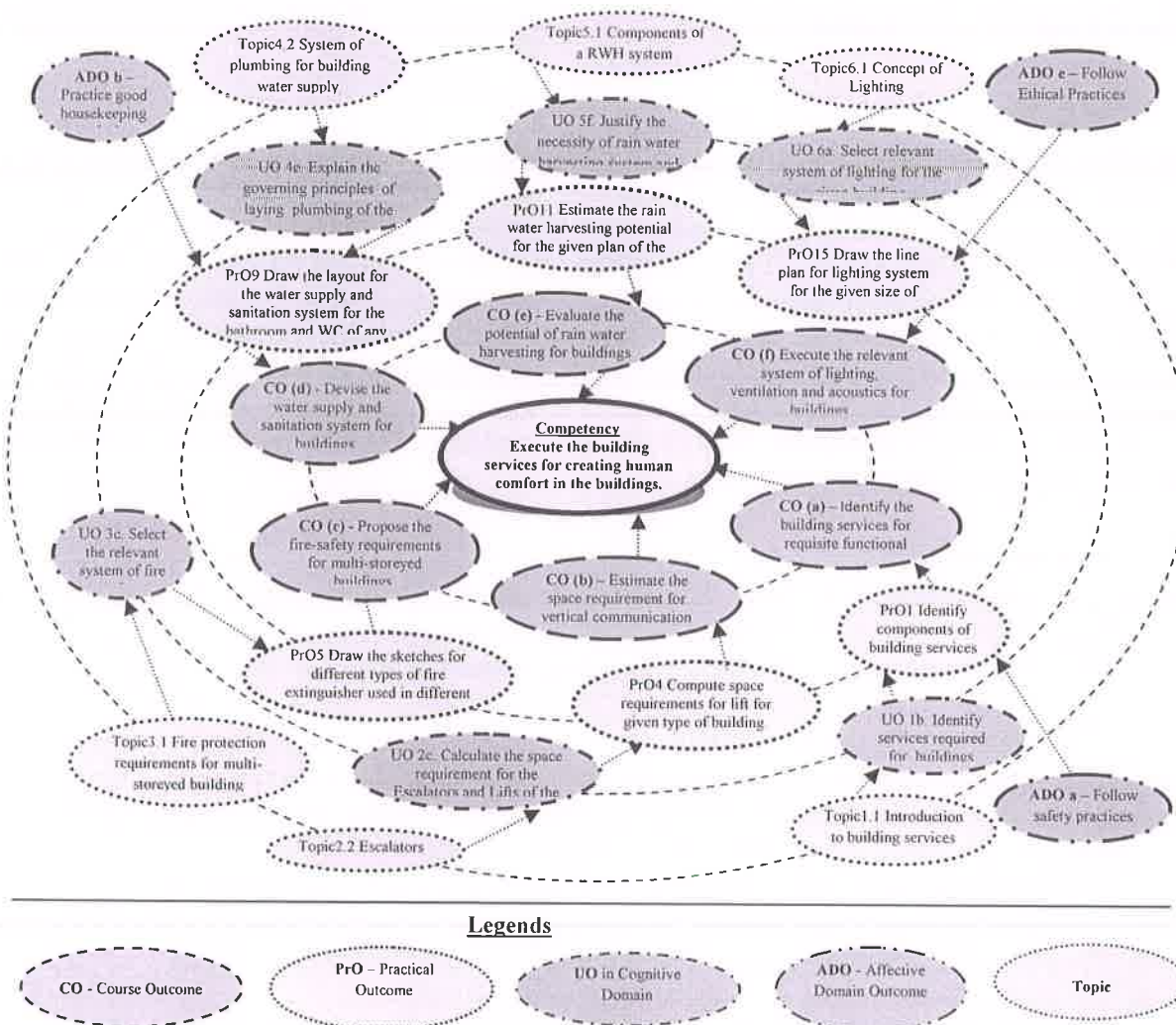


Figure 1 - Course Map

6. SUGGESTED PRACTICALS / EXERCISES

The practical/exercises/tutorials in this section are psychomotor domain PrOs (i.e. sub-components of the COs) are to be developed and assessed in the student to lead to the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Identify components of building services available in your institute building and prepare a report.	I	02
2	Compute the space requirements for the rain water harvesting system for the given type of building.	I	02
3	Compute the space requirements for the escalator for the given type of building as per guidelines of national building code.	II	02*
4	Compute the space requirements for the lift for the given type	II	02*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
	of building as per guidelines of national building code.		
5	Submit your observations along with your comments on the specifications and working of the fire extinguisher by viewing the relevant video/simulation/photographs.	III	02*
6	View the relevant video/simulation/photographs and then draw a line plan showing the provisions of fire safety system in any multi storied residential building/anyone public building in your locality.	III	02
7	Submit your observations along with your comments on the layout for the water supply and sanitation system for the bathroom and WC of any multi-storey building including design parameters by viewing the relevant video/simulation/photographs.	IV	02*
8	Submit your observations along with your comments on the layout for the water supply and sanitation system for the bathroom and WC of any local public building including design parameters by viewing the relevant video/simulation/photographs.	IV	02*
9	Submit your observations along with your comments (labeled sketch, specifications) on the working of valves, pipes of different sizes and fittings (five each) by viewing the relevant video/simulation/photographs.	IV	02*
10	Estimate the rain water harvesting potential for the given plan of the residential building (single storey load bearing structure) and given data.	V	02*
11	Plan the proposed rain water harvesting system for data produced in practical no.10 with necessary sketch, diagram, specifications.	V	02
12	Estimate the rain water harvesting potential for the given plan of the residential building (multi storey framed structure) and given data.	V	02*
13	Submit your observations along with your comments on the specifications and data required for installation and maintenance of the solar water heating system for a dwelling unit with provided data by viewing the relevant video/simulation/photographs.	V	02*
14	Submit your observations along with your comments on the components and working of solar water heating system for the given type of dwelling unit with provided data by viewing the relevant video/simulation/photographs.	V	02
15	Submit your observations along with your comments on the laying of lighting system to be provided for the given size of room of a dwelling unit by viewing the relevant video/simulation/photographs.	VI	02
16	Estimate the quantities of the electrical points, switches and wiring system required for the given type of dwelling unit and Prepare a budget for it with summarization of all relevant information in the form of a report.	VI	02*



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
17	Submit your observations along with your comments on natural and artificial ventilation for the public building by viewing the relevant video/simulation/photographs.	VI	02
18	Submit your observations along with your comments on natural and artificial ventilation for the residential building by viewing the relevant video/simulation/photographs.	VI	02
Total			36

Note:

- A suggestive list of PrOs is given in above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical UOs/tutorials need to be performed, out of which, the practical marked as '*' are compulsory so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Preparation of practical set up	10
2	Setting and operation	10
3	Safety measures	20
4	Observations and Recording	20
5	Interpretation of result and Conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

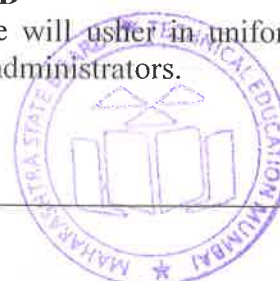
- Follow safety practices.
- Practice good housekeeping.
- Work as a leader/a team member.
- Follow ethical Practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year.
- 'Organization Level' in 2nd year.
- 'Characterization Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by administrators.



S. No.	Equipment Name with Broad Specifications	PrO S. No.
1	Model of a civil engineering structure depicting various components.	1,2
2	Chart showing detailing of lift, escalator and ramp.	3,4
3	Model of various material used in water supply and sanitary drainage system such as fixtures, fittings, pipe section, joints and valves.	7, 8 and 9
4	Model of a civil engineering structure depicting various components of Rain Water Harvesting system.	10
5	Model of a civil engineering structure depicting various components of Solar Water Heating system.	12

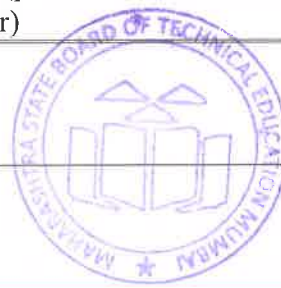
8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop the same UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Overview of Building Services	1a. Classify the building based on the basis of the given type of occupancy with reference to the provisions of National Building Code. 1b. List the relevant type of services required for the given building with justification. 1c. Explain the different components of the given building services provided in the given building. 1d. Explain the salient characteristics of BMS required for the given type of building. 1e. Describe the relevant parameters to convert the given type of building into a smart building. 1f. Justify the necessity of providing the relevant building services in the given type of building.	1.1 Introduction to building services, Classification of buildings as per national building code, Necessity of building services, Functional requirements of building. Different types of building services i.e. HVAC (Heat, Ventilation and Air Conditioning), escalators and lifts, fire safety, protection and control, plumbing services, rain water harvesting, solar water heating system, lightening, acoustics, sound insulation and electric installation etc. 1.2 Role and responsibility of Building Service Engineer, Introduction to BMS (Building Management Services), Role of BMS, concept of smart building.
Unit – II Modes of vertical communication	2a. Suggest the civil engineering requirements for the Escalators to be installed in the given type of civil structure with justification. 2b. Explain the safety measures required for installing the Escalators and Lifts in the given type of civil structure. 2c. Explain the method of	2.1 Objectives and modes of Vertical Communication in building. Lifts: Different types of lifts and its uses Component parts of Lift- Lift Well, Travel, Pit, Hoist Way, Machine, Buffer, Door Locks, Suspended Rope, Lift Car, Landing Door, Call Indicators, Call Push etc., Design provisions for basic size calculation of space enclosure to

	<p>computing the space requirement for the Escalators and Lifts of the given type of civil structure.</p> <p>2d. Suggest the specifications for the elevator required in the given building with justification.</p> <p>2e. Draft the specifications required for construction of ramp required for physically handicapped and elderly persons for the given type of the building structure.</p>	<p>accommodate lift services, Safety measures.</p> <p>2.2 Escalators: Different Types of Escalators and its Uses. Components of escalators, Design provisions for basic size calculation of space enclosure to accommodate escalator services, Safety measures.</p> <p>2.3 Ramp: Necessity, design consideration, gradient calculation, layout and Special features required for physically handicapped and elderly.</p>
Unit- III Fire Safety	<p>3a. Justify the provision of the fire safety system for the given type of buildings.</p> <p>3b. Explain the working principle of the given type of fire protection systems provided in the given type of building.</p> <p>3c. Select the relevant system of fire safety for the given structure with justification.</p> <p>3d. Explain the national building code requirements of providing Fire protection system for the given type of multi-storeyed building.</p> <p>3e. Specify the provisions of NBC for the installation of fire extinguishing equipments in the given type of building.</p>	<p>3.1 Fire protection requirements for multi-storeyed building. Causes of fire in building. Fire detecting and various extinguishing system. Working principles of various fire protection systems.</p> <p>3.2 Safety against fire in residential and public buildings (multi-storeyed building), National Building Code provision for fire safety, Fire resisting materials and their properties, Fire resistant construction, procedures for carrying out fire safety inspections of existing buildings. Provisions for evacuation.</p>
Unit- IV Water supply and sanitation services	<p>4a. Explain the significance of AHJ approval in laying the plumbing system in the given type of building.</p> <p>4b. Select the fixtures required for laying the plumbing system for the given type of building.</p> <p>4c. Explain the governing principles of laying the plumbing services (water supply/drainage/vent) in the given type of building.</p> <p>4d. Select the relevant type of valves, pipe material and fittings required for laying the water supply and drainage system for the given site condition with justification.</p> <p>4e. Suggest the relevant plumbing</p>	<p>4.1 Importance of plumbing, AHJ (Authority Having Jurisdiction) approval, Plumbing Terminology and fixtures: Terms used in plumbing, Different types of plumbing fixtures, shapes/ sizes, capacities, situation and where used, Traps, Interceptors.</p> <p>4.2 System of plumbing for building water supply: sources of water, storage of water, hot and cold water supply system.</p> <p>4.3 System of plumbing for building drainage: types of drainage system such as two pipe system, one pipe system, types of Vents and purpose of venting, Concept of gray water and reclaimed water.</p> <p>4.4 Different pipe materials, and jointing methods, fittings, hanger, supports</p>

	system for the given type of building with justification.	and valves used in plumbing and their suitability.
Unit-V Natural resources conservation services	<p>5a. Propose the relevant components required for the design of rain water harvesting system in the given type of building structure.</p> <p>5b. Explain the method of estimating the rain water harvesting potential for the given type of structure.</p> <p>5c. Explain the procedure for designing the rain water harvesting system for the given type of structure.</p> <p>5d. Select the relevant Solar water heater system required for the given site condition with justification.</p> <p>5e. Draft the specifications for setting a solar water heating system in the given type of building.</p> <p>5f. Justify the necessity of rain water harvesting system and solar water heating system in the given situation.</p>	<p>5.1 Components of a RWH system (Catchments, gutters, conduits, filters, Storage facility, Recharge structures etc.), Advantages of RWH, Application of RWH, RWH potential and factors affecting RWH potential, planning, designing, construction and maintenance of RWH for residential and institutional buildings, colonies, industries, public areas like parks, airports, forested areas.</p> <p>5.2 Concept of SWH (Solar water heating), component parts of SWHS, various system of SWH (heat transfer, propulsion, passive direct system, active direct system, Do-it-yourself), SWHS design principles, specification, installation and maintenance, cost effect, energy production, life cycle energy assessment and applications of SWHS.</p>
Unit- VI Lighting, Ventilation, and Acoustics.	<p>6a. Select relevant system of lighting for the given building with justification.</p> <p>6b. Suggest the lumen capacity required for the given size of the room.</p> <p>6c. Describe the methods used for the ventilation purposes in the given type of building.</p> <p>6d. Explain the significance of providing air conditioning system in the given type of building.</p> <p>6e. Justify the need of acoustic treatment in the given type of building structure.</p> <p>6f. Explain the relevant method of acoustic treatment for the given type of building structure.</p>	<p>6.1. Concept of lighting, types of lighting (natural and artificial), factors influencing the brightness of room, factors affecting selection of artificial lighting, installation of light (direct, half-direct, indirect, half-indirect and direct-indirect), types of light control (manual switch, remote switch, timer switch and photo-electric cell switch), types of lamps (incandescent, tungsten halogen and electric discharge), Lamp selection as per room sizes. Conversion from Lumen (unit of measurement indicating the visible light output of a light source) to Lux (the metric system of luminance).</p> <p>6.2. Concept of ventilation, necessity and types of ventilation, Overview of Air Conditioning system for building.</p> <p>6.3. Building Acoustic, Objectives, acoustic Control in a building, acoustic material (porous absorber and cavity resonator)</p>



Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Overview of Building Services	02	02	02	-	04
II	Modes of Vertical Communication	10	04	04	06	14
III	Fire Safety	08	02	04	06	12
IV	Water Supply and Sanitation System	10	04	04	06	14
V	Natural Resources Conservation Services	10	04	04	06	14
VI	Lighting, Ventilation, and Acoustics	08	04	04	04	12
Total		48	20	22	28	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of LOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

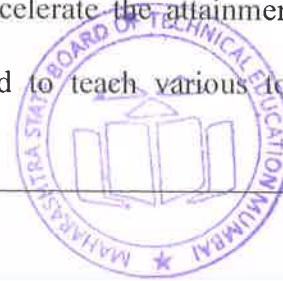
Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare journals based on practical performed in laboratory.
- Give seminar on relevant topic.
- Undertake micro-projects.
- Visit any three buildings near by your institute and classify them in accordance with the provisions made in National Building Code in report form.
- Identify the components of building services by inspecting the nearby buildings to prepare a detailed report w.r.t. adequacy, deficiency and exceeding the requirement.
- Collect the technical brochures of the different components of building services from the local market/internet to present in report form.
- Visit any building certified by Building Management Services to record the important features that has converted it into green building and submit a report.
- Estimate the RWH and SWH potential for your house and institute building.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.



- b) '**L**' in **item No. 4** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c) About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d) With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- e) Guide student(s) in undertaking micro-projects
- f) Arrange visit to nearby construction sites for understanding various construction activities.
- g) Use of video/animation films to explain various processes of building construction.
- h) Use different instructional strategies in classroom teaching.
- i) Demonstration of different small activities related to building services.
- j) Display of various technical brochures of modern building services.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

- a) Prepare a sketchbook consisting of components of modern building services (for Sketches which are not included in Practical sketch book).
- b) Collect the relevant information of recent technologies in elevators and prepare a report on it.
- c) Prepare a report on BMS including a case study.
- d) Collect the relevant information of different techniques for RWH or SWHS and submit a report on it.
- e) Prepare a summary report with reference to lighting, ventilation and acoustic system of a building.
- f) Prepare a report on modern Fire Safety, Detection and Protection systems.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	The A to Z of Practical Building Construction and its Management	Mantri, Sandeep	Satya Prakashan, New Delhi ISBN-13: 978-8176849692
2	Plumbing Design and Practice	Deolalikar, S. G.	McGraw-Hill, New Delhi, 2004 ISBN: 9780074620694

3	Fire Services in India: History, Detection, Protection, Management	Bag, S. P.	Mittal Publications, New Delhi, 1995, ISBN 8170995981
4	Principles of Fire Safety Engineering: Understanding Fire and Fire Protection	Akhil Kumar Das	PHI Learning Pvt. Ltd, New Delhi. 2014, ISB:9788120350380

BIS/ International Codes of Practice:

S. No.	Title of Book	Author	Publication
1	National Building Code Part1, 4, 8, 9	BIS	Bureau of Indian Standard, New Delhi
2	IS 12183(Part 1):1987 Code of practice for plumbing in multistoried buildings	BIS	
3	2008 Uniform plumbing code – India (UPC-I)	BIS	

14. SOFTWARE/LEARNING WEBSITES

- <http://bis.org.in>
- <https://www.capterra.com>
- <http://bmsbuildingservice.com>
- <http://www.plumbingservices.com>



Program Name : Civil Engineering Program Group
Program Code : CE/CR/CS
Semester : Sixth
Course Title : Solid Waste Management (Elective-II)
Course Code : 22605

1. RATIONALE

Industrialization and urbanization is increasing day by day. As a result of this, the generation of solid waste is a major problem all over the country within the urban as well as rural area and it is increasing day by day. In view of this, the management of solid waste produced is of prime need to keep the environment safe and clean. Information on classification and characteristics of solid waste will enable to decide appropriate technology about the collection and transportation of waste produced. Various disposal methods of solid waste will enable to recommend suitable method of disposal of solid waste with economy and acceptable environmental constraints including reuse and recycle wherever applicable. Content on other types of solid waste such as biomedical waste, construction waste, E-waste and plastic waste will be useful in deciding appropriate method for collection, transportation and disposal of these wastes. Thus, the knowledge of solid waste management with the concept like recycling, recovery and reuse will lead to proper disposal with acceptability. This will further lead to keeping the natural resources condemnation free.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Manage the solid waste effectively to maintain the hygienic conditions.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

- Identify the different sources of solid wastes.
- Execute the relevant method of collection and transportation of solid wastes.
- Execute an action plan for disposal of solid wastes.
- Implement the relevant method for disposal of Bio-medical wastes.
- Implement the relevant method for disposal of Industrial wastes and E-waste.
- Implement the relevant laws related to solid waste management.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25#	10	25	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.



Legends: *L*-Lecture; *T* – Tutorial/Teacher Guided Theory Practice; *P* - Practical; *C* – Credit, *ESE* - End Semester Examination; *PA* - Progressive Assessment.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

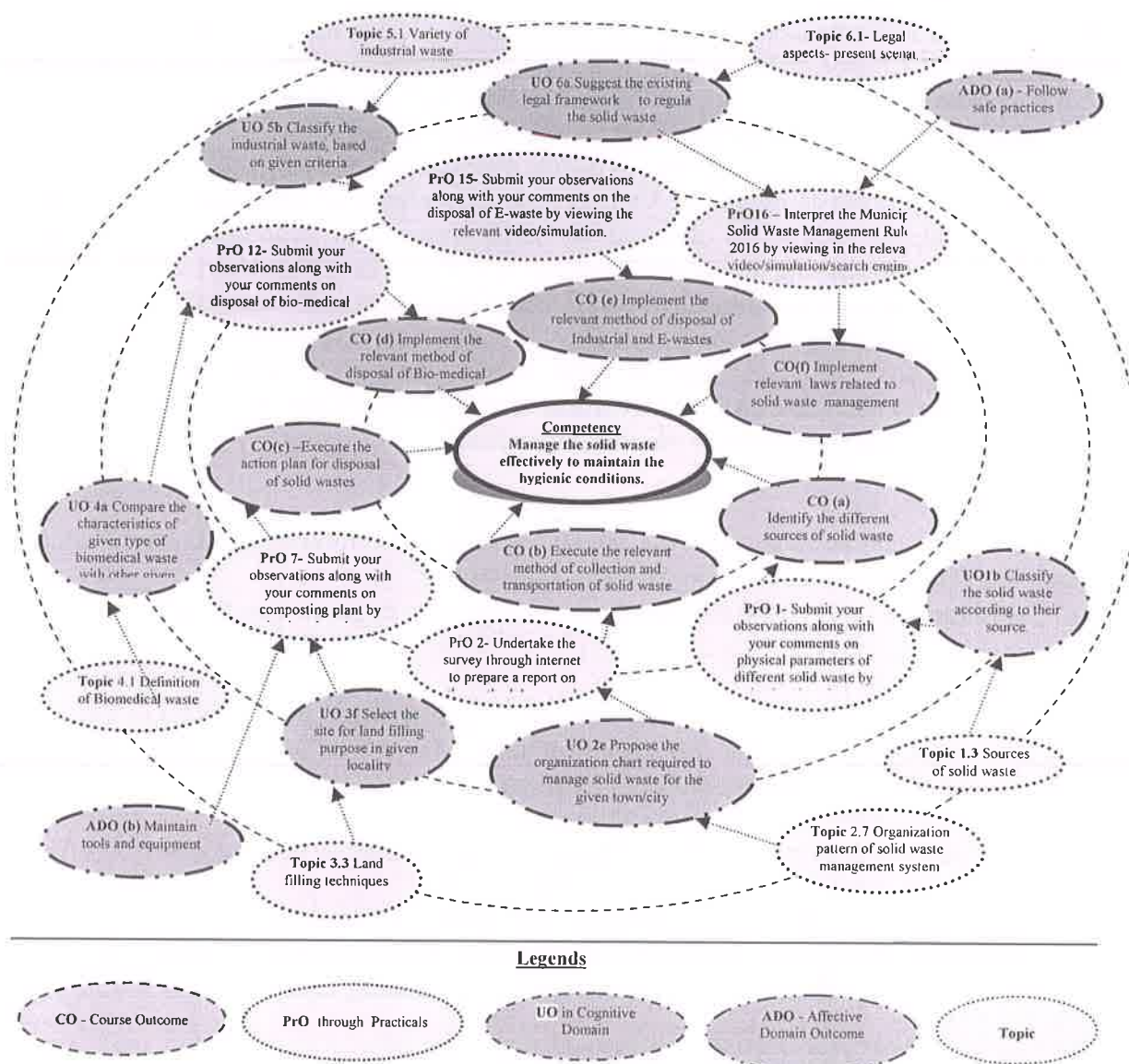


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency:

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Submit your observations along with your comments on physical parameters of different solid waste by viewing the relevant video/simulation/photographs.	I	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
2	Undertake the survey through internet to prepare a report on the methodology used in collection and transportation of Solid waste including equipments, specifications used therein	II	02*
3	View the relevant video/simulation/photographs/print material/non-print material of the operations in transfer station to draw the flow chart for the same.	II	04*
4	Design the organization chart for the agency managing solid waste for a given area with a report on w.r.t. population to be served, pattern, machineries, equipment, manpower used.	II	02*
5	Submit your observations along with your comments on solid waste management techniques by viewing the relevant video/simulation.	II	02
6	Submit your observations along with your comments on solid waste disposal plant by viewing the relevant video/simulation/photographs.	III	04*
7	Submit your observations along with your comments on composting plant by viewing the relevant video/simulation/photographs.	III	04*
8	Submit your observations along with your comments on Bio gas plant by viewing the relevant video/simulation/photographs.	III	04
9	Prepare the specifications of vermin-composting plant for the given type of building with suggested action plan to implement it by viewing the relevant video/simulation/photographs..	III	04*
10	Submit your observations along with your comments on working of vermin-composting plant by viewing the relevant video/simulation.	III	02
11	Submit your observations along with your comments on solid waste management system by landfills techniques by viewing the relevant video/simulation.	III	02
12	Submit your observations along with your comments on disposal of bio-medical waste by viewing the relevant video/simulation.	IV	04*
13	Prepare the specifications for the disposal of bio-medical waste by viewing the relevant video/simulation.	IV	04*
14	Submit your observations along with your comments on the problems of human agencies dealing with solid waste management by viewing the relevant video/simulation.	IV	02
15	Submit your observations along with your comments on the disposal of E-waste by viewing the relevant video/simulation.	V	02
16	Submit your observations along with your comments on the disposal of Industrial waste by viewing the relevant video/simulation.	V	02
17	Compile the relevant provisions Central Pollution Control Board (CPCB) and State Pollution Control Board (SPCB) pertaining to solid waste management by viewing in the relevant video/simulation/search engine..	V	02
16	Interpret the Municipal Solid Waste Management Rules, 2016 by viewing in the relevant video/simulation/search engine..	VI	02*
17	Interpret the Biomedical Waste Management Rules, 2016 by viewing in the relevant video/simulation/search engine.	VI	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
18	Interpret the E- Waste Management Rules, 2016. by viewing in the relevant video/simulation/search engine.	VI	02
19	Interpret the Construction and demolition Waste Management Rules, 2016" by viewing in the relevant video/simulation/search engine.	VI	02
20	Interpret the Hazardous and other waste Management Rules, 2016; by viewing in the relevant video/simulation/search engine.	VI	02
21	Interpret the Plastic Waste Management Rules, 2016 by viewing in the relevant video/simulation/search engine	VI	02
Total			60

Note

- A suggestive list of **PrOs** is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical UOs/tutorials need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Safety measures during visit	20
2	Observations and Recording	30
3	Answer to sample questions	20
4	Submission of report in time	30
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Work as a leader / team member.
- Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year.
- 'Organization Level' in 2nd year.
- 'Characterization Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will be useful in uniformity in conduct of experiments, as well as aid to procure equipment by administrators.



S. No.	Equipment Name with Broad Specifications	PrO. No.
1	Specific Uniform, Helmet, Goggle, Hand Gloves, specific shoes etc.	6-11
2	Use of specific models and charts for explanation regarding solid waste management practices.	6-11
3	Demonstration of specific Documentary, films or animated film related to solid waste management practices	6-11

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit I Fundamentals of solid waste management	1a. Explain the principles of waste reduction in the given condition. 1b. Classify the given solid wastes according to their sources. 1c. Describe the characteristics of the given solid wastes. 1d. Justify the need of solid waste management in the given situation. 1e. Assess the impact of solid waste management on the environment in the given situation. 1f. List the factors generating solid wastes in the given specific area with justification.	1.1 Definition of solid waste 1.2 Meaning of different solid waste – Domestic Waste, commercial waste, industrial waste, market waste, agricultural waste, biomedical waste, E-waste, hazardous waste, institutional waste 1.3 Sources of solid waste, Classification of solid waste – hazardous and non-hazardous waste. 1.4 Physical and chemical characteristics of municipal solid waste. 1.5 Impact of solid waste on environment. 1.6 Solid waste management techniques – solid waste management hierarchy, waste prevention and waste reduction techniques. 1.7 Factors affecting the solid waste generation.
Unit– II Storage, Collection and Transportation of Municipal Solid Waste	2a. Suggest the relevant method of storage of solid waste for the given site conditions with justification. 2b. Explain the relevant method of collecting the solid waste in the given situation. 2c. Implement the relevant techniques for management of solid waste in the given area. 2d. Suggest the relevant transportation system for	2.1 Storage of solid waste 2.2 Collection methods of solid waste 2.3 Tools and Equipment-Litter Bin, Broom, Shovels, Handcarts, Mechanical road sweepers, Community bin - like movable and stationary bin 2.4 Transportation of municipal waste. 2.5 Transportation vehicles with their capacity Working -Animal carts, Auto vehicles, Tractors or Trailers, Trucks, Dumpers, Compactor

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	<p>transporting the municipal solid waste at the given location with justification.</p> <p>2e. Propose the organization chart required to manage solid waste for the given village / town / city of your locality.</p>	<p>vehicles. Transfer station-meaning, necessity, location</p> <p>2.6 Role of rag pickers and their utility for society</p> <p>2.7 Organization pattern of solid waste management system, practices according to Population of the town or city.</p>
Unit- III Disposal of Municipal Solid Waste	<p>3a. Explain the principles of preparing the compost for the given site.</p> <p>3b. List the relevant factors affecting the given composting process with justification.</p> <p>3c. Describe the different steps of executing the relevant method of composting for the given site.</p> <p>3d. Suggest the design criteria adopted in execution of vermicomposting for the given area with justification.</p> <p>3e. Explain the relevant operating method of sanitary land filling for the given site condition and given type of waste.</p> <p>3f. Select the site suitable for the land filling purpose in the given locality with justification.</p> <p>3g. State the relevant parameters to select a site for land filling with justification.</p> <p>3h. Propose the relevant method to control the liquid Leachate generated in the given land filling site.</p> <p>3i. Suggest the relevant situation for disposal of given type of solid waste through incineration process with justification.</p> <p>3j. Select the relevant type of incinerator for the given type of solid waste.</p>	<p>3.1 Concept of composting of waste, Principles of composting process. Factors affecting the composting process</p> <p>3.2 Methods of composting – A) Manual Composting – Bangalore method, Indore Method B) Mechanical Composting – Dano Process C) Vermicomposting.</p> <p>3.3 Land filling technique, Factors to be considered for site selection</p> <ul style="list-style-type: none"> Land filling methods-Area method, Trench method and Ramp method. Leachate and its control, Biogas from landfill Advantages and disadvantages of landfill method Recycling of municipal solid waste <p>3.4 Incineration of waste:</p> <ul style="list-style-type: none"> Introduction of incineration process. Types of incinerators - Flash, Multiple chamber Incinerators, Products of incineration process with their use, Pyrolysis of waste – Definition, Methods <p>3.5 Products of incineration process</p> <ul style="list-style-type: none"> Advantages and disadvantages of incineration process



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit– IV Biomedical Waste management and Health aspects and public Involvement in Solid Waste Management	4a. Compare the characteristics of the given type of biomedical waste with other given type of waste material. 4b. Describe the different sources of generating the given type of biomedical waste in the given locality. 4c. Classify the biomedical waste on the basis of given criteria. 4d. Explain the method of executing the disposal of the given type of biomedical waste in the given area. 4e. Explain the ill effects on the health of humans handling the given type of solid waste in the given area. 4f. Justify the need of public participation in effective implementations of schemes managing the given type of solid waste in the given area.	Biomedical Waste Management 4.1 Definition of Bio medical Waste. 4.2 Sources and generation of Biomedical Waste 4.3 Classification of Biomedical Waste. 4.4 Management technologies. Health aspects and public Involvement in solid waste management 4.4. Health aspects during handling and processing 4.5. Health problems during time of segregation, recovery, recycling and reuse of solid waste. 4.6. Public involvement and participation in solid waste management practices.
Unit –V Industrial waste management and E-waste waste management	5a. Explain the relevant method of disposal of given type of industrial waste. 5b. Classify the industrial waste based on the given criteria. 5c. Describe the process of controlling the generation of Given type of industrial waste at the given site. 5d. Suggest the relevant appliance for the disposal of given type of E-waste with justification 5e. Explain the ill effects of given type of E-waste on the environment of that area. 5f. Suggest the relevant method of recycling and disposal of the given type of E-waste in the given situation.	Industrial waste Management : 5.1. Variety of industrial waste 5.2. Collection and disposal of industrial waste, 5.3. Control measures for industrial waste, 5.4. Recycling of industrial waste. E-waste Management 5.5. Definition of E- waste, Varieties of E- wastes, Dangers of E- waste, 5.6. Recycling of E- waste. 5.7. Disposal of E- waste.
Unit –VI Legal aspects of solid waste management.	6a. Suggest the existing legal framework to regulate the given type of solid waste with justification. 6b. Explain the relevant major provisions of Municipal Solid	Legal Aspects : 6.1. Legal aspects- present scenario 6.2. Municipal Solid Waste Management Rules, 2016 6.3. Biomedical Waste Management Rules, 2016



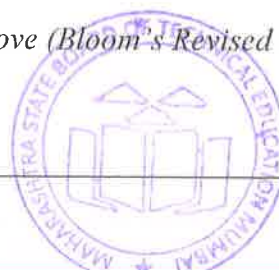
Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	<p>Waste Management Rules, 2016 for disposal of the given type of solid waste.</p> <p>6c. Explain the different major provisions of Biomedical Waste Management Rules, 2016 for managing the given type of bio-medical waste.</p> <p>6d. Compile the major features of Construction and demolition Waste Management Rules, 2016 for the disposal of the given type of waste.</p> <p>6e. Explain the salient features of Hazardous and other wastes Management Rules, 2016 for the disposal of the given type of waste.</p> <p>6f. Explain Role of CPCB (Central Pollution Control Board) and MPCB (Maharashtra Pollution Control Board) in managing the given type of solid waste.</p>	<p>6.4. E- Waste Management Rules, 2016</p> <p>6.5. Construction and demolition Waste Management Rules, 2016</p> <p>6.6. Hazardous and other wastes Management Rules, 2016</p> <p>6.7. Plastic Waste Management Rules, 2016</p> <p>6.8. Role of Central Pollution Control Board and Maharashtra Pollution Control Board in management of solid waste from various sources.</p>

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Fundamental of Solid Waste Management.	04	02	04	---	06
II	Storage, Collection and Transportation of Municipal Solid Waste	10	04	04	06	14
III	Disposal of Municipal Solid Waste	14	02	06	08	16
IV	Biomedical Waste Management and Health Aspects and Public Involvement in Solid Waste Management.	08	04	04	06	14
V	Industrial waste management and E- Waste Management	08	04	04	06	14
VI	Legal aspects of Solid Waste Management.	04	02	04	--	06
Total		48	18	26	26	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)



Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- a) Preparation of charts showing solid waste management techniques.
- b) Preparation of charts showing tools, equipment, vehicles and machineries used in solid waste management practices.
- c) Preparation of compost using decomposable waste material at home adopting appropriate method.
- d) Preparation of compost using decomposable waste material at the institute adopting appropriate method..
- e) Preparation of vermicompost using decomposable waste material and worms at home.
- f) Preparation of vermicompost using decomposable waste material and worms at institute.
- g) Recycling of plastic wastes obtained from various sources and study the machineries and outcome product.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

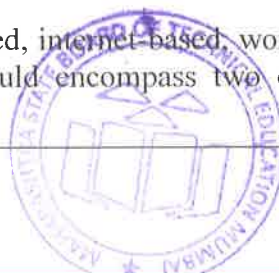
These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- a) Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- b) '**L**' in **item No. 4** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c) About **15-20% of the topics/sub-topics**, which is relatively simpler or descriptive in nature, is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d) With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- e) Guide student(s) in undertaking micro-projects.
- f) Arrange visit to nearby newly started site for understanding various solid waste management practices.
- g) Show video/animation films to explain various instruments used in solid waste management practices.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project is group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he can contribute to the projects of the industry or society in future. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs



which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the micro-project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project report by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

- a) Carry out comparative study of vehicles used for collection of solid wastes from various sources.
- b) Collect the relevant technical and commercial information of tools, equipment, vehicles and machineries used for collection, segregation, transportation, processing and disposal of solid waste with specifications
- c) Preparation of report about route used for collection and transportation of solid waste of the city and optimization of it.
- d) Preparation of report regarding solid waste management practices adopted in the campus of the institute
- e) Writing a report on case studies for solid waste management practices of specific cities
- f) of the country.
- g) Writing a detailed report on legal aspects about Municipal Solid Waste Management
- h) Rules, 2016
- i) Writing a detailed report on legal aspects about Biomedical Waste Management Rules,
- j) 2016
- k) Writing a detailed report on legal aspects about E- Waste Management Rules, 2016
- l) Writing a detailed report on legal aspects about Construction and demolition Waste Management Rules, 2016
- m) Writing a detailed report on legal aspects about Hazardous and other wastes
- n) Management Rules, 2016
- o) Writing a detailed report on legal aspects about Plastic Waste Management Rules, 2016
- p) Develop a specific model regarding solid waste management practices.
- q) Preparation of models concerned with solid waste management practices like incineration, pyrolysis etc.
- r) Preparation of charts, PPT presentation concerned with solid waste management practices
- s) Creation of awareness about good habits of scientific; better solid waste management practices
- t) Any other suitable topic for various solid waste management practices in the area, town, city or country as a whole

13. SUGGESTED LEARNING RESOURCES

S. No	Title	Author	Publisher
1	Solid Waste Management	Bhide A. D.	Indian National Scientific Documentation Centre, New Delhi Edition 1983 ASIN: B0018MZ0C2
2	Solid Waste	Techobanoglous George; Kreith, Frank	McGraw Hill Publication, New Delhi 2002, ISBN 9780071356237
3	Environmental Studies	Manjunath D. L.	Pearson Education Publication, New Delhi, 2006 ISBN-13: 978-8131709122

4	Solid Waste Management	Sasikumar K.	PHI learning, New Delhi, 2009 ISBN 8120338693
5	Environmental Pollution	Khopkar S. M.	New Age International limited, Delhi, 2007, ISBN 8122415075
6	Environmental Studies	Basak Anindita	Pearson Publication, Delhi, 2009 ISBN : 8131785688, 9788131785683
7	Environmental Pollution Control Engineering	Rao C. S.	New Age International, 2006, New Delhi, ISBN-13: 978-8122418354
8	Prospect and Perspectives of Solid Waste Management	Hosetti B. B.	New Age International Publisher, 2006 New Delhi, ISBN-13: 978- 8122417777

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

- a) www.hsagolden.com
- b) www.almitrapatel.com
- c) www.yousee.in
- d) www.skgsangha.org
- e) www.epa.gov/epaoswer/non-hw/municipal/index.htm
- f) En.wikipedia.org/waste-management



Program Name : Civil Engineering Program Group
Program Code : CE/CR/CS
Semester : Sixth
Course Title : Earthquake Resistant Buildings (Elective-II)
Course Code : 22606

1. RATIONALE

This course is the specialized subject for Civil Engineering. The students having interest in structural engineering and perceive career in this field have a better option to choose this course. Earthquake is a natural disaster phenomenon which could not be denied, but its impact on the structure can be reduced by proper analysis and design of buildings to minimize loss of properties and lives. In recent past, a major part of the peninsular India experienced earthquakes periodically; therefore study of earthquake engineering is introduced in the curriculum of sixth semester civil engineering diploma students.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Execute construction of earthquake resistant buildings using relevant IS code provisions.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Execute the principles of earthquake resistant buildings in the constructions.
- Relate the failure in the structures on the basis of the intensity of damage.
- Select the relevant shape of building for seismic sustainability of structures.
- Execute the relevant method of removal of defect in structures causing failure.
- Execute the relevant provisions of IS code in construction of earthquake resistant buildings.
- Execute the post-earthquake management system.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25#	10	25	10	50	20

(*): Under the theory PA; Out of 30 marks, 10 marks of theory PA are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)



This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

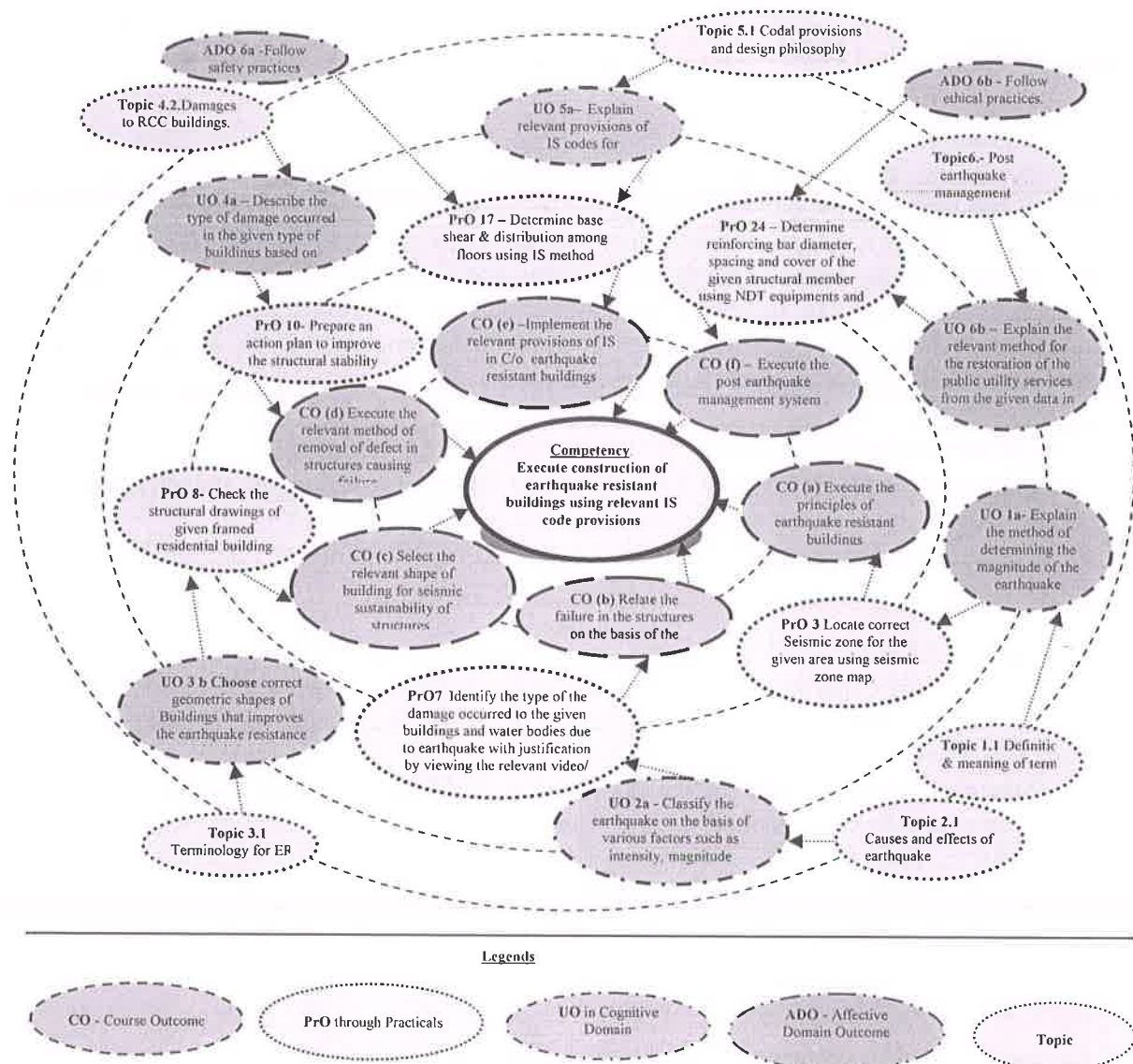


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Interpret the past earthquake having magnitude less than 6 (richter scale) through internet survey and submit your report including sketches/photos wherever necessary.	I	02*
2	Relate magnitude of the earthquake occurred in the given area to the severity of the damages by viewing the relevant video/ simulation/ photographs and Submit your observations along with your comments.	I	

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
3	Locate correct Seismic zone for the given area using seismic zone map.	I	
4	Interpret the past earthquake having magnitude more than 6 (richter scale) through internet survey and submit your report including sketches/photos wherever necessary.	I	02
5	Mark various seismic zones on a printed map of India with earthquake magnitude as per the guidelines provided in IS: 1893-2002 to list four cities in India in each earthquake zone.	I	02*
6	Interpret the damages to the masonry and concrete structures from the relevant information of any two past earthquakes from India w.r.t.type of structures, zones, site conditions, type of failures etc.	II	02*
7	Identify the type of the damage occurred to the given buildings and water bodies due to earthquake with justification by viewing the relevant video/ simulation/ photographs and Submit your observations along with your comments..	II	02
8	Check the structural drawings of the given framed residential building for seismic vulnerability for the given seismic zone	III	02*
9	Check the structural drawings of the given framed public building for seismic vulnerability for the given seismic zone	III	02
10	Prepare an action plan to improve the structural stability of the given structure against earthquake.	IV	02
11	Draw the sketches of the given method of retrofitting for improving seismic resistance of existing framed building with a report on its procedure including other methods of retrofitting.	IV	02
12	Determine strength of any two given structural members of framed building using rebound hammer and comment on its seismic stability	IV	02*
13	Classify damages occurred in the given buildings based on earthquake intensity in the given seismic zone by viewing the relevant video/ simulation/ photographs and Submit your observations along with your comments..	IV	02
14	Identify the failure pattern observed in the building failure occurred due to earthquake in the given seismic zone by viewing the relevant video/ simulation/ photographs and Submit your observations along with your comments.	IV	02
15	Check the stability of the given two members of framed building using ultrasonic pulse velocity and comment on its seismic stability.	IV	02
16	Determine compressive strength of the given member of framed structure by taking core from cubes or from existing concrete structures and comment on its seismic stability.	IV	02
17	Determine base shear and distribution among floors using IS method for two bay single storey RCC building.	V	02*
18	Calculate base shear and distribution among floors using any ETAB software for two bay single storey RCC building.	V	02
19	Calculate base shear and distribution among floors using Indian Standard method for three storied RCC building.	V	02
20	Calculate base shear and distribution among floors using software for single bay three storey RCC building.	V	02
21	Draw typical sketches of beam, column and beam-column joint	V	02*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	showing reinforcement details as per I.S. 13920-1993.		
22	Draw the sketches to represents the methods to strengthen steel structure with roof truss against earthquake damages with a brief note on it.	VI	02
23	Draw the sketches to represents the methods to strengthen steel structure with gable frame against earthquake damages with a brief note on it.	VI	02
24	Determine reinforcing bar diameter, spacing and cover of the given structural member using NDT equipments and comment on ductile detailing requirement.	VI	02
25	Submit your observations along with your comments on case study of an earthquakes occurred in India by viewing the relevant video/simulation/photographs.	VI	02*
26	Carryout the earthquake simulation for the given type of building structure using software STADDPRO/E-TABS/ABAQUS/ SAP	VI	02
	Total		48

Note

- A suggestive list of **PrOs** is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical UOs/tutorials need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Interpretation of data and its presentation.	10
2	Selection of case studies/ collection of data and its relevance/process followed in analysis, estimate, drawing and interpretation	30
3	Precision in drawing sketches /data collection/ presentation, neatness, cleanliness, relevance with COs	30
4	Individual work and working in groups	20
5	Submission of assigned work in time	10
	Total	100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Work as a leader/a team member.
- Follow ethical Practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs

according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year.
- 'Organization Level' in 2nd year.
- 'Characterization Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by administrators.

S. No.	Equipment Name with Broad Specifications	PrOs. S. No.
1	Concrete core cutter	10
2	Rebound Hammer	8
3	Ultrasonic Pulse Velocity Equipment	9
4	Compression Testing Machine, capacity minimum 2000 kN.	10
5	Any design related software such as STAAD Pro/ STRUDS etc.	14

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs in cognitive domain for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Basics of earthquake phenomena	1a. Explain the method of determining the magnitude of the earthquake occurred in the given type of structure in the specified seismic zone. 1b. Classify seismic waves on the basis of given criteria in the given situation. 1c. Select the relevant Seismic zone for the given area using seismic zone map. 1d. Describe the different safety measures required to minimize the damage in the given zone. 1e. Explain the procedure to increase resistance against earthquake of the given building in the given seismic zone.	1.1 Definition and meaning of terms: Focus, Epicenter, Focal depth, foreshocks, aftershocks, magnitude and intensity of Earthquake. Seismic waves, Body waves. 1.2 Natural period, fundamental natural period, nodal natural period, response spectrum, seismic mass, seismic weight, structural response factor, time history analysis, earthquake zones, zone map, zero period acceleration. 1.3 Measurement of earthquake shaking and it's working principle, Richter scale. 1.4 Guidelines for Earthquake preparedness: Individual, Home and community planning.
Unit– II Causes and effects of earthquake	2a. Classify the earthquake on the basis of given criteria. 2b. Explain the procedure of formation of the earth and movement of tectonic plates for the given earthquake zone. 2c. Explain the elastic rebound theory method of determining the	2.1 Causes and effects of earthquake 2.2 Formation of earth and its cores. Formation, types and movement of tectonic plates, Elastic rebound theory, Types of earthquake and Faults. 2.3 Ground shaking, Ground failure,

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	<p>intensity of earthquake occurred in the specified zone.</p> <p>2d Compare the given type of failure of building with another type of failure occurred due to earthquakes in the specified zone based on the given criteria.</p>	Tsunami and fire.
Unit III- Planning and design aspects	<p>3a. Establish relationship between mass centers, stiffness from the given data.</p> <p>3b. Choose correct geometric shapes of the given Buildings to improve its resistance against earthquake with justification.</p> <p>3c. Select the most relevant site for constructing earthquake resistant building on the basis of the given data of soil strata with justification.</p> <p>3d. Justify significance of seismic base shear in the design of the given earthquake resistant building in the given zone.</p> <p>3e. Explain the effect of given geometric shape on the damages due to earthquake for the given zone.</p>	<p>3.1 Terminology for Earthquake resistant Building - Base, base dimensions, centre of mass, centre of stiffness, design eccentricity, design seismic base shear (V_b), diaphragm, storey drift, storey shear, weak storey</p> <p>3.2 Plan of Building- symmetry, regularity, separation of blocks, simplicity, enclosed area, separate building for different functions, soft storey effect</p> <p>3.3 Choice of site- Stability of slopes, loose sand</p>
Unit –IV Concrete and masonry buildings	<p>4a. Describe the type of damage occurred in the given type of buildings based on earthquake intensity in the given seismic zone.</p> <p>4b. Explain the causes of the failure observed in the given type of the building from the given seismic zone.</p> <p>4c. Correlate damage of building for the given type of masonry building for the given data.</p> <p>4d. Compare the types of damages before and after earthquake with reference to the given data.</p>	<p>4.1 Typical damage and failure patterns of brick masonry, causes of damages in brick masonry.</p> <p>4.2 Damage to RCC buildings: Sliding of roof support, falling of infill walls, crushing of column ends, diagonal cracking of column beam joints, pulling out of reinforcement bars, foundation sinking and tilting.</p> <p>4.3 Typical damage and failure of stone masonry, causes of damages in stone masonry</p>
Unit –V Codal provisions and design philosophy	<p>5a. Explain the relevant provisions of IS codes for construction of earthquake resistant building for the given seismic zone.</p> <p>5b. Check reinforcement requirements for the given structural element from the given data as per IS:13920-1993.</p> <p>5c. Explain the relevant method of calculating the base shear for the</p>	<p>5.1 Codal Provision and Design Philosophy :</p> <p>5.2 IS: 1893 (part I)-2002: General provisions and principles for design of earthquake resistant buildings: Definition of seismic zone factor, Importance factor, damping, critical damping, floor spectra, seismic mass, seismic weight, meaning of soft storey,</p>

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	<p>given building frames as per relevant IS provision.</p> <p>5d. Explain the provisions of IS: 4326:1993 to improve seismic behavior of masonry buildings in the given seismic zone.</p> <p>5e. Integrate the relevant provisions of IS: 13920 in design of earthquake resistant building to be constructed in the given seismic zone.</p>	<p>storey drift, assumptions in earthquake resistant design of structure.(No numerical)</p> <p>5.3 IS:13920-1993 Ductile detailing, meaning of ductility, need of ductility in concrete structure, critical sections in the building where ductile detailing is required, typical sketches with reinforcement details of columns, beams and beam column connections showing longitudinal steel , splicing of steel, transverse steel, stirrups as per IS:13920. (No numerical)</p> <p>5.4 Determination of design base shear using equivalent static lateral force method, distribution of design base shear.</p> <p>5.5 IS:4326:1993 Recommended provisions to improve seismic resistance of buildings earthquake resistance of masonry buildings: mortar, wall enclosure, openings in walls, masonry bond, horizontal bands, section of bands, dowels at corners and junctions, vertical reinforcement in walls</p>
Unit –VI Post-earthquake management	<p>6a. Suggest action plan required to handle the earthquake of building in the given area with justification.</p> <p>6b. Explain the relevant method for the restoration of the public utility services from the given data in the given area after earthquake.</p> <p>6c. Explain the process of executing the plan for restoration of the given public utility services in the given area/zone.</p> <p>6d. Suggest with justification the precautions to be taken in design and construction of earthquake affected zone.</p>	<p>6.1 Post-earthquake handling of building, Lifelines, Roads, Bridges, communication systems, electricity, water distribution systems</p> <p>6.2 Learning from Prominent past earthquakes in India such as Koyna, Killari(Latur), Jabalpur, Bhuj.</p>

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.



9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Basics of Earthquake Phenomenon	06	02	04	04	10
II	Causes and Effects of Earthquake	08	02	04	06	12
III	Planning and Design Aspects	08	02	04	06	12
IV	Concrete and Masonry Buildings	08	02	04	06	12
V	Codal Provisions and Design Philosophy	10	04	04	08	16
VI	Post-Earthquake Management	08	02	00	06	08
Total		48	14	20	36	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare journals based on practical performed in laboratory/data collection/case studies.
- Give seminar on relevant topic.
- Undertake micro-projects.
- Study any two case studies of past earthquake in Maharashtra.
- Study any two case studies of past earthquakes in India
- Study any two case studies of past earthquakes in World
- Study of minimum earthquake related to magnitude, intensity, epicenter and damages caused.
- Study of tsunami after earthquake.
- Indian standard provisions for earthquake resistant structures for your regions.
- Behavior of old masonry structures during earthquake.
- Effect of earthquakes on reservoirs/dams.
- Behavior of steel structures during earthquake.
- Effect of earthquakes on liquefaction of soils during earthquake.
- Behavior of buildings with open parking during earthquake.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- 'L' in item No. 4** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the

- development of the COs through classroom presentations (see implementation guideline for details).
- d) With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
 - e) Guide student(s) in undertaking micro-projects.
 - f) Demonstrate students thoroughly before they start doing the practice.
 - g) Encourage students to refer different websites to have deeper understanding of the subject.
 - h) Observe continuously and monitor the performance of students in Lab.
 - i) Demonstrate students thoroughly before they start doing the practice.
 - j) Encourage students to refer different websites to have deeper understanding of the subject.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be *individually* undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

- a) Write 5 to 6 page report with sketches and photographs on case study of any one earthquake occurred in India in past covering following: focal length, focus, intensity, magnitude, natural period, damages occurred in terms of property and lives with reasons, pre earthquake preparation of local administration and post-earthquake handling of situation, lesson learned and corrective measures taken for future.
- b) Visit a site of earthquake resistant building construction and prepare a report based on building foundation and RCC work with detailed sketches (only sample members be taken).
- c) Visit structural designer's office and collect data about ductile detailing of any one structure in progress.
- d) Carry out market survey and collect data of new building materials more suitable for earthquake resistant construction.
- e) Visit web site of prominent institutes (IIT Kanpur) having research and development cell on earthquake engineering and prepare a report.
- f) Visit seismic data analysis and measurement centre of Government of Maharashtra for your district and prepare a report.
- g) Collect data of any three non-destructive equipments and prepare a report giving technical specifications, make, cost, nature of test, degree of accuracy of results etc.
- h) Study effect of pure parking space at ground floor without bracing of walls.



13. SUGGESTED LEARNING RESOURCES :

S. No.	Title of Book	Author	Publication
1	Earthquake Resistant Design of Structures	Agarwal, Pankaj Shrikhande, Manish	PHI Learning, Delhi, 2011 ASIN: B00K7YFYVE ISBN-13 9788120328921
2	Elements of Earthquake Engineering	Jai Krishna, A. R. Chandrashekharan Chandra, B.	South Asian Publishers Pvt Ltd, Delhi, 2014, ISBN13 9788180142192
3	Earthquake Resistant Design of Structures	Duggal, S. K.	Oxford University Press, Delhi, 2013 ISBN-13 9780198083528

I.S. Codes:

- 4 IS 1893(Part I):2002 ,Indian Standard Criteria for Earthquake Resistant Design of Structures- General Provisions and Buildings , BIS, New Delhi.
- 5 IS 13920:1993 Ductile Detailing of Reinforced Concrete Structures subjected to Seismic forces-Code of Practice, BIS, New Delhi.
- 6 IS 456:2000 - Plain and Reinforced concrete code of Practice
- 7 I.S. 875 (Part 1-5) - 1987 code of practice of design loads for Buildings and structures
- 8 IS 13935- Repair and seismic strengthening of building: Guidelines
- 9 IS 4326-1993 Earthquake resistant design and construction of buildings
- 10 IITK-BMTPC Earthquake Tips- IIT Kanpur
- 11 A CD on Earthquake Engineering- An ICJ Compilation

14. SOFTWARE/LEARNING WEBSITES

- a) www.nptel.ac.in
- b) <https://youtu.be/uBMqJMXhs4M>
- c) https://youtu.be/n0_LNyfQTJg
- d) https://youtu.be/DR_PQyYMaA0
- e) www.tn.gov.in/tsunami/digitallibrary/ebooks
- f) <https://www.nicee.org/EQTips.php>



Program Name : Civil Engineering Program Group
Program Code : CE/CR/CS
Semester : Sixth
Course Title : Advanced Design of Structures (Elective-II)
Course Code : 22607

1. RATIONALE

A Civil Engineering technologist needs to understand the behaviour of various structural components for developing insight for the design concept. Advanced Design of Structures is the core subject for the Civil Engineering which comprises of knowhow of Analysis and Design concept of Steel and Reinforced Concrete structures. For the design of steel components, the properties of steel, available sections, grades and strength characteristics are used along with IS: 800-2007. In the design of RCC structures Limit State Method is to be used as per IS: 456-2000 for analysis and design and IS: 875-1987 is to be used for Loading Standards.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Design Steel and RCC structural components using relevant software.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following **industry oriented** COs associated with the above mentioned competency:

- Design the steel tension members under different loading conditions.
- Design the steel compression members under different loading conditions.
- Design the doubly-reinforced rectangular RCC beams under different loading conditions.
- Design the Flanged RCC beams under different loading conditions.
- Design waist slabs of RCC dog legged staircase.
- Design the circular columns and the isolated RCC rectangular column footings.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme													
L	T	P		Theory								Practical					
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
3	-	2	5	4	70	28	30*	00	100	40	25#	10	25	10	50	20	

(*): Under the theory PA; Out of 30 marks, 10 marks of theory PA are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)



This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

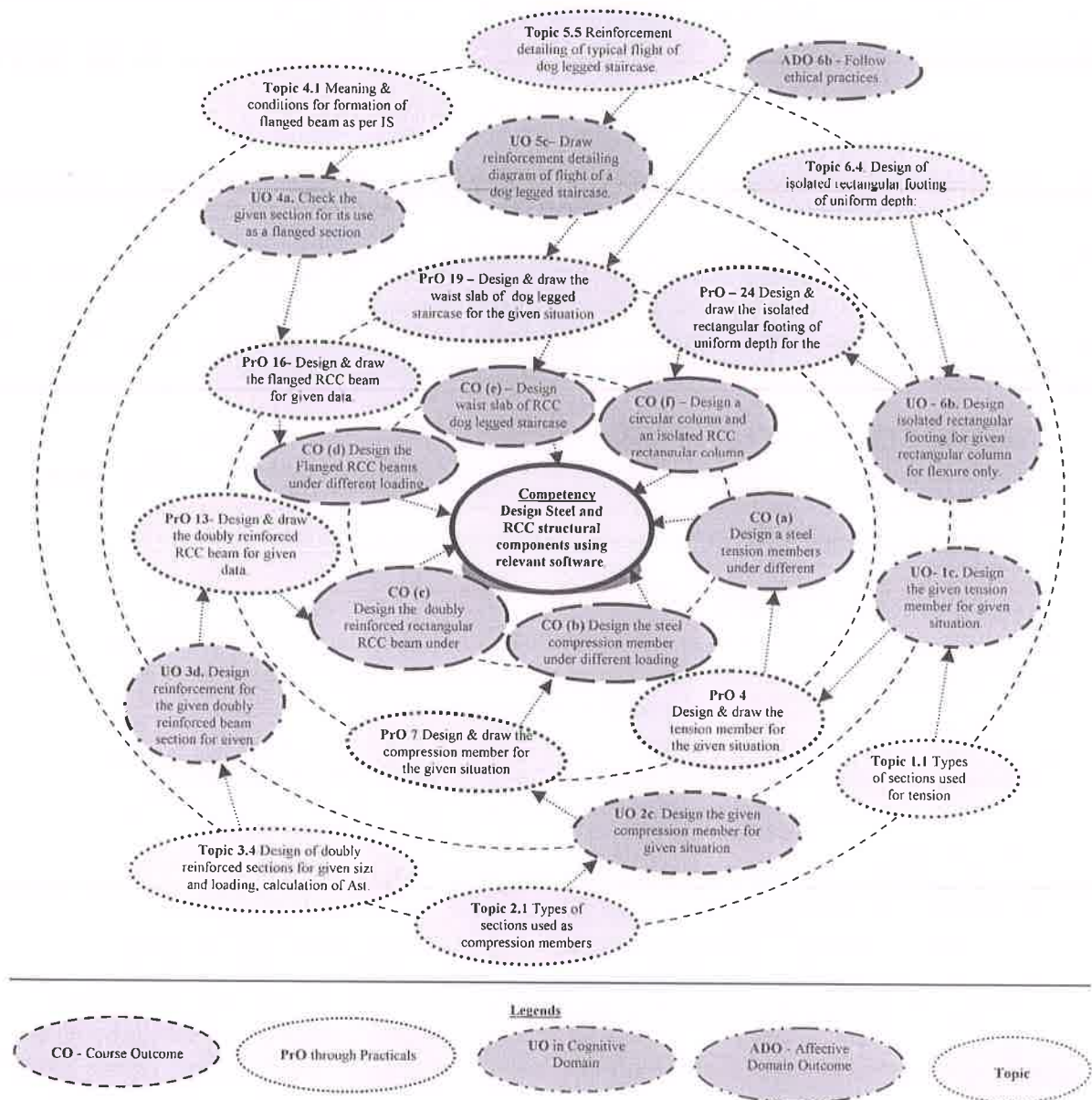


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Draw labeled sketches of five given rolled steel sections and built up sections..	I	2
2	Write the provisions of IS 800-2007 required for the design of the given tension member.	I	2
3	Determine the load carrying capacity of the given tension member for the given situation.	I	2

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
4	Design and draw a tension member for the given situation.	I	2*
5	Compile relevant clauses from IS 800-2007 required for the design of a compression member and submit it in report form.	II	2
6	Determine the effective length of the given compression member for various configurations under different end conditions with neat sketches using the relevant software.	II	2
7	Design and draw a compression member for the given situation using the relevant software.	II	2*
8	Determine the load carrying capacity of compression member for the given situation using the relevant software..	II	2
9	Draw sketches for single & double lacing of given built up columns.	II	2
10	Draw sketches for battening of given built up columns.	II	2
11	Write the provisions of IS800-2007 pertaining to design of lacing and battening along with its significance by viewing the relevant video/simulation	II	2
12	Draw cross section, strain diagram and stress diagram for doubly reinforced section by viewing the relevant software.	III	2
13	Design and draw a doubly reinforced RCC beam for given data using relevant software.	III	2*
14	Draw reinforcement details of the doubly reinforced RCC beam designed in PrO No. 13.	III	2#
15	Draw stress diagrams for Flanged sections for all cases of Neutral axis.	IV	2
16	Design and draw a flanged RCC beam for given data using relevant software..	IV	2*
17	Draw reinforcement details of the flanged RCC beam designed in PrO No 16.	IV	2#
18	Draw the neat sketches of the different staircases used in your institute building mentioning its type, tread, rise, thickness of waist slab.	V	2
19	Design and draw the waist slab of dog legged staircase for the given data using relevant software.	V	2*
20	Draw reinforcement details of waist slab for typical flight of a dog legged staircase designed in PrO No 19.	V	2*#
21	Design and draw a circular column with spiral ties for the given situation using relevant software.	VI	2
22	Draw sketches of different types of column footings.	VI	2
23	Write procedural steps for design of a rectangular RCC footing from the given data as per the relevant IS code.	VI	2
24	Design and draw the isolated rectangular footing of uniform depth for the given situation using relevant software.	VI	2*
25	Draw reinforcement details of the isolated rectangular footing designed in PrO No 24.	VI	2#
26	Interpret the given RCC Structural Drawings with reference to reinforcement details of various structural elements.	III to VI	2*
27	Prepare a checklist for reinforcement provided from the given drawings for various structural elements.	III to VI	2

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
28	Show the reinforcement detailing of structural elements like beams, columns, staircase and footing of the given structure.	III to VI	2*
29	Draw the sketches of given rolled steel tension & compression members provided in the given structures.	I and II	2
	Total		58

Note

- A suggestive list of **PrOs** is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical LOs/tutorials need to be performed, out of which, the practicals marked as '*' are compulsory, and marked as '#' indicates use of auto CAD software for drawing so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Interpretation of given data and its presentation.	10
2	Selection of sketches /Process of designing of the given structural components using relevant I.S. Codes /writing of visit report.	30
3	Precision in sketch book, sheets and report and its neatness, cleanliness.	30
4	Individual work and working in groups	20
5	Submission of assigned work in time	10
	Total	100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Work as a leader/a team member.
- Follow ethical Practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year.
- 'Organization Level' in 2nd year.
- 'Characterization Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by administrators.



S. No.	Equipment Name with Broad Specifications	PrO. S. No.
1	Computers	14, 17, 20 and 25.
2	Printers	14, 17, 20 and 25.
3	Available CAD software	14, 17, 20 and 25.

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs in cognitive domain for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Design of Steel Tension Members (Limit State Method).	1a. Suggest the type of the steel sections from the given data that can be used as tension member in the given structure with justification. 1b. Explain the method of computing the capacity of the given tension member for given end connection. 1c. Design the given tension member for the given situation from the specified data.	1.1 Types of sections used for Tension members. 1.2 Strength of tension member governed by yielding of section, rupture of net cross-section and block shear. 1.3 Design of axially loaded single angle and double angle tension members with bolted and welded connections.
Unit– II Design of Steel Compression Members (Limit State Method).	2a Suggest the type of the given steel sections that can be used as a compression member with justification. 2b Explain the method of computing the capacity of the given compression member for given end conditions. 2c Design the given compression member for the specified situation from the given data. 2d Explain with sketches the single and double lacing system for the given built up columns of the specified structure. 2e Explain with sketch the battening system for the given built up columns of the given structure.	2.1 Types of sections used as compression member. Calculation of effective length, radius of gyration and slenderness ratio. Permissible values of slenderness ratio as per IS 800. Design compressive stress. 2.2 Strength of axially loaded single and double angle struts connected by bolted and welded connections with gusset plate only. Limits of width to thickness ratios to prevent local buckling. 2.3 Design of axially loaded single angle and double angle compression members with bolted and welded connections. 2.4 Introduction to built up sections, lacing and battening (Meaning and purpose). Diagrams of single and double lacing and battening system. (No numerical problems)
Unit III- Analysis and Design of Doubly Reinforced Rectangular Concrete Sections by	3a Check the given section for its use as doubly or singly reinforced section from the given data. 3b Calculate the Young's modulus for the given parameters of the specified doubly reinforced beam. 3c Describe the method of determining ultimate moment of resistance of	3.1 Meaning and conditions for providing doubly reinforced sections. 3.2 Stress in steel (f_{sc}) for different values of d'/d ratio. 3.3 Analysis of doubly reinforced sections, strain and stress diagrams, numerical problems on ultimate

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Limit State Method.	doubly reinforced beam from the given data. 3d Design reinforcement for the given doubly reinforced beam section for the specified conditions.	moment of resistance of a doubly reinforced beam. 3.4 Design of doubly reinforced sections for given size and loading, calculation of A_{st} and A_{sc} only.
Unit –IV Analysis and Design of Flanged Concrete Beams by Limit State Method	4a. Determine the reinforcement for the specified section for its use as a flanged section from the given data. 4b. Explain the procedure of calculating the effective flange width of the specified flanged beam under given situation. 4c. Explain the method of computing ultimate moment of resistance of the given flanged section. 4d. Calculate A_{st} required for the specified flanged beam for case of neutral axis lying in the flange from the given data.	4.1 Meaning and conditions for formation of flanged (T and L) beams as per IS 456:2000, comparison with rectangular beams, effective width of flange. 4.2 Analysis of singly reinforced flanged beams having neutral axis in flange or web. Determination of Moment of Resistance. 4.3 Determination of reinforcement in a singly reinforced flanged beam for the given dimensions. (Neutral axis lies in flange only).
Unit –V Design of RCC Staircase Slab by Limit State Method.	5a. Explain the procedure to calculate different loads on the waist slab of the given dog legged staircase from the given data. 5b. Design the waist slab of the given dog legged staircase from the given data. 5c. Draw reinforcement detailing diagram for the flight from the given data of the given dog legged staircase. 5d. Describe the method of determining the live load for the given type of the building.	5.1 Various clauses in IS456-2000 regarding effective span and load calculation for typical flight of a dog legged staircase. 5.2 Live load on staircase of different types of buildings such as residential, office, commercial, public, factory etc. 5.3 Load calculation for a typical flight of a dog legged staircase with load distribution on landing slab as per IS 456-2000. 5.4 Design of waist slab of a dog legged staircase for given rise, tread, width, and number of steps, with supporting beams at the ends of flight, parallel to steps. 5.5 Reinforcement detailing of typical flight of dog legged staircase.
Unit –VI Design of RCC Circular Column and Rectangular Footing by Limit State Method	6a. Design the given axially loaded short circular column with spiral ties for the given data. 6b. Design the given isolated rectangular footing for given rectangular column for flexure from the given data. 6c. Draw the reinforcement detailing for the specified type of footing from the given data. 6d. Describe the method of determining the load on the given axially loaded short column of the specified structure.	6.1 Introduction to rectangular and circular columns and related codal provisions in IS 456-2000. 6.2 Procedure and numerical problems on design of axially loaded short circular columns with lateral and spiral ties. 6.3 Procedure and numerical problems on design of axially loaded short rectangular and circular columns with lateral and spiral ties 6.4 Introduction to various types of RCC footings like isolated, stepped and sloped footings,

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		combined footings, piles, raft, eccentric footing. 6.5 Design of isolated rectangular footing of uniform depth. Flexural design with checks for one-way shear, two-way shear and bond.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Design of Steel Tension Members (by Limit State Method)	08	2	4	6	12
II	Design of Steel Compression Members (by Limit State Method)	10	2	6	6	14
III	Analysis and Design of Doubly Reinforced Rectangular Concrete Sections by Limit State Method.	08	0	6	6	12
IV	Analysis and Design of Flanged Concrete Beams by Limit State Method.	08	2	4	6	12
V	Design of RCC Staircase Slab by Limit State Method.	06	0	2	6	08
VI	Design of RCC Circular Column and Rectangular Footing by Limit State Method	08	2	4	6	12
Total		48	8	26	36	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare journals based on practical performed in laboratory.
- Give seminar on relevant topic.
- Undertake micro-projects.



11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- a) Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- b) '**L**' in **item No. 4** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c) About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d) With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- e) Guide student(s) in undertaking micro-projects.
- f) Demonstrate students thoroughly before they start doing the practice.
- g) Encourage students to refer different websites to have deeper understanding of the subject.
- h) Observe continuously and monitor the performance of students in Lab.
- i) Demonstrate students thoroughly before they start doing the practice.
- j) Encourage students to refer different websites to have deeper understanding of the subject.

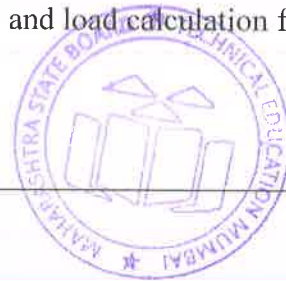
12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

- a) Collect the information of various types steel sections used in actual practice.
- b) Prepare a report on any structural software used for analysis/design of steel structure.
- c) Prepare a report on any structural software used for analysis/design of RCC structure.
- d) Prepare an excel program for analysis of steel tension member.
- e) Prepare an excel program for analysis of steel compression member.
- f) Prepare a chart showing capacity of various angle struts for different slenderness ratio.
- g) Procure actual working drawing / blue print of structural design and write report after checking actual reinforcement placed at site.
- h) Prepare an excel program for analysis of doubly reinforced RCC beam.
- i) Prepare an excel program for analysis of flanged RCC beam.
- j) Prepare a video report/ recording of actual placement of reinforcement on site.
- k) Collect data from IS 456-2000 regarding effective span and load calculation for typical flight of a dog legged staircase.



13. SUGGESTED LEARNING RESOURCES :

S. No.	Title of Book	Author	Publication
1	Design of Steel Structures	Dayarathnam, P.	S. Chand and Company, Delhi, 2012 ISBN-13: 978-8121923200
2	Design of Steel Structures	Sairam, K.S.	Pearson Publication, Delhi, 2015 ISBN-13: 9332516308
3	Fundamentals of Reinforced Concrete	Sinha N.C. Roy S.K.	S. Chand and Co., New Delhi, 2007. ISBN-13: 978-8121901277
4	Reinforced Concrete Design Principles and Practice	Krishna Raju, N.Praneesh, R.N.	New Age International, Mumbai, 2018 ISBN-13: 9788122414608
5	Reinforced concrete Design	Pillai, S.U. Menon, Devdas	McGraw Hill Publications, New Delhi, 2017; ISBN: 978-0070141100
6	Limit State Design of Reinforced Concrete	Varghese, P. C.	PHI Learning Private Limited, Delhi, 2008, ISBN: 978-8120320390

I.S. Codes:

- 1 IS 800-2007 Indian Standard code of practice for use of structural steel in general building construction , BIS New Delhi.
- 2 IS-875-1987 Part-1 to 5: Indian Standard Code for Loading Standards.
- 3 IS hand book No. 1 Properties of structural steel rolled section.
- 4 Steel tables
- 5 IS 456:2000 - Plain and Reinforced concrete code of Practice
- 6 SP16- Design Aids for reinforced concrete to IS 456
- 7 I.S. 875 (Part 1-5) - 1987 code of practice of design loads for Buildings and structures.
- 8 SP 24 - Explanatory Handbook on IS 456
- 9 SP34: 1987 - Handbook on concrete reinforcement and Detailing.

14. SOFTWARE/LEARNING WEBSITES

- a) <https://www.youtube.com/watch?v=mtRR-5fzKo8>
- b) <https://www.youtube.com/watch?v=X8WhkG70tAc>
- c) <https://www.youtube.com/watch?v=-JMNMIg-CE>
- d) freevidelectures.com › Civil Engineering › IIT Guwahati
- e) www.youtube.com/playlist?list=PLF5B83BDDDBB8FCBE3
- f) nptel.ac.in/noc/individual_course.php?id=noc17-ce21
- g) <http://freevidelectures.com/Course/2686/Design-of-Reinforced-Concrete-Structures>
- h) <https://www.youtube.com/watch?v=hVaB0jGcyB4>
- i) <https://www.youtube.com/watch?v=AfHmpWlcq4>
- j) <https://www.youtube.com/watch?v=PDJPcQq3PZE>
- k) <https://www.youtube.com/watch?v=GgatFNtQrBo>
- l) <https://www.youtube.com/watch?v=A9JUGWhEW5A>
- m) freevidelectures.com › Civil Engineering › IIT Madras
- n) https://www.youtube.com/watch?v=zwtVO3-_iNQ
- o) <https://www.youtube.com/watch?v=wJWt0dcgafs>
- p) <https://www.youtube.com/watch?v=csK9eNk6S1c>
- q) au.autodesk.com/au-online/classes-on.../class...steel/msf11860



Program Name : All Branches of Diploma in Engineering and Technology.
Program Code : CE/CR/CS/CH/CM/CO/IF/CW/DE/EJ/EN/EQ/ET/EX/IE/
MU/EE/EP/EU/IS/IC/AE/FG/ME/PG/PT/DC/TX/TC
Semester : Sixth
Course Title : Capstone Project – Execution & Report Writing
Course Code : 22060

1. RATIONALE

This course on 'Capstone Project–Execution and Report Writing' is the continuation of the previous semester course on 'Capstone Project–Planning'. So, in this semester, the students are to implement the detailed Capstone Project Plan, which they have prepared in the preceding semester. Therefore, to successfully complete this Capstone Project by the end of this semester, it is necessary to incorporate the suggestions of the guide/examiners of the preceding semester. Hence, it is of utmost importance for the student to again re-capitulate and comprehend the importance, concept and need of the 'Capstone Projects' which are well explained in the 'Capstone Project–Planning' course in the previous semester.

Often, the jobs in the industry, which the diploma holders will come across when they join it and will be in the form of small or large projects. Such projects are generally an integration of the various types of skills which cut across the three major domains of learning i.e. cognitive, psychomotor and affective domain which must have acquired during their journey from first semester to the last semester. Hence, it is essential that students are also given an opportunity to do large projects which require more time compared to the micro-projects in order to develop and integrate the highly essential industry oriented competencies and associated skills in the students. Therefore, in this semester the 'Capstone Project – Execution and Report Writing' will continue to integrate some more additional competencies along with those in the previous semester and hence build up greater confidence to face such situations in the world of work.

2. COMPETENCY

The course should be taught and implemented with the aim to develop the required course outcomes (COs) so that students will acquire following competency needed by the industry:

- **Implement the Capstone Project Plan to solve the identified problem/task faced by industry/user related to the concerned occupation by integrating the various types of skills acquired during the programme.**

3. COURSE OUTCOMES (COs)

Depending upon the nature of the projects undertaken, the following could be some of the major course outcomes that could be attained, although, in case of some projects few of the following course outcomes may not be applicable.

- a) Implement the planned activity individually and/or as team.
- b) Select, collect and use required information/knowledge to solve the identified problem.
- c) Take appropriate decisions based on collected and analysed information.
- d) Ensure quality in product.
- e) Incorporate energy and environment conservation principles.
- f) Consider the ethical issues related to the project (if there are any).
- g) Assess the impact of the project on society (if there is any).
- h) Communicate effectively and confidently as a member and leader of team.



- i) Prepare project report after performing due plagiarism check using appropriate tools.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
-	-	4	4	-	-	-	-	-	-	-	50#	20	50~	20	100	40

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment

5. Course details

As the implementation of the Capstone project progresses and which has to be submitted at the end of project work, one of the outputs of this course is a detailed **Project Report** that is continuously prepared by the student. There will also be regular progressive assessment by the teacher as per the criteria no 7 on the basis of rubrics mentioned in **Appendix –C** and in the formats as shown in **Appendix-B** and also for the end-of-semester examination.

5.1 Guidelines for Capstone Project–Execution and Report Writing

- The students would like to revise the ‘Capstone Project – Plan’ based on the feedback received in the fifth semester examination.
- This revised ‘Capstone Project – Plan’ would be again approved by the project guide. As soon as the revised plan is approved by the teacher, the student will begin to work according to it and would also continue to maintain a dated ‘**Project Diary**’ for the whole semester. This is a sort of a ‘weekly diary’ indicating all the activities conducted by the student every week in the semester to complete the project. This ‘Project Diary’ should be got signed by the teacher at regular intervals for progressive assessment. If this is maintained sincerely and truthfully by the student, it will be very helpful in compiling the **Final Project Report** at the end of the semester by him/her.

6. Project report

During the final Semester, the student will prepare a 'Project Report' in continuation with the activities conducted in fifth semester under Project Planning having following sub-titles:

Suggested contents of the Project report

- Title page (with name of team members and mentor teacher)
- Certificate (in the Format given in this document as annexure A)
- Acknowledgements (this may need revision at the end of the final semester)
- Abstract (in one paragraph not more than 150 words)
- Content Page

Chapters

- Chapter–1 Introduction (background of the Industry or User based Problem/Task)
- Chapter–2 Literature Survey (to finalise and define the Problem Statement)
- Chapter–3 Scope of the project
- Chapter–4 Methodology
- Chapter-5 Details of designs, working and processes



6. Chapter-6 Results and Applications
7. Chapter-7 Conclusions And future scope
8. Appendix (if any)
9. References and Bibliography

Note:

- i. The report should contain as many diagrams, figures and charts etc as relevant for the project.
- ii. Originality of the report (written in own words) would be given more importance rather than quality of printing and use of glossy paper or multi-colour printing

7. ASSESSMENT OF PROJECT WORK

Project work has two components, first is Progressive Assessment (PA), while another is End Semester Examination (ESE).

7.1. Progressive Assessment (PA) Guidelines and Criteria

Project guide is supposed to carry out this assessment. It is a continuous process, during which for developing desired qualities in the students, faculty should orally give **informal feedback** to students about their performance and interpersonal behaviour while guiding them on their project work every week. Following criteria should be considered while assessing students informally or formally during different stages of the project work.

The following factors need consideration for both Capstone Project-Planning and Capstone Project-Execution and Report Writing.

- a) Students should be assessed during the project work so that students can also get feedback for further improvement.
- b) It should be kept in mind that project work is mainly experiential learning and it is not the research work, so emphasis should be on work based learning or learning from experience and development of attitudes and skills as mentioned in course outcomes. So focus of assessment should also be on learning from the process of completing project work rather than on novelty or innovation in the project work.
- c) For progressive assessment at the end, students should be asked to give the power point presentation before group of teachers and junior students (so that junior students may also get awareness about the major project work they have to carry out in future)
- d) The students would be awarded marks for their efforts (In some cases it may happen that due to some reasons such as unavailability of some material or component or some other resources, students may not be able to complete the project, but they have tried their best, in such cases students would be given appropriate marks if they have done enough efforts.)
- e) The students would not be awarded marks if they have completed the project by getting done the work from market or some professionals (taking some help and guidance is different as compared to getting the work or maximum part of the work completed from others on payment basis).
- f) Originality of the report (written in own words) would be given more importance.
- g) The Project Guide will assure the quality of project done by his group.



Criteria of Marks for PA for Capstone Project -Execution and Report Writing.

S. No.	Criteria	Marks
1	Project Proposal /Identification	10
2	Punctuality and overall contribution	
3	Project Diary	
4	Execution of Plan during sixth semester	20
5	Project Report including documentation	15
6	Presentation	05
Total		50

7.2 END SEMESTER EXAMINATION (ESE)

Evaluation shall be carried out according to following criteria. For each project, students from the concerned group should be asked to make presentation of their project, in front of the external and internal examiners which should be followed by question answer session to ascertain the contribution made by each student.

Criteria of Marks for ESE for Capstone Project -Execution and Report Writing

S. No.	Criteria	Marks
1	Project Proposal	05
2	Punctuality and overall contribution	
3	Project diary	
4	Execution of Plan during sixth semester	10
5	Project Report including documentation	10
6	Presentation	10
7	Question and Answer	15
Total		50

8. SPECIAL TEACHING STRATEGIES (If any)

- Teacher's should not spoon feed the students and let them try on their own at different stages of the project work and even first let them strive hard and only when efforts of students have failed, then teacher should guide them. Guidance should be in initially in the form of clues or hints rather than complete explanation, detailed explanation should be given only when students are not able to work based on clues/hints. The role of teacher should be limited to guide and facilitator
- Teachers should help students in selecting a topic which is relevant and challenging (but within capacity) for students according to their abilities.
- Teachers should come out of the mindset that there should be compulsorily some innovation and novelty in the project work. Because as discussed earlier, project is mainly opportunity for work based or experiential learning, the aim of which is to develop higher order cognitive skills and attitudes. Project at diploma level is not research or innovation.* The main thing teachers have to ensure is that students choose a task or problem for their project work which is challenging but according to their capability i.e. a task which they can complete on their own without getting it done from market.



- d) Teachers should ensure that students prepare the project plan in as much detail as possible, since this way only they would learn the importance of planning and how to do the detail planning. Teachers should allow students to proceed ahead only when they have detailed plan with them.
- e) Teachers should motivate students to maintain project document project diary and project report. They should explain benefits of these activities to students and also train them in these activities, because most of them may be doing this first time.
- f) Project Guide should ensure that students submit chapter of report one by one to him/her as per schedule and should check the content of the chapters. The Project guide should monitor that schedule is maintained and report writing is not left till last few weeks. It should not be a problem since first three chapters of the report should have been written in fifth semester itself.
- g) Teachers should also encourage students to openly discuss their weaknesses and shortcomings. Teachers should develop confidence in students that admitting mistakes and weaknesses helps in improving them.
- h) Teachers should continuously discuss with students about working of group and progress in the project and from this discussion should identify their personal qualities (both strengths and weaknesses) and suggest to them ways for improving those qualities.
- i) Internal as well as external examiners should reward students for original work and efforts of students even if they are not fully successful or not able to complete the project in comparison to those students who have taken paid help from others to complete their project.

Appendix–A

CERTIFICATE

This is to certify that Mr./Ms.....
fromInstitute having Enrolment No:
has completed project of final year having title during the
academic year 20__-20__. The project completed by individually/ in a group consisting
of..... persons under the guidance of the Faculty Guide.

.....
.....
Name & Signature of Guide:

Telephone:.....



Appendix-B**PROGRESSIVE ASSESSMENT (PA) OF CAPSTONE PROJECT – EXECUTION
AND REPORT WRITING****Evaluation Sheet for Internal Assessment****Name of Student:****Name of Programme:** **Semester: Sixth****Course Title:** Capstone Project : Execution and Report Writing **Code:22060.****Title of the Capstone Project:**
.....**A. POs addressed by the Capstone Project (Mention only those predominant POs)**

- a)
- b)
- c)
- d)

B. COs addressed by the Capstone Project (Mention only those predominant POs)

- a)
- b)
- c)
- d)

C. OTHER LEARNING OUTCOMES ACHIEVED THROUGH THIS PROJECT**1. Unit Outcomes (Cognitive Domain)**

- a)
- b)
- c)
- d)

2. Practical Outcomes (in Psychomotor Domain)

- a)
- b)
- c)
- d)

3. Affective Domain Outcomes

- a)
- b)
- c)
- d)



PROGRESSIVE ASSESSMENT (PA) Sheet		
S. No.	Criteria	Marks
1	Project Proposal /Identification	10
2	Punctuality and overall contribution	
3	Project Diary	
4	Execution of Plan during sixth semester	20
5	Project Report including documentation	15
6	Presentation	05
Total		50

Appendix-B

Suggested Rubric for Capstone Project – Execution and Report Writing

S. No.	Characteristic to be assessed	Poor	Average	Good	Excellent
1	Problem/Task Identification (Project Title)	Relate to very few POs Scope of Problem not clear at all	i. Related to some POs ii. Scope of Problem/Task vague	i. Take care of at-least Three POs ii. Scope of Problem/task not very specific	• Take care of more than three POs ii. Scope of problem/task very clear
2	Literature Survey /Industrial Survey	Not more than ten sources (primary and secondary), very old reference	At-least 10 relevant sources, at least 5 latest	At –least 15 relevant sources, most latest	About 20 relevant sources, most latest
3	Project proposal	Methods are not appropriate, All steps not mentioned, Design of prototype not started (if applicable).	Appropriate plan but not in much detail. Plan B for critical activities not mentioned. Time line is not developed. Design of Prototype is not complete. (if applicable)	Appropriate and detailed plan with Plan B for critical activities mentioned, but clarity is not there in methods, time line is given but not appropriate. Design of prototype is not detailed (if applicable)	Appropriate and detailed plan with Plan B for critical activities mentioned, clarity in methods with time line, Detailed design of prototype (if applicable)
4	Project Diary	Entries for most weeks are missing. There is no proper sequence and details are not correct.	Entries for some weeks are missing, details are not appropriate, not signed regularly by the guide.	Entries were made every week but are not in detail. Signed and approved by guide every week	Entries were made every week in detail, signed and approved by guide every week
5	Final Report Preparation	Very short, poor quality sketches, Details about methods, material, precaution and conclusions	Detailed, correct and clear description of methods, materials, precautions and	Conclusions. Sufficient Graphic Description.	Very detailed, correct, clear description of methods, materials, precautions and conclusions. Enough tables,

S. No.	Characteristic to be assessed	Poor	Average	Good	Excellent
		omitted, some details are wrong			charts and sketches
6	Presentation	Major information is not included, information is not well organized .	Includes major information but not well organized and not presented well	Includes major information and well organized but not presented well	Well organized, includes major information ,well presented
7	Defense	Could not reply to considerable number of question.	Replied to considerable number of questions but not very properly	Replied properly to considerable number of question.	Replied to most of the questions properly

Appendix C

Suggestive Project Diary format

Week no:
Activities planned:
Activities Executed:
Reason for delay if any
Corrective measures adopted
Remark and Signature of the Guide



Program Name : Civil Engineering Program Group
Program Code : CE/CR/CS
Semester : Sixth
Course Title : Construction Management
Course Code : 22061

1. RATIONALE

Civil engineering projects are costly and involve various resources like men, materials, machinery, time and money. Therefore these projects need to be efficiently managed to utilize the resources to the optimum so that they are completed at least cost and within stipulated time duration. Civil engineers at the site and office are responsible to manage the projects efficiently. Therefore Civil engineering diploma holders working in the projects should be conversant with the various aspects of managing the resources. This course is designed to develop competencies in the diploma holders and enable them to manage the resources efficiently and use specialized, project management techniques to oversee the planning, design, and construction of a project, from its beginning to its end. at construction projects. The purpose of Construction Management is to control a project's time, cost and quality.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Manage various resources for optimised completions of construction projects.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Organize the human resources for the Civil engineering project.
- Prepare networks and bar charts for the given construction project.
- Apply safety measures at construction projects

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1	-	2	3	--	--	--	--	--	--	--	25#	10	25~	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)



This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

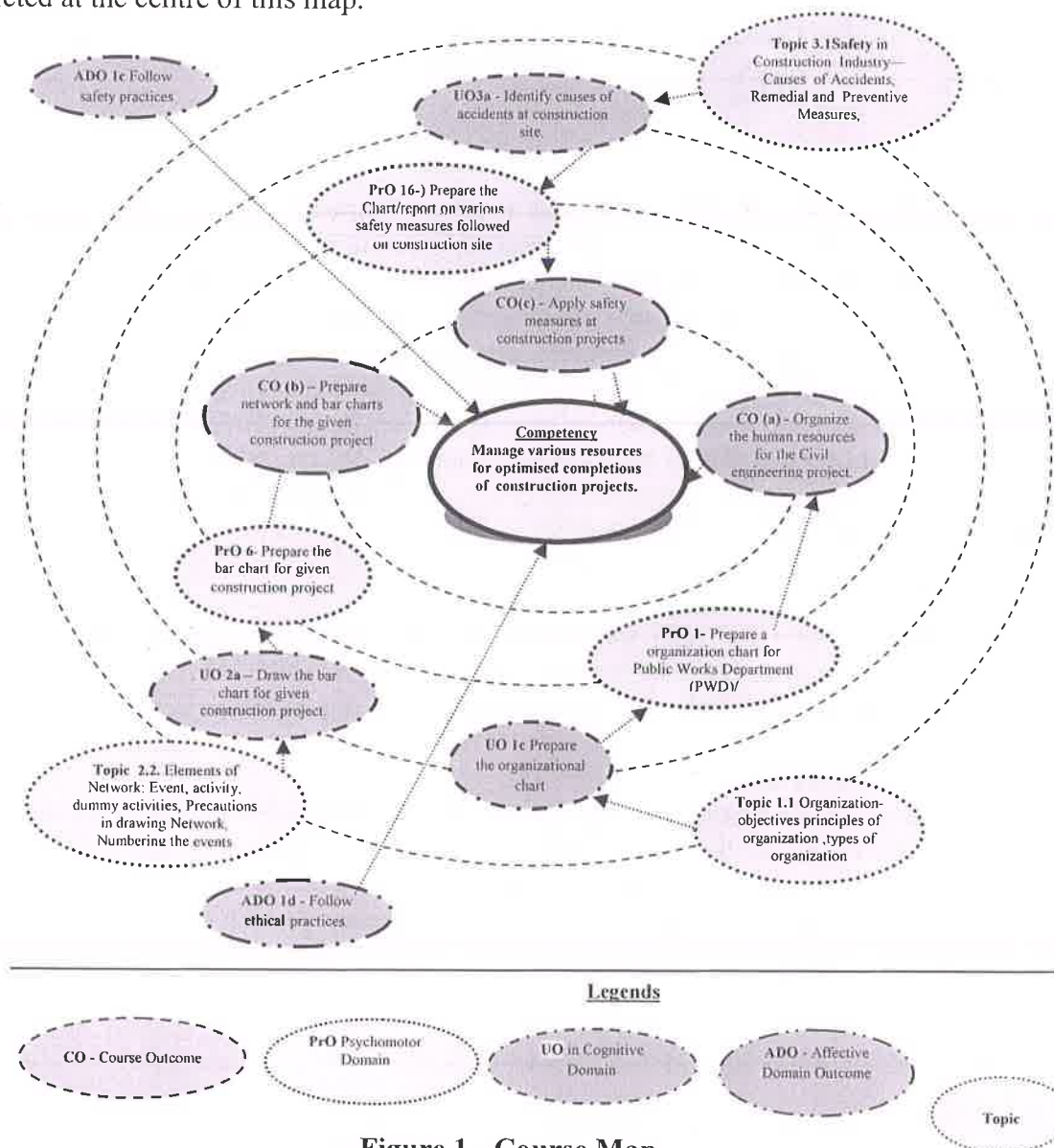


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Prepare the organization chart of any one government/public sector organization executing any major civil engineering projects in your area.	I	02*
2	Prepare the organization chart of any one private organization executing any major civil engineering projects in your area.	I	02
3	Prepare the list of roles and responsibilities of various personnel in any Government Construction organization.	I	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
4	Prepare the list of roles and responsibilities of various personnel in any Private Construction organization.	I	02
5	Check the breakdown structure of the given typical construction project to justify its role in managing its relevant activities.	II	02*
6	Prepare the bar chart for given construction project.	II	02*
7	Prepare the time schedule of different activities for practical no 5	II	02
8	Prepare a network for given construction project to identify the critical activity in a project.(to develop the critical path)	II	02*
9	Compute activity times, event times and floats for network drawn in above practical number 8	II	02
10	Carry out cost optimization of the given project.	II	02
11	Carry out labor resource levelling for the given project	II	02*
12	Prepare Job layout for the given construction site	II	02*
13	Carry out the ABC analysis of the given items in a store.	II	02
14	Determination of EOQ (Economic order quantity) based on the given data.	II	02*
15	Prepare the action plan to reduce the accidents on given construction project.	III	02
16	Prepare the charts/power point presentation on various safety devices used at construction site.	III	02*
			32

Note

- A suggestive list of **PrOs** is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical UOs/tutorials need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S.No.	Performance Indicators	Weightage in %
1	Collecting information.	20
2	Interpretation of data collected	20
3	Preparing the report.	30
4	Answer to sample questions.	10
5	Submission of report in time.	10
6	Attendance and punctuality	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices on site.
- Work as a leader/a team member.
- Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of

practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year.
- 'Organization Level' in 2nd year.
- 'Characterization Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

Not applicable.

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs in cognitive domain for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Construction industry and management	1a Identify the roles of different agencies in the given construction industry with justification. 1b Prepare organizational chart for the given organization 1c Identify the functions of specified personnel in the given organization with justification. 1d Prepare job layout for the given construction site.	1.1 Organization-objectives principles of organization ,types of organization government/public and private construction industry roles of various personnel in construction organization 1.2 Agencies associated with construction work-owner, promoter, builder, designer, architects. 1.3 Job layout for construction site
Unit- II Planning and scheduling	2a Draw the bar chart for the given construction project. 2b Draw the network for the given construction project. 2c Compute activity times, event times, floats and duration of the given construction project. 2d Calculate optimum cost and duration of the given project. 2e Carry out resource levelling for the given project. 2f Calculate EOQ in the given situation. 2g Identify the ABC analysis for the given items of store. 2h Identify the forms pertaining to the given store item with justification.	2.1 Identifying broad activities in construction work & allotting time to it based on rate analysis, Methods of Scheduling , Development of bar charts, Merits & limitations of bar chart 2.2 Elements of Network: Event, activity, dummy activities, Precautions in drawing Network, Numbering the events. 2.3 CPM networks, activity time estimate, Event Times by Forward Pass & Backward Pass Calculation, start and finish time of activity, project duration, Floats, Types of Floats-Free, independent and total floats, critical activities and critical path , 2.4 Purpose of crashing a network. Normal Time & Normal Cost, Crash Time and Crash Cost, Cost slope. Optimization of cost and duration. 2.5 Material management- Ordering cost, inventory carrying cost, EOQ 2.6 Store management various records related to store management, inventory control by

		ABC technique.
Unit– III Safety in Constructi on	3a Identify causes of accidents at construction site in the given situation with justification. 3b Suggest safety measures to avoid accidents for the given construction site 3c Apply relevant labor law/s in the given situation of a construction industry	3.1 Safety in Construction Industry—Causes of Accidents, Remedial and Preventive Measures, 3.2 Labor laws related to construction industry.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

-Not applicable –

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare journals based on practical performed in laboratory.
- Give seminar on relevant topic.
- Undertake micro-projects.
- Collect organizational set up of various departments.
- Collect and interpret the bar charts or networks from construction sites.
- Solve the numerical on bar chart, CPM and cost optimization
- Collect and interpret various store forms from PWD, WRD, MJP.
- Download the labour laws documents from internet and wrote a brief summary on it.
- Compile various safety slogans displayed at various sites with sources and write a brief summary on it.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- 'L' in item No. 4** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Guide student(s) in undertaking micro-projects.
- Arrange visit to nearby industries and workshops for understanding various construction materials.



- g) Use video/animation films to explain various processes like Manufacturing of construction materials, concrete mixing, and base preparation for painting, mortar laying, carpentry work, false ceiling.
- h) Use different instructional strategies in classroom teaching.
- i) Display various technical charts related to construction management process.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

- a) Use any software of Construction Management to prepare the scheduling of a project.
- b) Use any software of Construction Management to determine the critical path for the given construction project.
- c) Interpret the network figures used in given civil engineering projects.
- d) Prepare a report on different forms of inventory storage along with your interpretation
- e) Collect the information about latest safety measures adopted at construction project
- f) Compare various construction management software.
- g) Use a relevant software to collect information about modern techniques of material management like JIT/SAP/ERP

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Construction planning and management	Gahlot, P.S. Dhir, B.M.	New Age International (P) Ltd., New Delhi. 2016, ISBN 978-81224-04111
2	Construction planning and management	Shrivastava, U.K.	Galgotia Publication Pvt Ltd. New Delhi ISBN 10: 817515246X
3	The A To Z of Practical Building Construction and its Management	Mntri, Sandip	Satya Prakashan New Delhi, 2015 ISBN-8176842052
4	Industrial engineering and management	Khanna, O.P.	Dhanpat Rai New Delhi ISBN-10: 818992835X
5	Project Planning and Controlling with PERT And CPM	Punmia, B.C. Khandelwal, K.K.	Laxmi Publications (P)Ltd. New Delhi, ISBN 9788170083092
6	Construction Management and accounts	Harpal, Singh	Mc-Graw Hill, New Delhi ISBN: 978-0070966437
7	Industrial engineering and	Bangal, T. R.	Khanna Publications, New Delhi

S. No.	Title of Book	Author	Publication
	management	Sharma, S.C.	ISBN: 978-9386173072

IS, BIS and International Codes:

8	IS 4082:1996	Recommendations on stacking and storage of construction materials and components at site
9	IS 7293:1974	Safety code for working with construction machinery
10	IS 7969:1975	Safety code for handling and storage of building materials
11	IS 10067:1982	Material constants in building works
12	IS 15883-1:2009	Construction project management - Guidelines, Part 1: General
13	IS 15883-2:2013	Construction project management - Guidelines, Part 2: Time Management

14. SOFTWARE/LEARNING WEBSITES/LEARNING RESOURCES

- a) https://docs.google.com/spreadsheets/d/e/2PACX-1vQOHER38F_mi8Nj0n4NOrrvligNWQcyBiPtSRjj1gvRiaxL4py3UYem0o8nP0LLKk78qfC2bdeBtaw/pubhtml
- b) Prima-Vera P6b
- c) MS Project



Program Name : Diploma in Computer Engineering Group/ Diploma in Mechanical /Chemical Engineering /Diploma in Electronics Engineering Group/ Diploma in Fashion & Clothing

Program Code : CO/CM/CW/DC/EJ/ET/EN/EX/EQ/IE/ME/CH

Semester : Sixth

Course Title : Entrepreneurship Development

Course Code : 22032

1. RATIONALE

Globalisation, liberalization and privatization along with revolution in information technology have opened up new opportunities transforming lives of masses. In this context, there is immense opportunity of establishing manufacturing, service, trading, marketing and consultancy enterprises by diploma engineer. Our fast growing economy provides ample scope for diploma engineers to succeed as an entrepreneur. Entrepreneurship requires distinct skill sets which are attempted to be developed through this course. To begin with, this course aims to develop the competency and the related outcomes in order to start small enterprises.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Develop project proposals to launch small scale enterprises.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

- Identify your entrepreneurial traits.
- Identify the business opportunities that suits you.
- Use the support systems to zero down to your business idea.
- Develop comprehensive business plans.
- Prepare plans to manage the enterprise effectively.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
2	-	2	4	--	--	--	--	--	--	50@	20	50~	20	100	40	

@ : Internal examination

(~): For the practical only courses, the PA has two components under practical marks i.e. the assessment of practicals (seen in section 6) has a weightage of 60% (i.e.30 marks) and micro-project assessment (seen in section 11) has a weightage of 40% (i.e.20 marks). This is designed to facilitate attainment of COs holistically, as there is no theory ESE.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P – Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

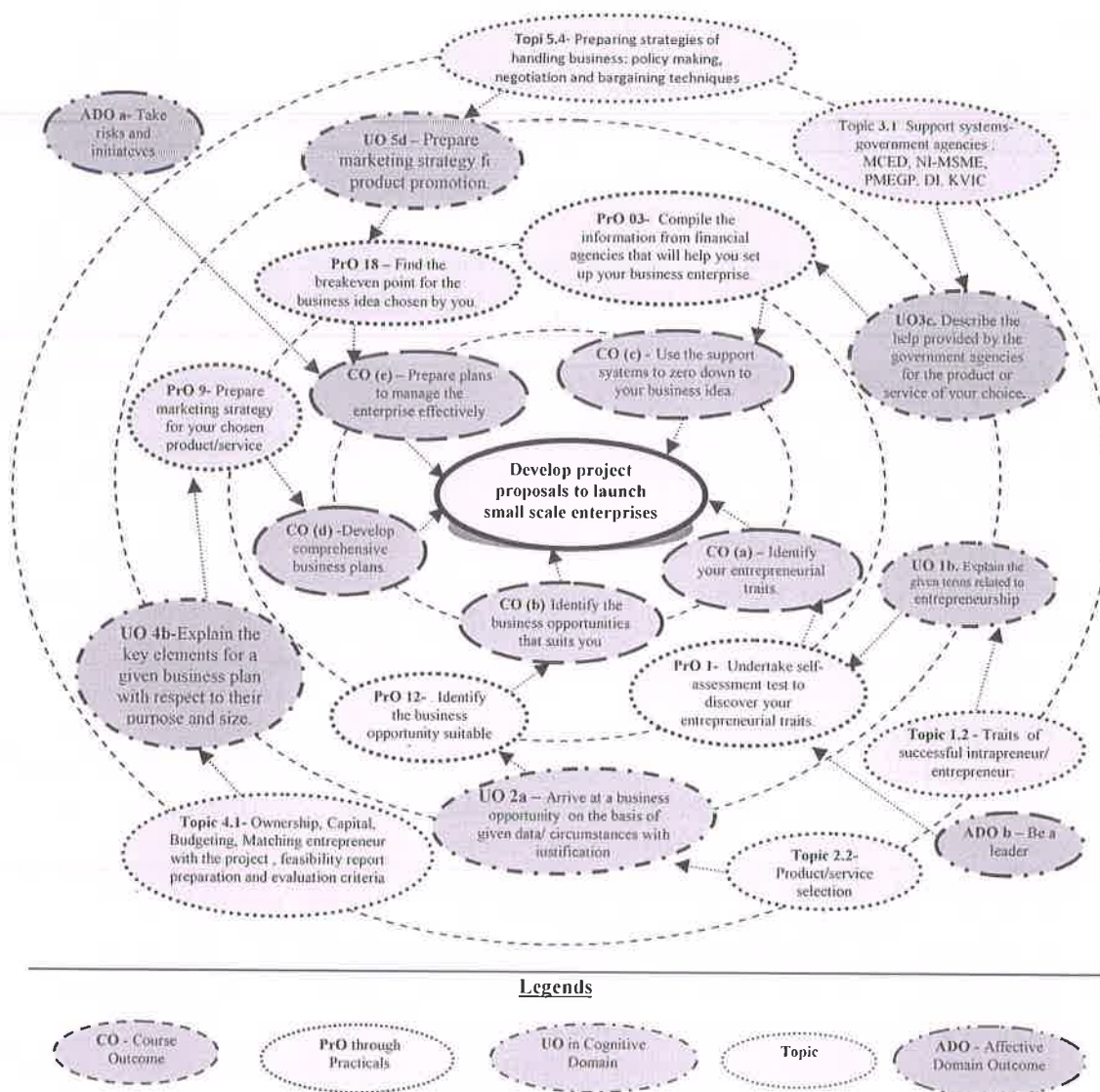


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Submit a profile summary(about 500 words) of a successful entrepreneur indicating milestone achievements.	I	02*
2	Undertake SWOT analysis to arrive at your business idea of a product/service.	I	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
3	Generate business ideas(product/service) for intrapreneurial and entrepreneurial opportunities through brainstorming.	II	02*
4	Undertake self-assessment test to discover your entrepreneurial traits.	II	02*
5	Identify the business opportunity suitable for you.	II	02
6	Arrange an exhibition cum sale of products prepared out of waste.	II	02
7	Survey industries of your stream, grade them according to the level of scale of production, investment, turnover, pollution to prepare a report on it.	II	02*
8	Visit a bank/financial institution to enquire about various funding schemes for small scale enterprise.	III	02*
9	Collect loan application forms of nationalise banks/other financial institutions.	III	02*
10	Compile the information from financial agencies that will help you set up your business enterprise.	III	02*
11	Compile the information from the government agencies that will help you set up your business enterprise.	III	02*
12	Prepare Technological feasibility report of a chosen product/service.	III	02*
13	Prepare financial feasibility report of a chosen product/service.	III	02*
14	Craft a vision statement and enabling mission statements for your chosen enterprise.	III	02
15	Prepare a set of short term,medium and long term goals for starting a chosen small scale enterprise	III	02*
16	Prepare marketing strategy for your chosen product/service.	IV	02*
17	Compile information about various insurance schemes covering different risk factors.	IV	02
18	Organize a funfair of your class and write a report of profit/loss	V	02
19	Find the breakeven point for the business idea chosen by you.	V	02
20	Arrange a discussion session with your institute's pass out students who are successful entrepreneurs.	V	02
21	Prepare a business plan for your chosen small scale enterprise	V	02*
	Total		42

Note:

- A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

Sample Products that can be manufactured under SME

- Badges cloth embroidered and metals



2. Bags of all types i.e. made of leather, cotton, canvas and jute etc. including kit bags, mail bags, sleeping bags and water-proof bag
3. Bandage cloth
4. Basket cane (Procurement can also be made from State Forest Corpn. and State Handicrafts Corporation)
5. Bath tubs of plastic
6. Battery Charger
7. Belt leather and straps
8. Bolts and Nuts
9. Boot Polish
10. Brooms
11. Domestic Brushes of different types
12. Buckets of all types of plastic
13. Button of all types
14. Chappals and sandals
15. Cleaning Powder
16. Cloth Covers for domestic use
17. Cloth Sponge
18. Coir mattress cushions and matting
19. Cotton Pouches
20. Curtains mosquito
21. Domestic Electric appliances as per BIS Specifications: Toaster Electric, Elect. Iron, Hot Plates, Elect. Mixer, Grinders Room heaters and convectors and ovens
22. Dust Bins of plastic
23. Dusters Cotton all types except the items required in Khadi
24. Electronic door bell
25. Emergency Light (Rechargeable type)
26. Hand drawn carts of all types
27. Hand gloves of all types
28. Hand numbering machine
29. Hand Pump
30. Hand Tools of all types
31. Handles wooden and bamboo (Procurement can also be made from State Forest Corpn. and State Handicrafts Corporation)
32. Haver Sacks
33. Honey
34. Invalid wheeled chairs.
35. Iron (dhobi)
36. Lamp holders
37. Letter Boxes
38. Nail Cutters
39. Oil Stoves (Wick stoves only)
40. Paper conversion products, paper bags, envelopes, Ice-cream cup, paper cup and saucers and paper Plates
41. Pickles, Chutney and Pappads
42. Pouches for various purposes
43. Safe meat and milk
44. Safety matches
45. Safety Pins (and other similar products like paper pins, staples pins etc.)
46. Shoe laces



47. Sign Boards painted
48. Soap Liquid
49. Spectacle frames
50. Steel Chair
51. Umbrellas
52. Utensils all types

Sample Services that can be offered under SME

1. Marketing Consultancy
2. Industrial Consultancy
3. Equipment Rental & Leasing
4. Typing Centres
5. Photocopying Centres (Zerowing)
6. Industrial photography
7. Industrial R & D Labs.
8. Industrial Testing Labs.
9. Desk Top publishing
10. Advertising Agencies
11. Internet Browsing/Setting up of Cyber Cafes
12. Auto Repair, services and garages
13. Documentary Films on themes like Family Planning, Social forestry, energy conservation and commercial advertising
14. Laboratories engaged in testing of raw materials, finished products
15. 'Servicing Industry' Undertakings engaged in maintenance, repair, testing or electronic/electrical equipment/ instruments i.e. measuring/control instruments servicing of all types of vehicles and machinery of any description including televisions, tape recorders, VCRs, Radios, Transformers, Motors, Watches.
16. Laundry and Dry Cleaning
17. X-Ray Clinic
18. Tailoring
19. Servicing of agriculture farm equipment e.g. Tractor, Pump, Rig, Boring Machines.
20. Weigh Bridge
21. Photographic Lab
22. Blue printing and enlargement of drawing/designs facilities
23. ISD/STD Booths
24. Teleprinter/Fax Services
25. Sub-contracting Exchanges (SCXs) established by Industry Associations.
26. Coloured or Black and White Studios equipped with processing laboratory.
27. Ropeways in hilly areas.
28. Installation and operation of Cable TV Network:
29. Operating EPABX under franchises
30. Beauty Parlours
31. Creches.

S. No.	Performance Indicators	Weightage in %
1	Leadership skills	20
2	Team work	20
3	Lateral/creative thinking	10
4	Observations and recording	10
5	Self learning	20



S. No.	Performance Indicators	Weightage in %
6	Answer the sample questions	10
7	Submission of report in time	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safe practices
- Practice good housekeeping
- Practice energy conservation
- Demonstrate working as a leader/a team member
- Maintain tools and equipment
- Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	Seminar Hall equipped with conference table, chairs and multimedia facilities	All
2	Modern desktop Computer with internet connection.	All

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (In cognitive domain)	Topics and Sub-topics
Unit – I Entrepreneurship Development - Concept and Scope	1a. Describe the procedure to evaluate your entrepreneurial traits as a career option for the given product to be manufactured or services to be rendered. 1b. Explain the given terms related to Entrepreneurship	1.1 Entrepreneurship as a career 1.2 Traits of successful intrapreneur/ entrepreneur: consistency, creativity, initiative, independent decision making, assertiveness, persuasion, persistence, information seeking, handling business communication, commitment to work contract, calculated risk taking. 1.3 Entrepreneurship : scope in local and

Unit	Unit Outcomes (In cognitive domain)	Topics and Sub-topics
	1c. Describe the salient features of the resources required for starting the specified enterprise. 1d. Identify the characteristics for a given type of enterprise.	global market. 1.4 Intrapreneur and entrepreneur 1.5 Types of enterprises and their features : manufacturing, service and trading. 1.6 Steps in setting up of a business.
Unit – II Entrepreneurial Opportunities and selection process	2a. Arrive at a business opportunity on the basis of given data/circumstances with justification. 2b. Describe the scheme(s) offered by the government for starting the specified enterprise. 2c. Suggest a suitable place for setting up the specified enterprise on the basis of given data/circumstances with justification. 2d. Suggest the steps for the selection process of an enterprise for the specified product or service with justification. 2e. Describe the market study procedure of the specified enterprise.	2.1 Product/Service selection: Process, core competence, product/service life cycle, new product/ service development process, mortality curve, creativity and innovation in product/ service modification / development. 2.2 Process selection: Technology life cycle, forms and cost of transformation, factors affecting process selection, location for an industry, material handling. 2.3 Market study procedures: questionnaire design, sampling, market survey, data analysis 2.4 Getting information from concerned stakeholders such as Maharashtra Centre for Entrepreneurship Development[MCED], National Institute for Micro, Small and Medium Enterprises [NI-MSME], Prime Minister Employment Generation Program [PMEGP], Directorate of Industries[DI], Khadi Village Industries Commission[KVIC]
Unit – III Support Systems	3a. Describe the support system required for the specified enterprise. 3b. Describe the help provided by the government agencies for the specified product/service. 3c. Describe the help provided by the non-governmental agencies for the specified product/service. 3d. Compute the breakeven point for the specified	3.1 Categorisation of MSME, ancillary industries 3.2 Support systems- government agencies: MCED, NI-MSME, PMEGP,DI, KVIC 3.3 Support agencies for entrepreneurship guidance, training, registration, technical consultation, technology transfer and quality control, marketing and finance. 3.4 Breakeven point, return on investment and return on sales.



Unit	Unit Outcomes (In cognitive domain)	Topics and Sub-topics
	business enterprise, stating the assumptions made.	
UNIT IV Business Plan Preparation	4a. Justify the importance of the business plan for the given product/service. 4b. Explain the key elements for the given business plan with respect to their purpose/size 4c. Prepare the budget for the given venture. 4d. Prepare the details of the given component of the given startup business plan.	4.1 Sources of Product for Business : Feasibility study 4.2 Ownership, Capital, Budgeting, Matching entrepreneur with the project , feasibility report preparation and evaluation criteria 4.3 Business plan preparation
Unit –V Managing Enterprise	5a. Justify the USP of the given product/ service from marketing point of view. 5b. Formulate a business policy for the given product/service. 5c. Choose the relevant negotiation techniques for the given product/ service with justification. 5d. Identify the risks that you may encounter for the given type of business/enterprise with justification. 5e. Describe the role of the incubation centre for the given product/service.	5.1 Unique Selling Proposition [U.S.P.]: Identification, developing a marketing plan. 5.2 Preparing strategies of handling business: policy making, negotiation and bargaining techniques. 5.3 Risk Management: Planning for calculated risk taking, initiation with low cost projects, integrated futuristic planning, angel investors, venture capitalist. 5.4 Incubation centres: Role and procedure.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Develop two products from household waste (attach photographs).
- Download product development and innovative films from internet.
- Prepare a collage for 'Traits of successful entrepreneurs'.
- Invite entrepreneurs, industry officials, bankers for interaction.
- Identify your hobbies and interests and convert them into business idea.



- f. Convert your project work into business.
- g. Choose a product and design a unique selling proposition, brand name, logo, advertisement (print, radio, television), jingle, packing, packaging, label for it.
- h. Develop your own website. Share your strengths and weakness on it. Declare your time bound goals and monitor them on the website.
- i. Choose any advertisement and analyse its good and bad points.
- j. Decide any product and analyse its good and bad features.
- k. Select any product and prepare its cost sheet.
- l. Choose any product and study its supply chain.
- m. Arrange brainstorming sessions for improvement of any product.
- n. Study schemes for entrepreneurship promotion of any bank.
- o. Visit industrial exhibitions, trade fairs and observe nitty-gritty of business.
- p. Open a savings account and build your own capital.
- q. Organise industrial visit and suggest modifications for process improvement.
- r. Interview at least four entrepreneurs or businessman and identify Charms of entrepreneurship and Traits of successful entrepreneurs.
- s. Analyse case studies of any two successful entrepreneurs.
- t. Perform a survey and identify local resources available for setting up of an enterprise.
- u. Engage in marketing of products.
- v. Carry out a demand supply gap analysis for a particular product.
- w. Organise a prototype development competition.
- x. Arrange fairs, events in the institute and try for sponsorships.
- y. Select any performance criteria and continuously compete with yourself.
- z. On any performance criteria continuously compete with others.
- aa. Foresee your dream and make a long term plan for its accomplishment.
- bb. Dream for something unique and make a write-up.
- cc. Read articles, books on creativity.
- dd. Using morphological analysis technique, reduce cost or increase quality of a product.
- ee. Conduct a market survey for a project. Collect data on machinery specifications, price, output/hr, power consumption, manpower requirement, wages, raw material requirement, specification, price, competitor's product price, features, dealer commissions, marketing mix.
- ff. Prepare a business plan and organize a business plan competition.
- gg. Select a social cause, set objectives, plan and work for its accomplishment.
- hh. Videograph as many as possible from the above and upload on your website, YouTube, facebook.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- a. Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- b. '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c. About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs/UOs through classroom presentations (see implementation guideline for details).
- d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.



- e. Use Flash/Animations to explain various maintenances techniques.
- f. Guide student(s) in undertaking micro-projects.
- g. Instructors should emphasise more on deductive learning. Students should learn to recognise, create, shape opportunities, and lead teams for providing economic-social value to society.
- h. Business simulations should be used to enhance behavioural traits of successful intrapreneurs and entrepreneurs amongst students. Emphasis should be on creating entrepreneurial society rather than only setting up of enterprise.
- i. They must be encouraged to surf on net and collect as much information as possible.
- j. Each student should complete minimum twenty activities from the suggested list. Minimum possible guidance should be given for the suggested activities.
- k. Students should be promoted to use creative ideas, pool their own resources, finish their presentation, communication and team skills.
- l. Alumni should be frequently invited for experience sharing, guiding and rewarding students.
- m. Display must be arranged for models, collages, business plans and other contributions so that they motivate others.

11. SUGGESTED MICRO-PROJECTS

One Business Plan as a micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he should submit it by the end of the semester to develop the industry oriented COs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation in the middle of the semester and one at the end of the semester before submission of the project proposal incorporating the concepts taught during semester. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course.

- a. Choose any advertisement and analyse its good and bad points.
- b. Decide any product and analyse its good and bad features.
- c. Select any product and prepare its cost sheet.
- d. Choose any product and study its supply chain.
- e. Arrange brainstorming sessions for improvement of any product.
- f. Study schemes for entrepreneurship promotion of any bank.
- g. Visit industrial exhibitions, trade fairs and observe nitty-gritty of business.
- h. Open a savings account and build your own capital.
- i. Organise industrial visit and suggest modifications for process improvement.

12. SUGGESTED LEARNING RESOURCES

S. No.	Title of Books	Author	Publication
1	The Entrepreneurial Instinct : How Everyone Has the Innate Ability to Start a Successful Small Business	Mehta, Monica	McGraw-Hill Education, New Delhi, 2012, ISBN 978-0-07-179742-9
2	Entrepreneurship	Hisrich, R. D.	McGraw-Hill Education, New Delhi, 2013 ISBN-13: 978-1259001635
3	Part I Readings in Entrepreneurship Education	Sareen, S.B.	Entrepreneurship Development Institute of India (EDI), GOI,

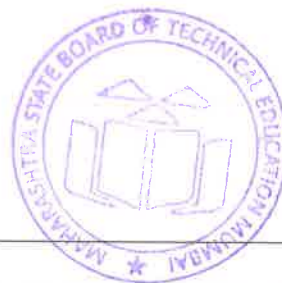
S. No.	Title of Books	Author	Publication
			Ahmedabad, 2016; ISBN: 978-0078029196 ..
4	Reading Material of Entrepreneurship Awareness Camp	Gujral, Raman	Entrepreneurship Development Institute of India (EDI), GOI, 2016 Ahmedabad,
5	Product Design and Manufacturing	Chitale, A K	PHI Learning, New Delhi, 2014; ISBN: 9788120348738
6	Entrepreneurship Development Small Business Entrepreneurship	Charantimath, Poornima	Pearson Education India, New Delhi; ISBN: 9788131762264
7	Entrepreneurship Development: Special edition for MSBTE	CPSC, Manila	Tata Mc-Graw Hill, New Delhi,
8	Entrepreneurship and Small Business Management	Khanka, S.S.	S.Chand and Sons, New Delhi, ISBN: 978-93-5161-094-6
9	Entrepreneurship Development	S, Anil Kumar	New Age International, New Delhi, ISBN: 9788122414349

13. SUGGESTED SOFTWARE/LEARNING WEBSITES

1	MCED Books links	http://www.mced.nic.in/UdyojakSpecial.aspx?linktype=Udyojak
2	MCED Product and Plan Details	http://www.mced.nic.in/allproduct.aspx
3	The National Institute for Entrepreneurship and Small Business Development Publications	http://niesbud.nic.in/Publication.html
4	Courses : The National Institute for Entrepreneurship and Small Business Development	http://niesbud.nic.in/docs/1standardized.pdf
5	Entrepreneur.com	https://www.entrepreneur.com/lists
6	GOVT. SPONSORED SCHEMES	https://www.nabard.org/content1.aspx?id=23andcatid=23andmid=530
7	NABARD - Information Centre	https://www.nabard.org/Tenders.aspx?cid=501andid=24
8	NABARD – What we Do	http://www.nabard.org/content1.aspx?id=8andcatid=8andmid=488
9	Market Review	http://www.businesstoday.in/markets
10	Start Up India	http://www.startupindia.gov.in/pdf/file.php?title=Startup%20India%20Action%20Planandtype=Actionandq=Action%20Plan.pdfandcontent_type=Actionandsubmenupoint=action
11	About - Entrepreneurship Development Institute of India (EDII)	http://www.ediindia.org/institute.html
12	EDII - Centres	http://www.ediindia.org/centres.html
13	EDII - Publications	http://www.ediindia.org/publication.html
14	Business Plans: A Step-by-Step Guide	https://www.entrepreneur.com/article/247574
15	The National Science and Technology Entrepreneurship Development Board (NSTEDB)	http://www.nstedb.com/index.htm



16	NSTEDB - Training	http://www.nstedb.com/training/training.htm
17	Tata Exposures	http://www.tatasocial-in.com/project-exposure
18	Ministry Of Micro, Small And Medium EnterpriseS	http://www.dcmsme.gov.in/schemes/TEQUPEtail.htm
19	List of Business Ideas for Small Scale Industry	https://smallb.sidbi.in/%20thinking-starting-business/big-list-business-ideas-small-business
20	Thinking of Entrepreneurship	https://smallb.sidbi.in/entrepreneurship-stage/thinking-entrepreneurship
21	List of services for Small Scale Industry	http://www.archive.india.gov.in/business/Industry_services/illustrative.php
22	NSIC Schemes and Services	http://www.nsic.co.in/SCHSERV.ASP





Maharashtra State Board of Technical Education, Mumbai

Teaching and Examination Scheme for Post S.S.C. Diploma Courses

Program Name : Diploma in Computer Engineering / Diploma in Computer Technology / Diploma in Computer Science and Engineering

Program Code : CO/CM/CW

With Effect From Academic Year: 2017 - 18

Duration of Program : 6 Semesters

Duration : 16 Weeks

Semester : Sixth

Scheme : I

S. N.	Course Title	Course Abbre- viation	Course Code	Teaching Scheme			Credit (L+T+P)	Examination Scheme												Grand Total	
				L	T	P		Theory						Practical							
								Exam Duration in Hrs.	ESE		PA		Total		ESE		PA		Total		
									Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks		Min Marks
1	Management	MGT	22509	3	-	-	3	90 Min	70*#	28	30*	00	100	40	--	--	--	--	--	--	100
2	Programming with Python	PWP	22616	3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150
3	Mobile Application Development	MAD	22617	3	-	4	7	3	70	28	30*	00	100	40	25#	10	25	10	50	20	150
4	Emerging Trends in Computer and Information Technolgy	ETI	22618	3	-	-	3	90 Min	70*#	28	30*	00	100	40	--	--	--	--	--	--	100
	Elective – II (Select Any One)																				
5	Web Based Application Development Using PHP	WBP	22619	3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150
	Network and Information Security	NIS	22620	3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150
	Data Warehousing with Mining Techniques	DWM	22621	3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150
6	Enterpreneurship Development	EDE	22032	2	-	2	4	--	--	--	--	--	--	--	50@	20	50~	20	100	40	100
7	Capstone Project - Execution & Report Writing	CPE	22060	-	-	4	4	--	--	--	--	--	--	--	50#	20	50~	20	100	40	100
Total				17	-	14	31	--	350	--	150	--	500	--	175	--	175	--	350	--	850

Student Contact Hours Per Week: **31 Hrs.**

Medium of Instruction: **English**

Theory and practical periods of 60 minutes each.

Total Marks : 850

Abbreviations: ESE- End Semester Exam, PA- Progressive Assessment, L - Lectures, T - Tutorial, P - Practical

@ Internal Assessment, # External Assessment, *# On Line Examination, ^ Computer Based Assessment

* Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain LOs required for the attainment of the COs.

~ For the courses having ONLY Practical Examination, the PA marks Practical Part - with 60% weightage and Micro-Project Part with 40% weightage.

➤ If Candidate not securing minimum marks for passing in the "PA" part of practical of any course of any semester then the candidate shall be declared as "Detained" for that semester.



Program Name : Diploma in Automobile Engineering / Civil Engineering Group /
 Electronics Engineering Group / Diploma in Plastic Engineering /
 Diploma in Production Engineering / Diploma in Fashion &
 Clothing Technology/ Computer Engineering Group

Program Code : AE/CE/CR/CS/ DE/EJ/ET/EN/EX/EQ/IS/IC/IE/PG/PT/DC/
 CO/CM/CW/IF

Semester : Sixth

Course Title : Management

Course Code : 22509

1. RATIONALE

An engineer has to work in industry with human capital and machines. Therefore, managerial skills are essential for enhancing their employability and career growth. This course is therefore designed to provide the basic concepts in management principles, safety aspects and Industrial Acts.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Use relevant managerial skills for ensuring efficient and effective management.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

- Use basic management principles to execute daily activities.
- Use principles of planning and organising for accomplishment of tasks.
- Use principles of directing and controlling for implementing the plans.
- Apply principles of safety management in all activities.
- Understand various provisions of industrial acts.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	-	3	90 Min	70*#	28	30*	00	100	40	--	--	--	--	--	--

(*#) Online Theory Examination.

(*) : Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the Cos. (*#): Online examination



Legends: *L*-Lecture; *T* – Tutorial/Teacher Guided Theory Practice; *P* - Practical; *C* – Credit, *ESE* - End Semester Examination; *PA* - Progressive Assessment

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

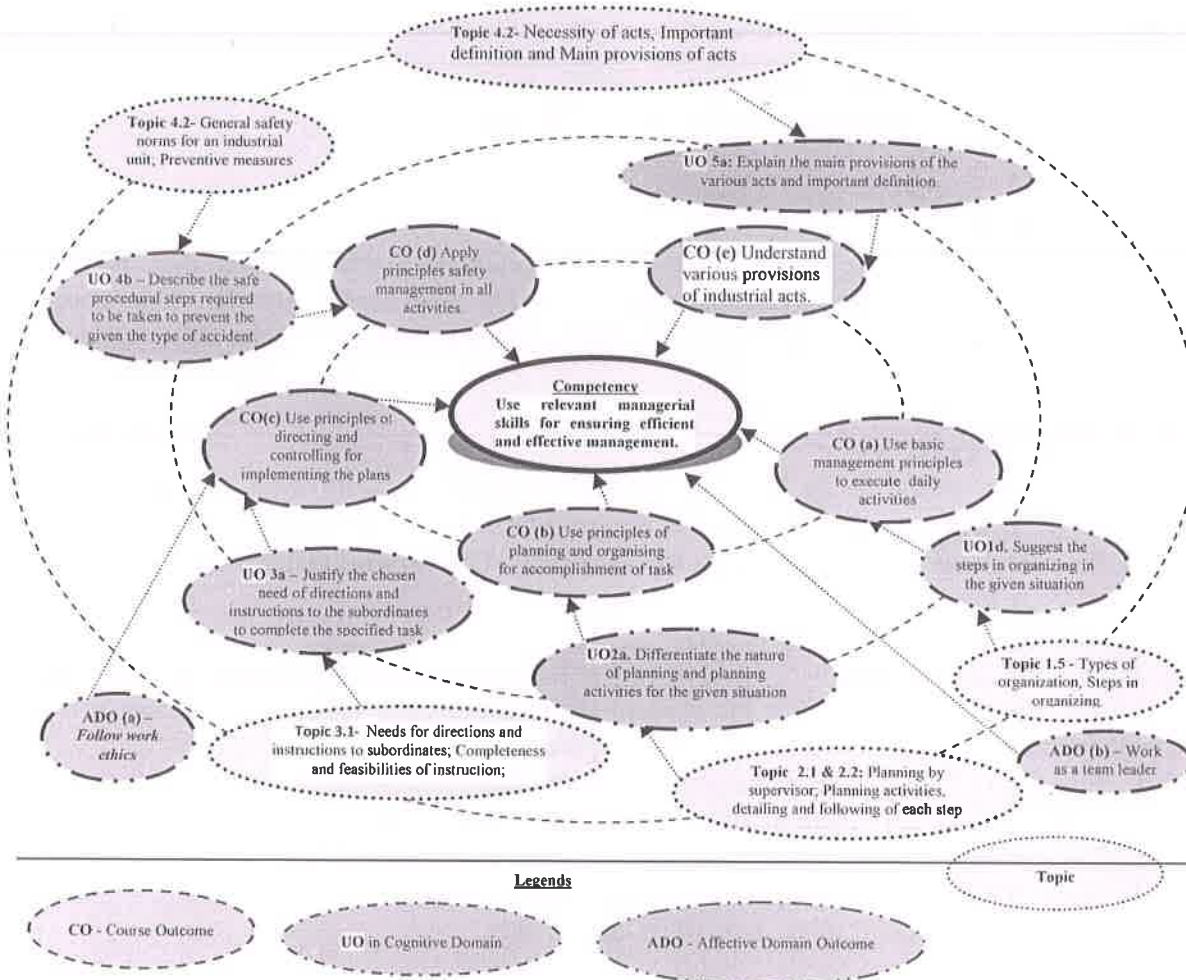


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

- Not applicable -

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

- Not applicable -

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Introduction to management concepts and managerial skills	1a. Differentiate the concept and principles of management for the given situation. 1b. Explain functions of management for given situation. 1c. Compare the features of the given types of planning 1d. Suggest the steps in organizing in the given situation. 1e. Suggest suitable type of organization for the given example. 1f. Identify the functional areas of management for the given situation 1g. Suggest suitable managerial skills for given situation with justification	1.1 Definitions of management, role and importance of management. 1.2 Management characteristics and principles, levels of management and their functions; management, administration and organization, relation between management and administration. 1.3 Functions of management: planning, organizing, leading/directing, staffing and controlling. 1.4 Types of planning and steps in planning 1.5 Types of organization, Steps in organizing 1.6 Functional areas of management. 1.7 Managerial skills.
Unit – II Planning and organizing at supervisory level	2a. Differentiate the nature of planning and planning activities for the given situation. 2b. Suggest the step wise procedure to complete the given activity in the shop floor. 2c. Prepare materials and manpower budget for the given production activity. 2d. Describe with block diagrams the organization of the physical resources required for the given situation. 2e. Describe the human needs to satisfy the job needs for the specified situation. 2f. List the tasks to be done by the concerned individuals for completing the given activity.	Planning at supervisory level 2.1 Planning by supervisor. 2.2 Planning activities, detailing and following of each step. 2.3 Prescribing standard forms for various activities. 2.4 Budgeting for materials and manpower. Organizing at supervisory level 2.5 Organizing the physical resources. 2.6 Matching human need with job needs. 2.7 Allotment of tasks to individuals and establishing relationship among persons working in a group
Unit– III Directing and Controlling at supervisory level	3a. Justify the chosen need of directions and instructions to the subordinates to complete the specified task. 3b. Select the feasible set of instructions to complete the given simple task, with justification 3c. Predict the possible mistakes for completing the given simple activity. 3d. Describe the managerial control	Directing at supervisory level 3.1 Needs for directions and instructions to subordinates; Completeness and feasibilities of instructions 3.2 Personal counselling advanced predictions of possible mistakes. 3.3 Elaborating decisions, laying disciplinary standards in overall working Controlling at supervisory level



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	actions and remedial measures required to be taken for completing the given task successfully.	3.4 Managerial control; Understanding team and link between various departments in respect of process and quality standards; Steps in control process 3.5 Controlling methods; Control over the performance in respect of quality, quantity of production, time and cost. Measuring performance, comparing with standards, correcting unfavorable deviations.
Unit – IV Safety Management	4a. State the general safety norms required to be taken in the given case. 4b. Suggest preventive measures of plant activities in the given situation. 4c. Describe the safe procedural steps required to be taken to prevent the given type of accident. 4d. Prepare a work permit in to conduct the given maintenance activity. 4e. Explain the causes of the specified type of accident in the given situation. 4f. Prepare the specifications of the firefighting equipment required for the given type of fire.	4.1 Need for safety management measures 4.2 General safety norms for an industrial unit; Preventive measures. 4.3 Definition of accident, types of industrial accident; Causes of accidents; 4.4 Fire hazards; Fire drill. 4.5 Safety procedure 4.6 Work permits.
Unit – V Legislative Acts	5a. Explain the purpose of the act 5b. Explain the main provisions of the various acts and important definition.	5.1 Necessity of acts, Important definition and Main provisions of acts. 5.2 Industrial Acts: a. Indian Factory Act b. Industrial Dispute Act c. Workman Compensation Act d. Minimum Wages Act

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to management	12	06	06	04	16

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
	concepts and managerial skills					
II	Planning and organizing at supervisory level	08	04	06	04	14
III	Directing and controlling at supervisory level	08	04	06	04	14
IV	Safety Management	08	04	06	04	14
V	Legislative Acts	12	02	06	04	12
Total		48	20	30	20	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Write assignments based on the theory taught in classrooms. Assignments consist of ten questions having long answers including charts, symbols, drawing, observations etc.
- Prepare/Download information about various industrial acts.
- Visit to any Manufacturing industry and prepare a report consisting of:
 - Organization structure of the organization/ Dept.
 - Safety measures taken in organization.
 - Mechanism to handle the disputes.
 - Any specific observation you have noticed.
- Give seminar on relevant topic.
- Undertake micro-projects.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Guide student(s) in undertaking micro-projects.
- Demonstrate students thoroughly before they start doing the practice.



- g. Encourage students to refer different websites to have deeper understanding of the subject.
- h. Observe continuously and monitor the performance of students in Lab.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

- a. Study of management principles applied to a small scale industry.
- b. Study of management principles applied to a medium scale industry.
- c. Study of management principles applied to a large scale industry.
- d. Prepare case studies of Safety measures followed in different types of organization.
- e. Study of measures to be taken for ensuring cyber security.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Management and entrepreneurship	Veerabhadrappe, Havinal	New age international publishers, New Delhi, 2014: ISBN: 978-81-224-2602-1
2	Principles of management	Chaudhry omvir Singh prakash	New Age international publishers, 2012, New Delhi ISBN: 978-81-224-3039-4
3	Industrial Engineering and management	Dr. O. P. Khanna	Dhanpath ray and sons, New Delhi
4	Industrial Engineering and management	Banga and Sharma	Khanna Publication, New Delhi

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

- a. <https://www.versesolutions.com/>
- b. <https://www.books.google.co.in/books?isbn=817758412X>
- c. <https://www. www.educba.com> › Courses › Business › Management



Program Name : Computer Engineering Program Group
Program Code : CO/CM/IF/CW
Semester : Sixth
Course Title : Programming with 'Python'
Course Code : 22616

1. RATIONALE

Python is powerful programming language. It has efficient high-level data structures and a simple but effective approach to object-oriented programming. Python code is simple, short, readable, intuitive, and powerful, and thus it is effective for introducing computing and problem solving to beginners. Its elegant syntax and dynamic typing, together with its interpreted nature, make it an ideal language for scripting and rapid application development in many areas on most platforms.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Develop general purpose programming using python to solve problems**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry-oriented* COs associated with the above-mentioned competency:

- Display message on screen using Python script on IDE.
- Develop python program to demonstrate use of Operators
- Perform operations on data structures in Python.
- Develop functions for given problem.
- Design classes for given problem.
- Handle exceptions.

4. TEACHING AND EXAMINATION SCHEME

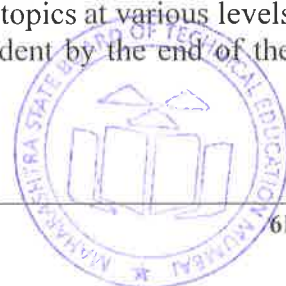
Teaching Scheme			Credit (L+T+P)	Examination Scheme													
L	T	P		Theory								Practical					
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
			Max		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min		
3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	

(*): Under the theory PA, out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the



course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

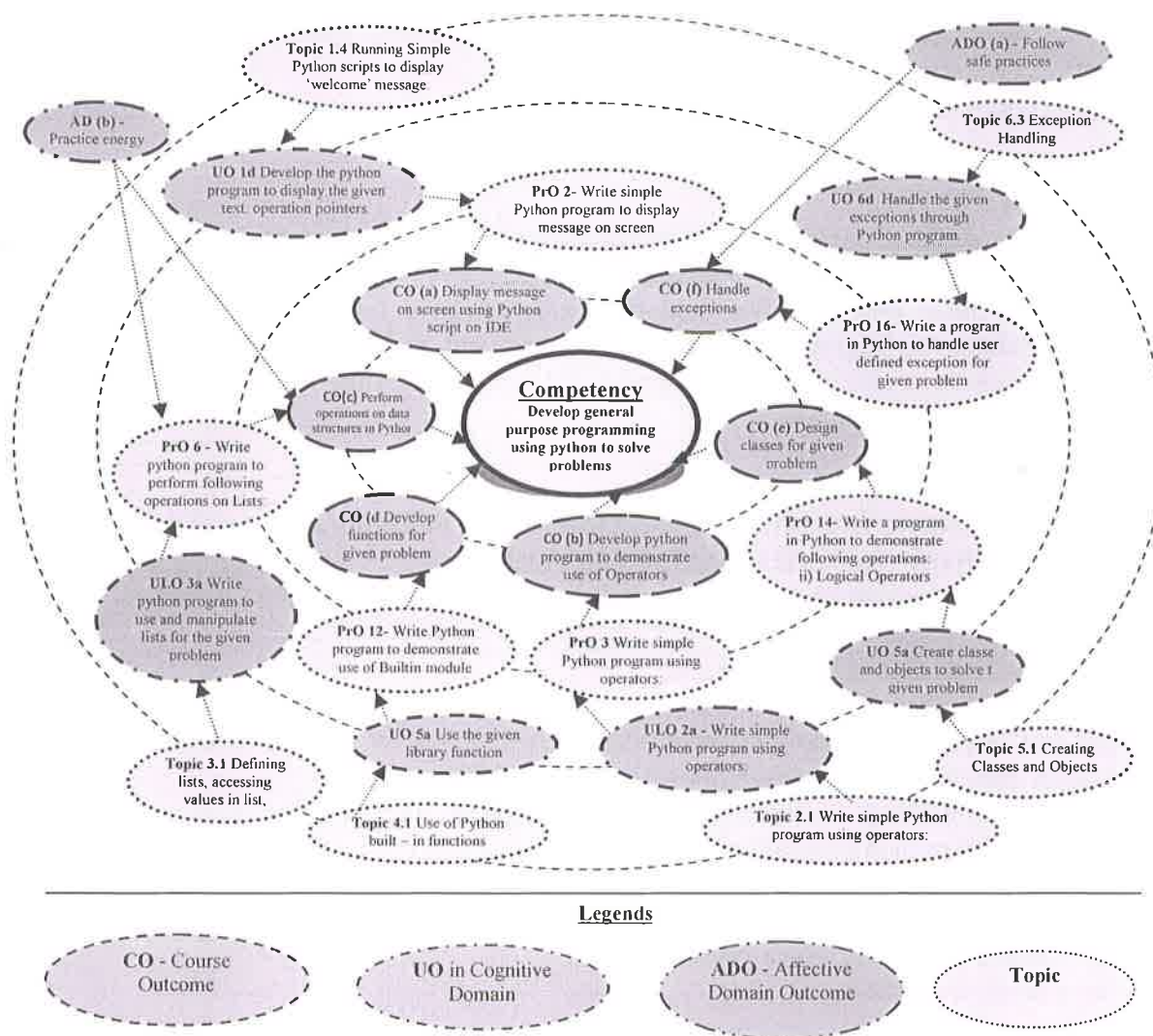


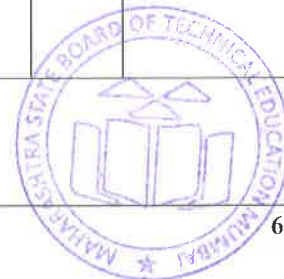
Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Install and configure Python IDE	I	02
2	Write simple Python program to display message on screen	I	02
3	Write simple Python program using operators: a) Arithmetic Operators b) Logical Operators c) Bitwise Operators	II	02
4	Write simple Python program to demonstrate use of conditional statements: a) 'if' statement	II	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	b) 'if ... else' statement c) Nested 'if' statement		
5	Write python program to demonstrate use of looping statements: a) 'while' loop b) 'for' loop c) Nested loops	II	02
6	Write python program to perform following operations on Lists: a) Create list b) Access list c) Update list (Add item, Remove item) d) Delete list	III	02
7	Write python program to perform following operations on Tuples: a) Create Tuple b) Access Tuple c) Update Tuple d) Delete Tuple	III	02
8	Write python program to perform following operations on Tuples: a) Create Set b) Access Set elements c) Update Set d) Delete Set	III	02
9	Write python program to perform following operations on Dictionaries: a) Create Dictionary b) Access Dictionary elements c) Update Dictionary d) Delete Set e) Looping through Dictionary	III	02
10	a) Write Python program to demonstrate math built- in functions (Any 2 programs) b) Write Python program to demonstrate string built – in functions (Any 2 programs)	IV	02
11	Develop user defined Python function for given problem: a) Function with minimum 2 arguments b) Function returning values	IV	02
12	Write Python program to demonstrate use of: a) Builtin module (e.g. keyword, math, number, operator) b) user defined module.	IV	02
13	Write Python program to demonstrate use of: a) built-in packages (e.g. NumPy, Pandas) b) user defined packages	IV	02
14	Write a program in Python to demonstrate following operations: a) Method overloading b) Method overriding	V	02
15	Write a program in Python to demonstrate following operations: a) Simple inheritance b) Multiple inheritance	V	02



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
16	Write a program in Python to handle user defined exception for given problem	VI	02
Total			32

Note

- A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. All the above listed practical need to be performed compulsorily, so that the student reaches the 'Applying Level' of Blooms's 'Cognitive Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO are to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Correctness of business logic	40
2	Debugging ability	20
3	Quality of input and output displayed (messaging and formatting)	10
4	Answer to sample questions	20
5	On time term work submission	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Work collaboratively in team
- Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year.
- 'Organization Level' in 2nd year.
- 'Characterization Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practicals, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. S. No.
1	Computer system (Any computer system with basic configuration)	All
2	'Python' Interpreter/ IDE	



8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed to develop UOs in cognitive domain for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Introduction and Syntax of Python Program	1a. Identify the given Variables, Keywords and constants in Python 1b. Use indentation, comments in the given program. 1c. Install the given Python IDE and editor. 1d. Develop the python program to display the given text.	1.1 Features of Python – Interactive, Object – oriented, Interpreted, platform independent 1.2 Python building blocks – Identifiers, Keywords, Indention, Variables, Comments 1.3 Python environment setup – Installation and working of IDE 1.4 Running Simple Python scripts to display 'welcome' message. 1.5 Python Data Types: Numbers, String, Tuples, Lists, Dictionary. Declaration and use of data types
Unit– II Python Operators and Control Flow statements	2a. Write simple Python program for the given arithmetic expressions. 2b. Use different types of operators for writing the the arithmetic expressions. 2c. Write a 'Python' program using decision making structure for two-way branching to solve the given problem. 2d. Write a 'Python' program using decision making structure for multi-way branching to solve the given problem.	2.1 Basic Operators: Arithmetic, Comparison/ Relational, Assignment, Logical, Bitwise, Membership, Identity operators, Python Operator Precedence 2.2 Control Flow: 2.3 Conditional Statements (if, if ... else, nested if) 2.4 Looping in python (while loop, for loop, nested loops) 2.5 loop manipulation using continue, pass, break, else.



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit- III Data Structures in Python	3a. Write python program to use and manipulate lists for the given problem 3b. Write python program to use and manipulate Tuples for the given problem 3c. Write python program to use and manipulate Sets for the given problem 3d. Write python program to use and manipulate Dictionaries for the given problem	3.1 Lists: a) Defining lists, accessing values in list, deleting values in list, updating lists. b) Basic List Operations c) Built – in List functions 3.2 Tuples: a) Accessing values in Tuples, deleting values in Tuples, and updating Tuples. b) Basic Tuple operations. c) Built – in Tuple functions 3.3 Sets: a) Accessing values in Set, deleting values in Set and updating Sets. b) Basic Set operations. c) Built – in Set functions 3.4 Dictionaries: a) Accessing values in Dictionary, deleting values in Dictionary and updating Dictionary. b) Basic Dictionary operations. c) Built – in Dictionaries functions
Unit-IV Python Functions, modules, and Packages	4a. Use the Python standard functions for the given problem. 4b. Develop relevant user defined functions for the given problem using Python code. 4c. Write Python module for the given problem 4d. Write Python package for the given problem	4.1 Use of Python built – in functions (e.g. type/ data conversion functions, math functions etc.) 4.2 User defined functions: Function definition, Function calling, function arguments and parameter passing, Return statement, Scope of Variables: Global variable and Local Variable. 4.3 Modules: Writing modules, importing modules, importing objects from modules, Python built – in modules (e.g. Numeric and mathematical module, Functional Programming Module) Namespace and Scoping. 4.4 Python Packages: Introduction, Writing Python packages, Using standard (e.g. math, scipy, Numpy, matplotlib, pandas etc.) and user defined packages
Unit-V Object Oriented Program ming in Python	5a Create classes and objects to solve the given problem. 5b Write Python code for data hiding for the given problem. 5c Write Python code using data abstraction for the given problem. 5d Write Python program using inheritance for the	5.1 Creating Classes and Objects. 5.2 Method Overloading and Overriding. 5.3 Data Hiding. 5.4 Data abstraction. 5.5 Inheritance and composition classes 5.6 Customization via inheritance specializing inherited methods.



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	given problem.	
Unit –VI File I/O Handling and Exception Handling	6a Write Python code for the given reading values from keyboard 6b Read data from the given file. 6c Write the given data to a file. 6d Handle the given exceptions through Python program.	6.1 I/O Operations: Reading keyboard input, Printing to screen 6.2 File Handling: Opening file in different modes, accessing file contents using standard library functions, Reading and writing files, closing a file, Renaming and deleting files, Directories in Python, File and directory related standard functions 6.3 Exception Handling: Introduction, Exception handling - 'try: except:' statement, 'raise' statement, User defined exceptions

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

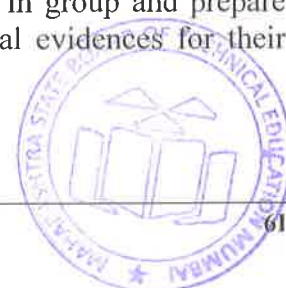
Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction and Syntax of Python Program	04	02	02	04	08
II	Python Operators and Control Flow statements	06	02	04	04	10
III	Data Structures in Python	12	02	04	08	14
IV	Python Functions, modules, and Packages	12	02	02	10	14
V	Object Oriented Programming in Python	08	02	02	08	12
VI	File I/O Handling and Exception Handling	06	02	02	08	12
Total		48	12	16	42	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:



- a) Prepare journal of practicals.
- b) Undertake micro-projects.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- a) Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- b) '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c) About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d) With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- e) Guide student(s) in undertaking micro-projects.
- f) Demonstrate students thoroughly before they start doing the practice.
- g) Encourage students to refer different websites to have deeper understanding of the subject.
- h) Observe continuously and monitor the performance of students in Lab.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

- a) Create an English dictionary which is able to perform following function.
 - i. Add a word and its meaning.
 - ii. Delete a word and its meaning.
 - iii. Update word or its meaning.
 - iv. Print list of word and its meaning.
 - b) To create simple calculator using classes and objects.
 - c) Develop student management system which will able to:
 - i) Add ii) Delete iii) Update iv) Display student related information like Roll No, Name, Age, Address, Email-Id, Contact Number etc.
 - d) Any other micro-projects suggested by subject faculty on similar line.
- (Use functions, Classes, Objects and other features of 'Python' to develop above listed applications)



13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Python Programing	Rao, K. Nageswara Shaikh Akbar	Scitech Publications (India) Pvt. Ltd. ISBN: 9789385983450
2	Learning Python	Lutz, Mark	5th Edition, O'Reilly Publication ISBN-13: 978-1449355739
3	Python Essential Reference	Beazley, David	4th Edition, Addison-Wesley Professional, ISBN: 9780672329784
4	Head First Python, 2nd Edition	Paul, Barry	O'Reilly Publication, 2 nd Edition, ISBN: 1491919531

14. SOFTWARE/LEARNING WEBSITES

- a) <https://www.tutorialspoint.com/python/index.htm>
- b) nptel.ac.in/courses/117106113/34
- c) <https://www.w3schools.com/python/default.asp>
- d) <https://www.programiz.com/python-programming>
- e) <http://spoken-tutorial.org/>
- f) <https://docs.python.org/3/tutorial/errors.html>
- g) <https://www.w3resource.com/python-exercises/>
- h) <https://www.anandology.com/python-practice-book/>





Program Name : Computer Engineering Program Group
Program Code : CO/CM/IF/CW
Semester : Sixth
Course Title : Mobile Application Development
Course Code : 22617

1. RATIONALE

Android application development is one of the rising and growing trend in the industry of mobile. This course examines the principles of mobile application design and covers the necessary concepts which are required to understand mobile based applications and develop Android based Applications in particular. After completing this course students will design and build a variety of real-time Apps using Android.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Create simple Android applications.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Interpret features of Android operating system.
- Configure Android environment and development tools.
- Develop rich user Interfaces by using layouts and controls.
- Use User Interface components for android application development.
- Create Android application using database.
- Publish Android applications.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme													
L	T	P		Theory								Practical					
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
3	-	4	7	3	70	28	30*	00	100	40	25#	10	25	10	50	20	

(*): Under the theory PA; Out of 30 marks, 10 marks of theory PA are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: L-Lecture; T- Tutorial/Teacher Guided Theory Practice; P -Practical; C – Credit, ESE -End Semester Examination; PA - Progressive Assessment.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

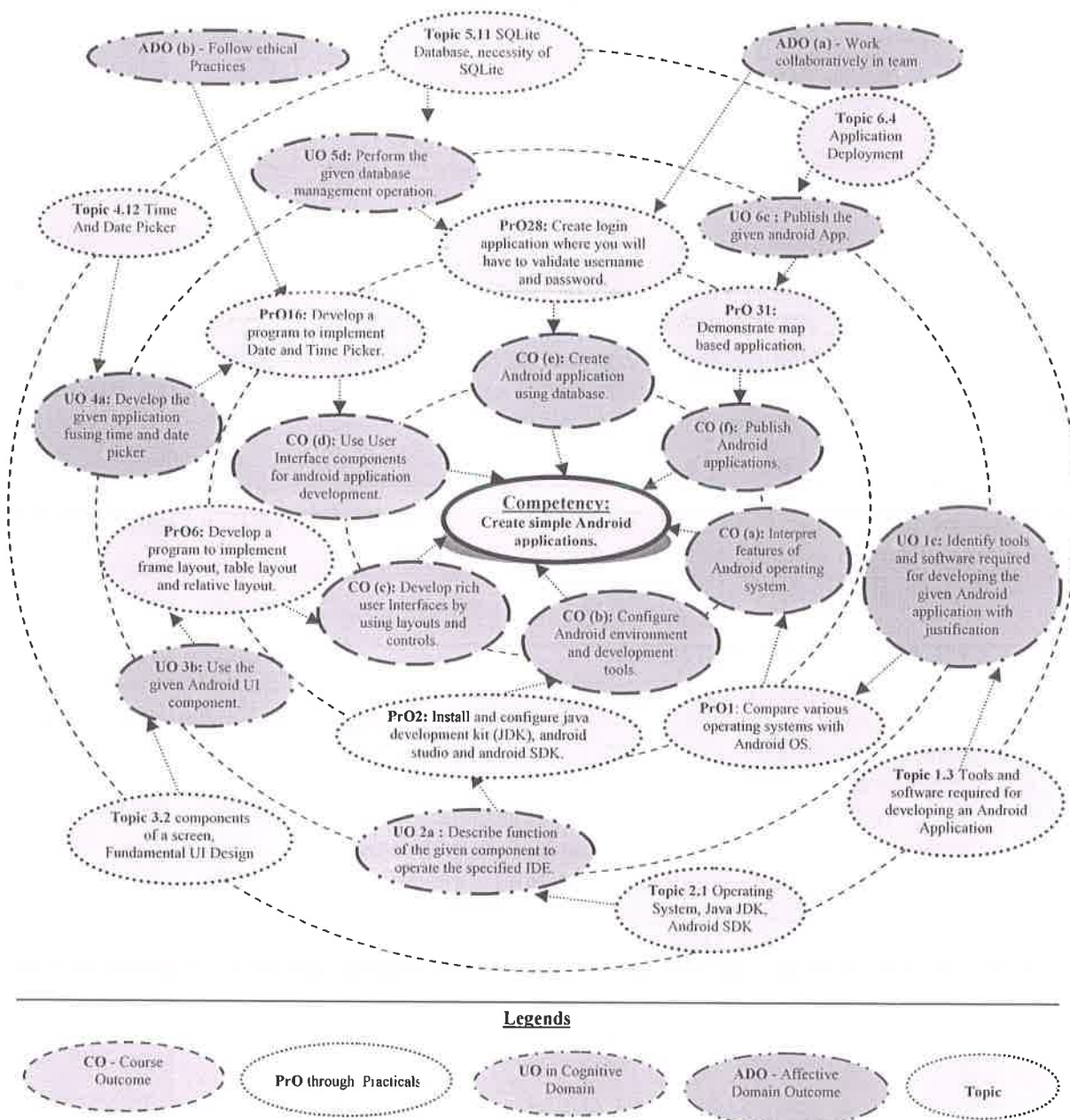


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the above stated competency.

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Compare various operating systems with Android OS.	I	2
2	Install /configure java development kit (JDK), android studio and android SDK.	II	2*
3	Configure android development tools (ADT) plug-in and create android virtual device.	II	2*
4	Develop a program to display Hello World on screen.	III	2*
5	Develop a program to implement linear layout and absolute layout.	III	2*

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
6	Develop a program to implement frame layout, table layout and relative layout.	III	2*
7	Develop a program to implement Text View and Edit Text.	IV	2*
8	Develop a program to implement Auto Complete Text View.	IV	2
9	Develop a program to implement Button, Image Button and Toggle Button.	IV	2*
10	Develop a program to implement login window using above UI controls.	IV	2*
11	Develop a program to implement Checkbox.	IV	2*
12	Develop a program to implement Radio Button and Radio Group.	IV	2*
13	Develop a program to implement Progress Bar.	IV	2*
14	Develop a program to implement List View, Grid View, Image View and Scroll View.	IV	2*
15	Develop a program to implement Custom Toast Alert.	IV	2*
16	Develop a program to implement Date and Time Picker.	IV	2*
17	Develop a program to create an activity.	V	2*
18	Develop a program to implement new activity using explicit intent and implicit intent.	V	2*
19	Develop a program to implement content provider.	V	2
20	Develop a program to implement service.	V	2
21	Develop a program to implement broadcast receiver.	V	2*
22	Develop a program to implement sensors.	V	2*
23	Develop a program to build Camera.	V	2*
24	Develop a program for providing Bluetooth connectivity.	V	2*
25	Develop a program for animation.	V	2
26	Perform Async task using SQLite.	V	2*
27	Create sample application with login module. (Check username and password) On successful login, Change TextView "Login Successful". And on login fail, alert user using Toast "Login fail".	V	2*
28	Create login application where you will have to validate username and password till the username and password is not validated, login button should remain disabled.	V	2*
29	Develop a program to: a) Send SMS b) Receive SMS	VI	2*+2*
30	Develop a program to send and receive e-mail.	VI	2*
31	Deploy map based application. Part I	VI	2*
32	Deploy map based application. Part II	VI	2*
Total			66

Note

- A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. The practicals marked as '*' are compulsory, so that the student reaches the 'Application Level' of Bloom's Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO are to be assessed according to a suggested sample given below:



S. No.	Performance Indicators	Weightage in %
1	Correctness of User Interface design	30
2	Correctness of business logic applied	40
3	Debugging ability	10
4	Correctness of answers to sample questions	10
5	On time submission	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Work collaboratively in team
- Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year.
- 'Organization Level' in 2nd year.
- 'Characterization Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practicals, as well as aid to procure equipment by authorities concerned.

Sr. No.	Equipment Name with Broad Specifications	PrO. No.
1	Computer system (Any computer system which is available in laboratory with minimum 2GB RAM)	All
2	Any compatible open source tools (e.g. Android Studio/ Eclipse IDE, Any compatible web server, Any compatible database tool e.g. SQLite)	

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed to develop UOs in cognitive domain for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Android and its tools	1a. Explain the given basic terms related to Android system. 1b. Explain with sketches Android architecture for the given application. 1c. Identify tools and software required for developing the given Android application with justification.	1.1 Introduction to Android, open handset alliance, Android Ecosystem. 1.2 Need of Android, Features Of Android 1.3 Tools and software required for developing an Android Application 1.4 Android Architecture

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	1d. Explain significance of the given component in Android architecture.	
Unit- II Installation and configuration of Android	2a. Describe function of the given component to operate the specified IDE. 2b. Explain the given term related to virtual machine. 2c. Explain the given basic term related to Android development tools. 2d. Describe the features of given android emulator. 2e. Describe the steps to configure the given android development environment	2.1 Operating System, Java JDK, Android SDK 2.2 Android Development Tools(ADT) 2.3 Android Virtual Devices(AVDs) 2.4 Emulators 2.5 Dalvik Virtual Machine, Difference between JVM and DVM 2.6 Steps to install and configure Android Studio and SDK
Unit- III UI Components and Layouts	3a. Explain with relevant analogy the given Directory Structure. 3b. Describe the steps to use the given Android rich UI component. 3c. Describe the steps to use the given type of Layout. 3d. Develop the given basic Android application.	3.1 Control Flow, Directory Structure 3.2 Components of a screen, Fundamental UI Design 3.3 Linear Layout; Absolute Layout; Frame Layout; Table Layout; Relative Layout
Unit-IV Designing User Interface With View	4a. Develop rich user Interfaces for the given Android application. 4b. Develop Android application using the given view. 4c. Explain the significance of the given display Alert. 4d. Develop the given application using time and date picker.	4.1 Text View, Edit Text; Button, Image Button; Toggle Button; Radio Button And Radio Group; Checkbox; Progress Bar 4.2 List View; Grid View; Image View; Scroll View; Custom Toast Alert 4.3 Time And Date Picker
Unit –V Activity And Multimedia with databases	5a. Apply the given Intents and service in Application development. 5b. Use Fragment to generate the given multiple activities. 5c. Develop programs to play the given multimedia. 5d. Write the query to perform the given database management operation.	5.1 Intent, Intent_Filter 5.2 Activity Lifecycle; Broadcast Lifecycle 5.3 Content Provider; Fragments 5.4 Service: Features Of service, Android platform service, Defining new service, Service Lifecycle, Permission, example of service 5.5 Android System Architecture, Multimedia framework, Play Audio and Video, Text to speech, Sensors, Async tasks 5.6 Audio Capture, Camera 5.7 Bluetooth, Animation 5.8 SQLite Database, necessity of SQLite, Creation and connection

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		of the database, extracting value from cursors, Transactions.
Unit –VI Security and Application Deployment	6a. Explain the given location based service. 6b. Write the steps to customize the given permissions for users. 6c. Explain features of the given android security service. 6d. Write the steps to publish the given android App.	6.1 SMS Telephony 6.2 Location Based Services: Creating the project, Getting the maps API key, Displaying the map, Displaying the zoom control, Navigating to a specific location, Adding markers, Getting location, Geocoding and reverse Geocoding, Getting Location data, Monitoring Location. 6.3 Android Security Model, Declaring and Using Permissions, Using Custom Permission. 6.4 Application Deployment: Creating Small Application, Signing of application, Deploying app on Google Play Store, Become a Publisher, Developer Console

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

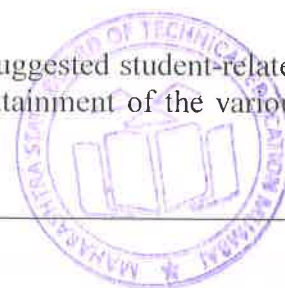
Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Android and its tools	04	02	02	-	04
II	Installation and configuration of Android	06	02	02	02	06
III	UI Components and Layouts	08	02	02	04	08
IV	Designing User Interface With View	10	02	02	08	12
V	Activity and Multimedia with databases	18	02	06	12	20
VI	Security and Application Deployment	18	02	06	12	20
Total		64	12	20	38	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of LOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various



outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- a) Prepare journal of practical.
- b) Undertake micro-projects.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- a) Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- b) '**L**' in **item No. 4** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c) About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d) With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- e) Use different Audio Visual media for Concept understanding.
- f) Guide student(s) in undertaking micro-projects.
- g) Demonstrate students thoroughly before they start doing the practice.
- h) Ensure use of latest version of tools.
- i) Encourage students to refer various web sites to have detail understanding of JSP and related concepts.
- j) Encourage students to refer different web-applications to have deeper understanding of web-applications.
- k) Observe continuously the performance of students in laboratory.

12. SUGGESTED MICRO-PROJECTS

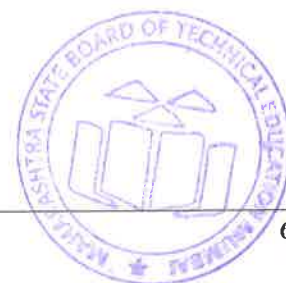
Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

- a) Develop an android application on traffic surveying.
- b) Develop an android application on online shopping.
- c) Develop an android application for making a calculator.
- d) Develop an android application for game.

Guidelines For Developing Micro Projects:



(Implement Following Relevant Guidelines For Micro Projects)

- i. Must implement concepts of Advance java.
- ii. Must publish the sample application on play store.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Android	Dixit, Prasanna Kumar	Vikas Publications, New Delhi 2014, ISBN: 9789325977884
2	Pro Android 5	Maclean David, Komatineni Satya, Allen Grant	Apress Publications, 2015, ISBN: 978-1-4302-4680-0
3	Android Programming for Beginners	Hortan, John	Packet Publication, 2015, ISBN: 978-1-78588-326-2

14. SOFTWARE/LEARNING WEBSITES

- a) <https://www.tutorialspoint.com/android>
- b) <http://developer.android.com/guide/index.html>.
- c) <http://developer.android.com/reference/packages.html>
- d) <http://developer.android.com/guide/components/fundamentals.html>
- e) <http://developer.android.com/guide/topics/ui/index.html>
- f) <http://developer.android.com/guide/topics/ui/declaring-layout.html>
- g) https://www.tutorialspoint.com/android/android_advanced_tutorial.pdf



Program Name : Computer Engineering Program Group
Program Code : CO/CM/IF/CW
Semester : Sixth
Course Title : Emerging Trends in Computer and Information Technology
Course Code : 22618

4a. RATIONALE

Advancements and applications of Computer Engineering and Information Technology are ever changing. Emerging trends aims at creating awareness about major trends that will define technological disruption in the upcoming years in the field of Computer Engineering and Information Technology. These are some emerging areas expected to generate revenue, increasing demand as IT professionals and open avenues of entrepreneurship.

4b. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Acquire knowledge of emerging trends.

4c. COURSE OUTCOMES (COs)

- Describe Artificial Intelligence, Machine learning and deep learning
- Interpret IoT concepts
- Compare Models of Digital Forensic Investigation.
- Describe Evidence Handling procedures.
- Describe Ethical Hacking process.
- Detect Network, Operating System and applications vulnerabilities

4d. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	--	--	3	90 Min	70*#	28	30*	00	100	40	--	--	--	--	--	--

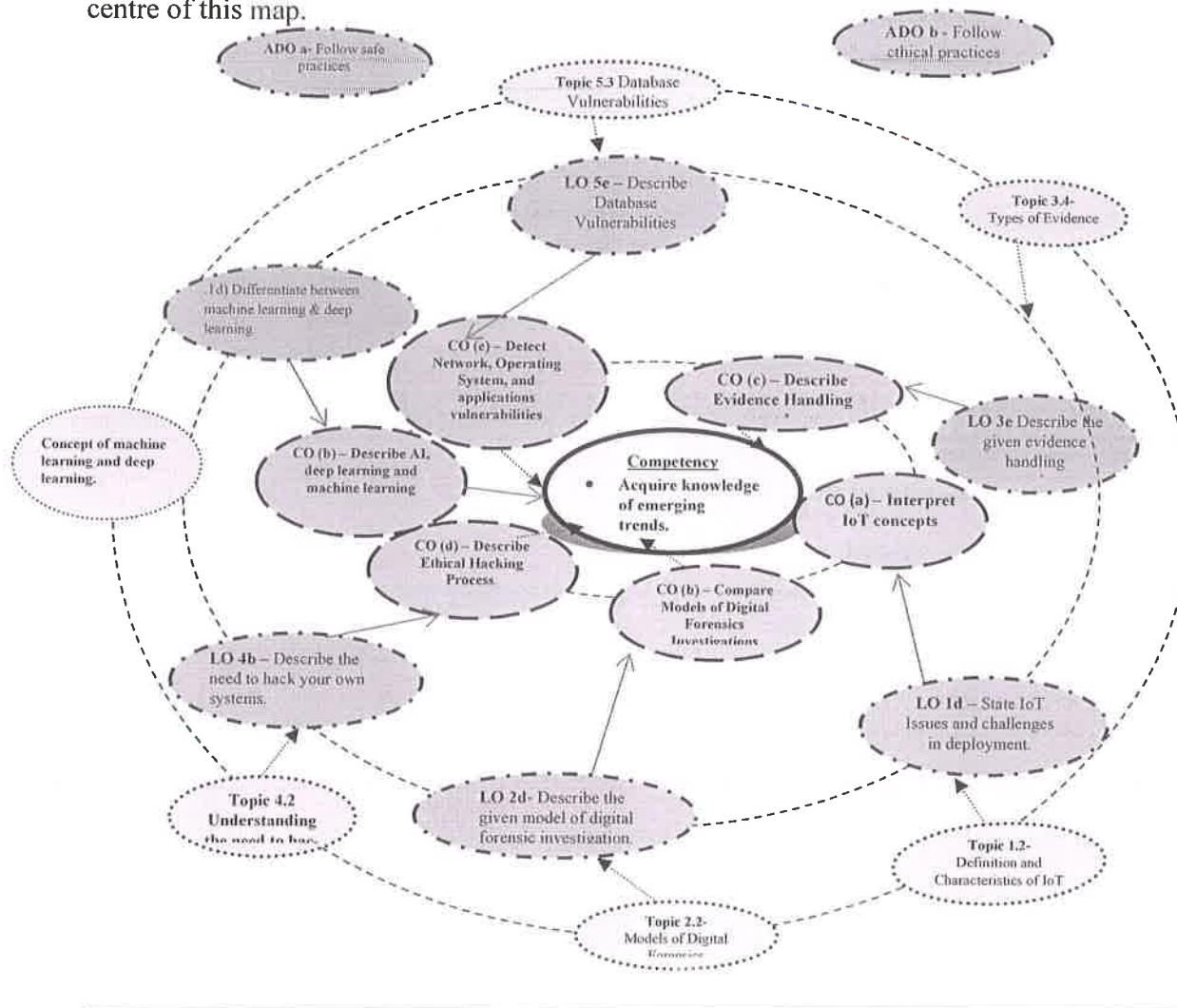
(*): Under the theory PA; Out of 30 marks, 10 marks of theory PA are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests(MCQ type) to be taken during the semester for the assessment of the UOs required for the attainment of the COs. (*#) :Online Examination

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P -Practical; C – Credit, ESE -End Semester Examination; PA - Progressive Assessment.



4e. COURSE MAP (with sample COs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

**Legends****Figure 1 - Course Map**

4f. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	Not Applicable		

4g. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO
	Not Applicable	

4h. UNDERPINNING THEORY COMPONENTS

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit I : Artificial Intelligence (06m, 4 hrs)	1a) Describe the concept of AI. 1b) State the components of AI. 1c) List applications of AI 1d) Differentiate between machine learning & deep learning.	1.1 Introduction of AI <ul style="list-style-type: none"> • Concept • Scope of AI • Components of AI • Types of AI • Application of AI 1.2 Concept of machine learning and deep learning.
Unit II: Internet of Things (18m,12 hrs)	2a) State the domains and application areas of Embedded Systems 2b) Describe IoT systems in which information and knowledge are inferred from data. 2c) Describe designs of IoT. 2d) State IoT Issues and challenges in deployment.	2.1 Embedded Systems: <ul style="list-style-type: none"> • Embedded system concepts, purpose of Embedded Systems, Architecture of Embedded Systems, Embedded Processors- PIC, ARM, AVR, ASIC 2.2 IoT: Definition and characteristics of IoT <ul style="list-style-type: none"> • Physical design of IoT, <ul style="list-style-type: none"> ○ Things of IoT ○ IoT Protocols • Logical design of IoT, <ul style="list-style-type: none"> ○ IoT functional blocks, ○ IoT Communication models, ○ IoT Communication APIs, • IoT Enabling Technologies • IoT levels and deployment



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		templates <ul style="list-style-type: none"> IoT Issues and Challenges, Applications IoT Devices and its features: Arduino, Uno, Raspberry Pi, Node Microcontroller Unit
Unit III: Basics of Digital Forensics (8m-5 hrs)	3a. Describe the history of digital forensics 3b. Define digital forensics. 3c. List the rules of digital forensic 3d. Describe the given model of digital forensic investigation. 3e. State the ethical and unethical issues in digital forensics	3.1 Digital forensics <ul style="list-style-type: none"> Introduction to digital forensic History of forensic Rules of digital forensic Definition of digital forensic Digital forensics investigation and its goal 3.2 Models of Digital Forensic Investigation <ul style="list-style-type: none"> Digital Forensic Research Workshop Group (DFRWS) Investigative Model Abstract Digital Forensics Model (ADFM) Integrated Digital Investigation Process (IDIP) End to End digital investigation process (EEDIP) An extended model for cybercrime investigation UML modeling of digital forensic process model (UMDFPM) 3.3 Ethical issues in digital forensic <ul style="list-style-type: none"> General ethical norms for investigators Unethical norms for investigation
Unit IV: Digital Evidence (10M- 08 Hrs)	4a. Define digital evidence. 4b. List the rules of digital evidence. 4c. State characteristics of digital evidence. 4d. Describe the given type of evidences 4e. Describe the given evidence handling procedures	4.1 Digital Evidences <ul style="list-style-type: none"> Definition of Digital Evidence Best Evidence Rule Original Evidence 4.2 Rules of Digital Evidence 4.3 Characteristics of Digital Evidence <ul style="list-style-type: none"> Locard's Exchange Principle Digital Stream of bits 4.4 Types of evidence Illustrative, Electronics, Documented, Explainable, Substantial, Testimonial 4.5 Challenges in evidence handling



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		<ul style="list-style-type: none"> • Authentication of evidence • Chain of custody • Evidence validation 4.6 Volatile evidence
Unit V: Basics of Hacking (12M- 8Hrs)	5a) Define hackers. 5b) Describe the need to hack your own systems. 5c) Describe the dangers in systems. 5d) Describe the Ethical hacking Process 5e) Identify the Hacker's Mindset	5.1 Ethical Hacking <ul style="list-style-type: none"> • How Hackers Beget Ethical Hackers • Defining hacker, Malicious users 5.2 Understanding the need to hack your own systems 5.3 Understanding the dangers your systems face <ul style="list-style-type: none"> • Nontechnical attacks • Network-infrastructure attacks • Operating-system attacks • Application and other specialized attacks 5.4 Obeying the Ethical hacking Principles <ul style="list-style-type: none"> • Working ethically • Respecting privacy • Not crashing your systems 5.5 The Ethical hacking Process <ul style="list-style-type: none"> • Formulating your plan • Selecting tools • Executing the plan • Evaluating results • Moving on 5.6 Cracking the Hacker Mindset <ul style="list-style-type: none"> • What You're Up Against? • Who breaks in to computer systems? • Why they do it? • Planning and Performing Attacks • Maintaining Anonymity
Unit VI: Types of Hacking (16 M- 11 Hrs)	6a. Describe Network Infrastructure Vulnerabilities (wired/wireless) 6b. List operating system Vulnerabilities 6c. Describe Messaging Systems Vulnerabilities 6d. Describe Web Vulnerabilities 6e. Describe Database Vulnerabilities	6.1 Network Hacking Network Infrastructure: <ul style="list-style-type: none"> • Network Infrastructure Vulnerabilities • Scanning-Ports • Ping sweep • Scanning SNMP • Grabbing Banners • Analysing Network Data and Network Analyzer • MAC-daddy attack



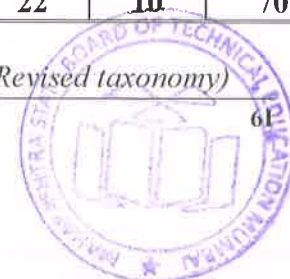
Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		Wireless LANs: <ul style="list-style-type: none"> • Implications of Wireless Network Vulnerabilities, • Wireless Network Attacks 6.2 Operating System Hacking <ul style="list-style-type: none"> • Introduction of Windows and Linux Vulnerabilities 6.3 Applications Hacking Messaging Systems <ul style="list-style-type: none"> • Vulnerabilities, • E-Mail Attacks- E-Mail Bombs, • Banners, • Best practices for minimizing e-mail security risks Web Applications: <ul style="list-style-type: none"> • Web Vulnerabilities, • Directories Traversal and Countermeasures, Database system <ul style="list-style-type: none"> • Database Vulnerabilities • Best practices for minimizing database security risks

4f. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

4g.

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Artificial Intelligence (06m,4 hrs)	04	04	02	--	06
II	Internet of Things (18m,12 hrs)	12	10	04	04	18
III	Basics of Digital Forensics (8m-5 hrs)	05	06	02	00	08
IV	Digital Evidence (10M- 08 Hrs)	08	06	02	02	10
V	Basics of Hacking (12M- 08 Hrs)	08	06	04	02	12
VI	Types of Hacking (16 M- 11 Hrs)	11	06	08	02	16
Total		48	38	22	10	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)



Note: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of LOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

4h. SUGGESTED STUDENT ACTIVITIES

Other than the classroom learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also **collect/record physical evidences for their (student's) portfolio** which will be useful for their placement interviews:

- a) Prepare report on suggestive case study of digital forensic, digital evidence and hacking as give below:
 - i. The Aaron Caffrey case – United Kingdom, 2003
<http://digitalcommons.law.scu.edu/cgi/viewcontent.cgi?article=1370&context=chtlj>
 - ii. The Julie Amero case – Connecticut, 2007
<http://dfir.com.br/wp-content/uploads/2014/02/julieamerosummary.pdf>
 - iii. The Michael Fiola case – Massachusetts, 2008
<http://truthinjustice.org/fiola.htm>.
- b) Prepare report on any given case study of IoT

4i. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

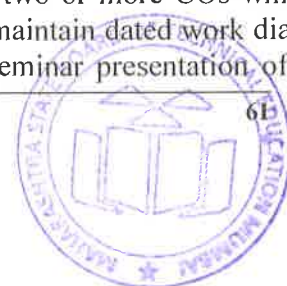
These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- a) Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
- b) '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c) About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d) With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
- e) Use different Audio Visual media for Concept understanding.
- f) Guide student(s) in undertaking micro-projects.
- g) Demonstrate students thoroughly before they start doing the practice.
- h) Observe continuously and monitor the performance of students.

4j. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project is group-based. However, in the fifth and sixth semesters, it should be preferably be *individually* undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In **special situations** where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it



before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a) IoT Based Humidity and Temperature Monitoring

- i. Explain the need of IoT Based Humidity and Temperature Monitoring.
- ii. What will be the hardware requirements for designing this system.
- iii. What will be the software requirements
- iv. Explain how circuit can be designed for this system along with its working
- v. Explain how to design an IoT application and how to store and retrieve a data on it.

b) IoT based Weather Monitoring System

- i. Explain the need of IoT Based Weather Monitoring System.
- ii. What will be the hardware requirements for designing this system.
- iii. What will be the software requirements
- iv. Explain how circuit can be designed for this system along with its working
- v. Explain how to design an IoT application and how to store and retrieve a data on it.

c) Study any case of fake profiling. Identify

- i. The way digital forensics was used in detecting the fraud.
- ii. Where was digital evidence located?
- iii. Effects.

d) Study any case of forgery /falsification crime case solved using digital forensics:

- i. Identify the model used for Digital Investigation.
- ii. Was investigation done ethically or unethically.
- iii. Where was digital evidence found for crime establishment?
- iv. State the punishment meted.

e) Study Credit card fraud as an identity threat. Identify:

- i. Use of digital media in carrying out fraud.
- ii. Vulnerability Exploited.
- iii. Effect of fraud.
- iv. Protection/Precaution to be taken against such frauds.

f) Study any Trojan attack. Identify the Trojan attack:

- i. State the way trojan got installed on particular Machine.
- ii. State the effects of the Trojan.
- iii. Elaborate/Mention/State protection/Blocking mechanism for this specific Trojan, example specification of any anti-threats platform which filters the Trojan.



4k. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	Artificial Intelligence	R.B. Mishra	PHI
2.	Introduction to Embedded systems	Shibu K. V	Tata Mcgraw Hill ISBN 978-0-07-014589-4
3.	Internet Of Things-A Hands-on Approach	Arshadeep Bahga, Vijay Madiseti,	University Press ISBN 978-8-17371-954-7
4.	The Basics of Digital Forensic	John Sammons	Elsevier ISBN 978-1-59749-661-2
5.	Digital Forensic (2017 Edition)	Dr. Nilakashi Jain Dr. Dhananjat R. Kalbande	Wiley Publishing Inc. ISBN: 978-81-265-6574-0
6.	Hacking for Dummies (5th Edition)	Kevin Beaver CISSP	Wiley Publishing Inc. ISBN: 978-81-265-6554-2

4l. SOFTWARE/LEARNING WEBSITES

- a) <https://www.allitebooks.in/the-internet-of-things/>
- b) <https://www.versatek.com/wp-content/uploads/2016/06/IoT-eBook-version5.pdf>
- c) https://www.tutorialspoint.com/internet_of_things/internet_of_things_tutorial.pdf
- d) <http://www.spmkck.co.in/Notes/Learning%20Internet%20of%20Things.pdf>
- e) <https://resources.infosecinstitute.com/digital-forensics-models/#gref>
- f) https://www.researchgate.net/publication/300474145_Digital_Forensics/download
- g) <https://docs.microsoft.com/en-us/sysinternals/downloads/psloggedon>
- h) www.openwall.com/passwords/windows-pwdump
- i) https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_process.htm
- j) <https://slideplayer.com/slide/7480056/>





Program Name : Computer Engineering Program Group
Program Code : CO/CM/IF/CW
Semester : Sixth
Course Title : Web Based Application development with PHP
Course Code : 22619

1. RATIONALE

PHP is a general purpose, server-side scripting language run a web server that's designed to make dynamic pages and applications. PHP as a web development option is secure, fast and reliable. In the growing field of Web technology it is essential for every Diploma pass outs to learn PHP Language to help them build interactive web applications. This course is designed to inculcate web based applications development skills in students using server side scripting with PHP.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Develop simple web-based application using PHP language.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following **industry oriented** COs associated with the above mentioned competency:

- Develop program using control statement.
- Perform operations based on arrays and graphics.
- Develop programs by applying various object oriented concepts.
- Use form controls with validation to collect user's input.
- Perform database operations in PHP.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.



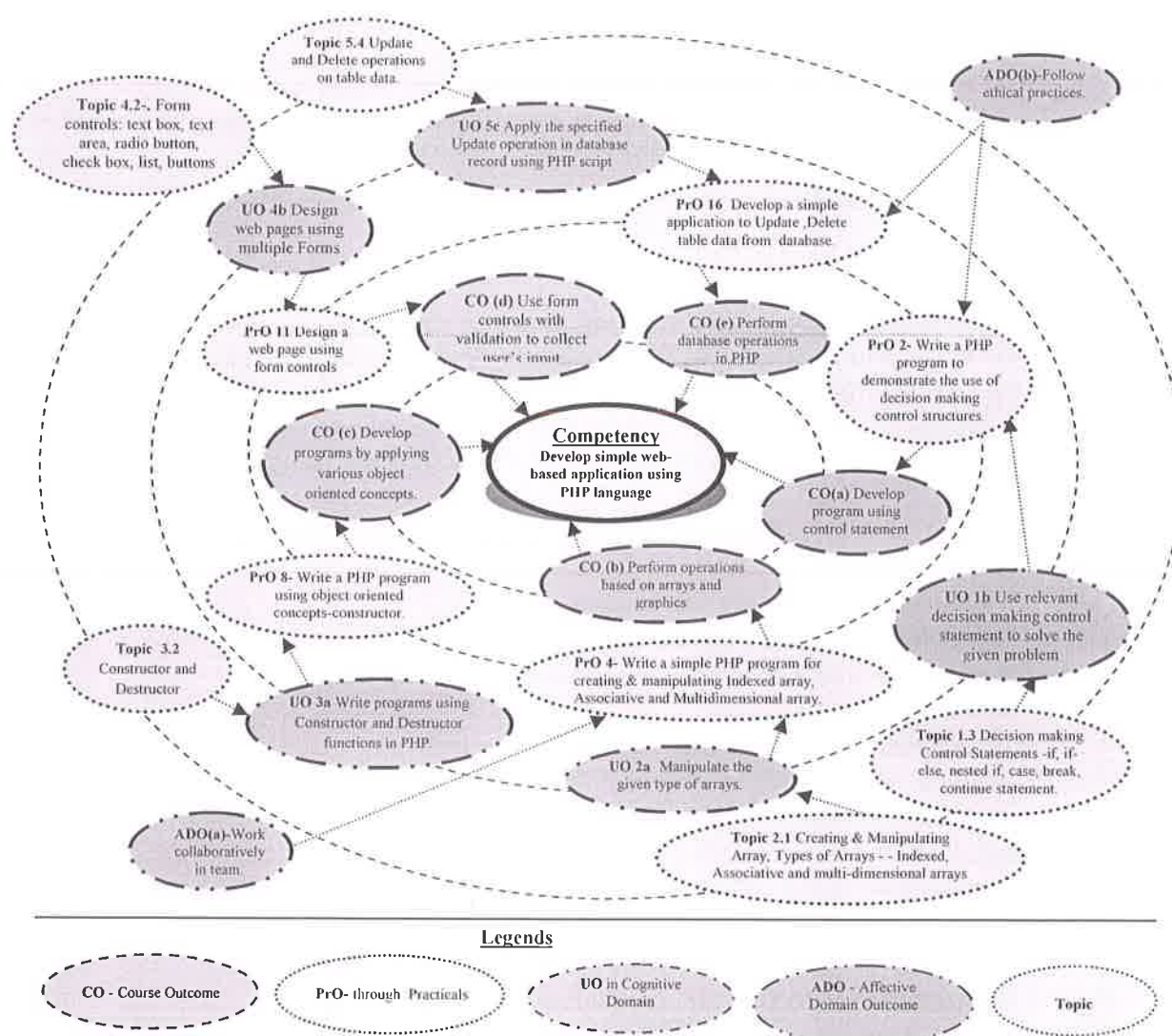


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	a. Install and configure PHP, web server, MYSQL b. Write a program to print "Welcome to PHP". c. Write a simple PHP program using expressions and operators.	I	02*
2	Write a PHP program to demonstrate the use of Decision making control structures using- a. If statement b. If-else statement c. Switch statement	I	02*
3	Write a PHP program to demonstrate the use of Looping structures using- a. While statement, b. Do-while statement c. For statement d. Foreach statement	I	02*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
4	Write a PHP program for creating and manipulating- a. Indexed array b. Associative array c. Multidimensional array	II	02
5	a. Write a PHP program to- i. Calculate length of string. ii. Count the number of words in string -without using string functions. b. Write a simple PHP program to demonstrate use of various built-in string functions.	II	02*
6	Write a simple PHP program to demonstrate use of Simple function and Parameterized function.	II	02
7	Write a simple PHP program to create PDF document by using graphics concepts.	II	02
8	Write a PHP program to- a. Inherit members of super class in subclass. b. Create constructor to initialize object of class --by using object oriented concepts	III	02*
9	Write a simple PHP program on Introspection and Serialization.	III	02
10	Design a web page using following form controls: a. Text box, b. Radio button, c. Check box, d. Buttons	IV	02*
11	Design a web page using following form controls: a. List box, b. Combo box, c. Hidden field box	IV	02*
12	Develop web page with data validation.	IV	02*
13	Write simple PHP program to - a. Set cookies and read it. b. Demonstrate session Management.	IV	02*
14	Write a simple PHP program for sending and receiving plain text message (e-mail).	IV	02*
15	Develop a simple application to- a. Enter data into database b. Retrieve and present data from database.	V	02*
16	Develop a simple application to Update, Delete table data from database.	V	02*
Total			32

Note:

- A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. All the above listed practical need to be performed compulsorily, so that the student reaches the 'Applying Level' of Bloom's 'Cognitive Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO are to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Write appropriate code to generate desired output in Web application	30

S. No.	Performance Indicators	Weightage in %
2	Debug, Test and Execute the programs	30
3	Presentation of Output	20
4	Able to Answer to oral questions	10
5	Submission of report in time	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Work collaboratively in team.
- Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organization Level' in 2nd year.
- 'Characterization Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practicals, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. S. No.
1	Hardware : Computer system (Any computer system, preferably i3 - i5 with basic configuration)	All
2	Operating system : Windows / Linux	
3	Any database tool such as MySQL, MariaDB or any equivalent tool	15,16

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs in cognitive domain for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Expressions and control statements in PHP	1a Write simple PHP program to solve the given expression. 1b Use relevant decision making control statement to solve the given problem 1c Solve the given iterative problem using relevant loop statement.	1.1 History and Advantages of PHP, , Syntax of PHP. 1.2 Variables, Data types, Expressions and operators, constants 1.3 Decision making Control statements - if, if-else, nested if, switch, break and continue statement. 1.4 Loop control structures-while , do-while , for and foreach

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit- II Arrays, Functions and Graphics	2a Manipulate the given type of arrays to get the desired result. 2b Apply implode, explode functions on the given array. 2c Apply the given string functions on the character array. 2d Scale the given image using graphics concepts/ functions.	2.1 Creating and Manipulating Array, Types of Arrays- Indexed , Associative and Multi-dimensional arrays 2.2 Extracting data from arrays, implode, explode, and array flip. 2.3 Traversing Arrays 2.4 Function and its types –User defined function, Variable function and Anonymous function. 2.5 Operations on String and String functions:str_word_count(),strlen(),strrev(),strpos(),str_replace(),ucwords(),strtoupper(),strtolower(),strcmp(). 2.6 Basic Graphics Concepts, Creating Images, Images with text, Scaling Images, Creation of PDF document.
Unit-III Apply Object Oriented Concepts in PHP	3a Write constructor and destructor functions for the given problem in PHP. 3b Implement inheritance to extend the given base class. 3c Use overloading / overriding to solve the given problem. 3d Clone the given object.	3.1 Creating Classes and Objects 3.2 Constructor and Destructor 3.3 Inheritance, Overloading and Overriding, Cloning Object. 3.4 Introspection, Serialization
Unit –IV Creating and validating forms	4a Use the relevant form controls to get user's input. 4b Design web pages using multiple Forms for the given problem. 4c Apply the given validation rules on form. 4d Set/ modify/ delete cookies using cookies attributes. 4e Manage the given session using session variables.	4.1 Creating a webpage using GUI Components, Browser Role-GET and POST methods, Server Role 4.2 Form controls: text box, text area, radio button, check box, list, buttons 4.3 Working with multiple forms : - A web page having many forms - A form having multiple submit buttons. 4.4 Web page validation. 4.5 Cookies - Use of cookies, Attributes of cookies, create cookies, modify cookies value, and delete cookies. 4.6 Session - Use of session, Start session, get session variables, destroy session. 4.7 Sending E-mail.
Unit-V Database Operation s	5a Create database for the given problem using PHP script. 5b Insert data in the given database using PHP script. 5c Apply the specified update operation in database record	5.1 Introduction to MySQL – Create a database. 5.2 Connecting to a MySQL database : MySQL database server from PHP 5.3 Database operations: Insert data, Retrieving the Query result 5.4 Update and delete operations on table

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	using PHP script. 5d Delete the given record from the database using PHP script.	data.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Expressions and control statements in PHP	06	02	02	08	12
II	Arrays, Functions and Graphics	10	02	04	10	16
III	Apply Object Oriented Concepts in PHP	12	02	04	10	16
IV	Creating and validating forms	12	02	04	06	12
V	Database operations	08	02	04	08	14
Total		48	10	18	42	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare journal of practicals.
- Undertake micro-projects.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.



- e) Guide student(s) in undertaking micro-projects.
- f) Demonstrate students thoroughly before they start doing the practice.
- g) Encourage students to refer different websites to have deeper understanding of the subject.
- h) Observe continuously and monitor the performance of students in Lab.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project is group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

- a) Develop web application for- Sending plain text email, Sending HTML message, Sending e-mails with attachment
- b) Develop web application for Library Management system. – Add book , Display list of book , Search book .
- c) Develop web application for Student Feedback System.
- d) Develop web application for Employee Pay Management System.

(Any other micro-projects suggested by subject faculty on similar line.)

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Programming PHP	Rasmus Lerdorf, Kevin.T and Peter M.	O'Reilly, USA, ISBN -978-1-449-39277-2, 2013
2	The Complete Reference PHP (Third Edition covers PHP)	Holzner, Steven	McGraw hill, New Delhi, ISBN 9780070223622, 2008.
3	PHP and MySQL	McGrath, Mike	McGraw Hill, New Delhi, ISBN-13: 978-1259029431
4	Advance Web Technology	Dr. Rajendra Kawle	Devraj Publication , ISBN- 978-93-86492-01-2

14. SOFTWARE/LEARNING WEBSITES

- a) <https://www.w3schools.com/php/default.asp>
- b) <https://www.guru99.com/what-is-php-first-php-program.html>
- c) <https://www.tutorialspoint.com/php/>
- d) <https://tutoriahtml.com/en/php-tutorial-introduction/>
- e) www.tizag.com/phpT/
- f) <https://books.goalkicker.com/PHPBook/>
- g) <https://codecourse.com/watch/php-basics>





Program Name : Computer Engineering Program Group
Program Code : CO/CM/IF/CW
Semester : Sixth
Course Title : Network and Information Security
Course Code : 22620

1. RATIONALE

Computer network security is an important aspect in today's world. Now days due to various threats designing security in organization is an important consideration. It is essential to understand basic security principles, various threats to security and techniques to address these threats. The student will be able to recognize potential threats to confidentiality, integrity and availability and also able to implement various computer security policies. This course will introduce basic cryptographic techniques, fundamentals of computer/network security, Risks faced by computers and networks, security mechanisms, operating system security, secure System design principles, and network security principles. Also it will create awareness about IT ACT and different Cyber laws.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Maintain Network and Information security of an organization.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Identify risks related to Computer security and Information hazard in various situations.
- Apply user identification and authentication methods.
- Apply cryptographic algorithms and protocols to maintain Computer Security.
- Apply measures to prevent attacks on network using firewall.
- Maintain secured networks and describe Information Security Compliance standards.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme													
L	T	P		Theory								Practical					
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P -Practical; C – Credit,ESE -End Semester Examination; PA - Progressive Assessment

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the



course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

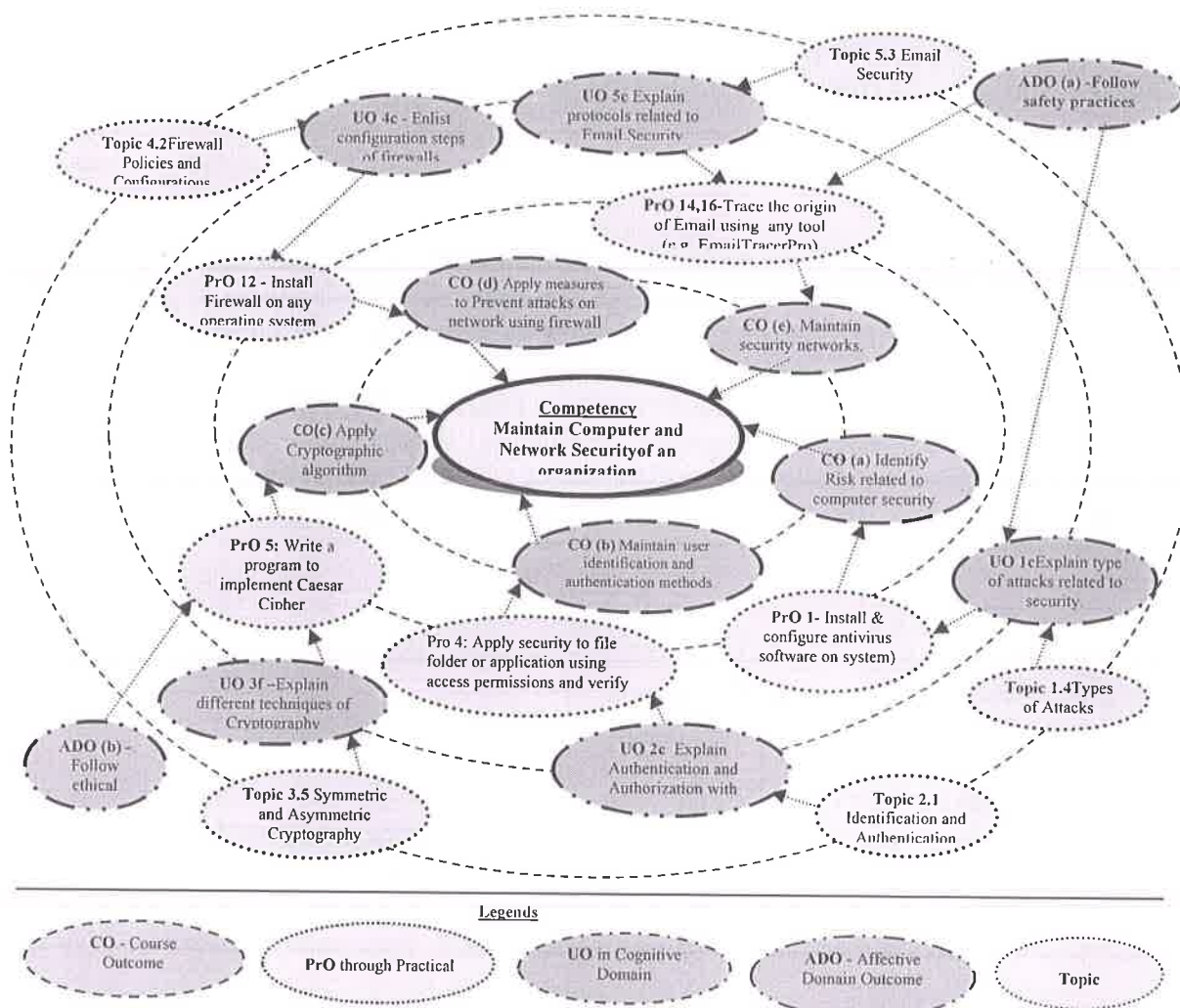


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	a. Install and configure Antivirus software on system (any). b. Set up operating system Updates.	I	2
2	Perform Backup and Restore of the system.	I	2
3	Set up passwords to operating system and applications.	II	2
4	Apply security to file folder or application using access permissions and verify.	II	2
5	Write a program to implement Caesar Cipher	III	2
6	Write a program to implement Vernam Cipher	III	2
7	Create and verify Hash Code for given message	III	2
8	Write a program to implement Rail fence technique	III	2
9	Write a program to implement Simple Columnar Transposition technique	III	2

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
10	Create and verify digital signature using tool (e.g. Cryptool)	III	2
11	Use Steganography to encode and decode the message using any tool.	III	2
12	a. Install firewall on any operating system.	IV	2
	b. Configure firewall settings on any operating system.		
13	Create and verify Digital Certificate using tool (e.g. Cryptool)	V	2
14	Trace the origin of Email using any tool(e.g. emailTrackerPro)	V	2
15	Trace the path of web site using Tracert Utility	V	2
16	PGP Email Security	V	2
	a. Generate Public and Private Key Pair.		
	b. Encrypt and Decrypt message using key pair.		
Total			32

Note

- A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. All the above listed practical need to be performed compulsorily, so that the student reaches the 'Applying Level' of Blooms's 'Cognitive Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO are to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Correctness of the flow of procedures.	40
2	Debugging ability.	20
3	Quality of input and output displayed (messaging and formatting)	10
4	Answer to sample questions	20
5	Submission of report in time	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Work collaboratively in team
- Follow ethical Practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organization Level' in 2nd year.
- 'Characterization Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practicals, as well as aid to procure equipment by authorities concerned.



S. No.	Equipment Name with Broad Specifications	PrO. S. No.
1	Computer system (Any computer system with basic configuration)	All
2	Antivirus Software(any)	
3	Any compiler	
4	Encryption Decryption tool(preferably Open source based)	6,7,8,9
5	Steganography Tools. (preferably Open source based)	10,13
6	E-mail tracing Tools. (preferably Open source based)	11
7	Web tracing Tools. (preferably Open source based)	14
		15

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs in cognitive domain for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Introduction to Computer and Information Security	1a. Explain the importance of the given component of computer security. 1b. Explain the characteristics of the given type of threat. 1c. Explain the given type of attacks related with security. 1d. Describe the features of given type of update of operating system. 1e. Classify Information. 1f. Explain Principles of Information Security.	1.1 Foundations of Computer Security: Definition and Need of computer security, Security Basics: Confidentiality, Integrity, Availability, Accountability, Non-Repudiation and Reliability. 1.2 Risk and Threat Analysis: Assets, Vulnerability, Threats, Risks, Counter measures. 1.3 Threat to Security: Viruses, Phases of Viruses, Types of Virus, Dealing with Viruses, Worms, Trojan Horse, Intruders, Insiders. 1.4 Type of Attacks: Active and Passive attacks, Denial of Service, DDOS, Backdoors and Trapdoors, Sniffing, Spoofing, Man in the Middle, Replay, TCP/IP Hacking, Encryption attacks. 1.5 Operating system security: Operating system updates : HotFix, Patch, Service Pack. 1.6 Information, Need and Importance of Information, information classification, criteria for information classification, Security, need of security, Basics principles of information security.



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit– II User Authenticati on and Access Control	2a. Explain techniques of the given type of attack on passwords. 2b. Explain mechanism of the given type of Biometric. 2c. Apply the relevant Authentication method for the given situation with an example. 2d. Describe features of the given access control policy.	2.1 Identification and Authentication: User name and Password, Guessing password, Password attacks-Piggybacking, Shoulder surfing, Dumpster diving. 2.2 Biometrics: Finger Prints, Hand prints, Retina, patterns, Voice patterns, Signature and Writing patterns, Keystrokes. 2.3 Access controls: Definition, Authentication Mechanism, principle-Authentication, Authorization, Audit, Policies: DAC, MAC, RBAC.
Unit– III Cryptograph y	3a. Encrypt/Decrypt the given text using different substitution techniques. 3b. Convert plain text to cipher text and vice versa using the given transposition technique. 3c. Convert the given message using steganography. 3d. Explain the given technique of cryptography using example.	3.1 Introduction: Plain Text, Cipher Text, Cryptography, Cryptanalysis, Cryptology, Encryption, Decryption. 3.2 Substitution Techniques: Caesar's cipher, Modified Caesar's Cipher, Transposition Techniques: Simple Columnar Transposition. 3.3 Steganography : Procedure 3.4 Symmetric and Asymmetric cryptography: Introduction to Symmetric encryption, DES (Data encryption Standard) algorithm, Asymmetric key cryptography: Digital Signature.
Unit-IV Firewall and Intrusion Detection System	4a. Compare types of firewall on the given parameter(s). 4b. Explain function of the given type of firewall configuration. 4c. Compare various IDS techniques on the given parameter(s). 4d. Describe features of the given IDS technique.	4.1 Firewall : Need of Firewall, types of firewall- Packet Filters, Stateful Packet Filters, Application Gateways, Circuit gateways. 4.2 Firewall Policies, Configuration, limitations, DMZ. 4.3 Intrusion Detection System : Vulnerability Assessment, Misuse detection, Anomaly Detection, Network-Based IDS, Host-Based IDS, Honeypots
Unit –V Network Security, Cyber Laws and Compliance Standards.	5a. Explain the given component of Kerberos authentication protocol. 5b. Explain the given IP Security protocol with modes. 5c. Explain working of the given protocol for Email security. 5d. Describe the given component of Public Key Infrastructure. 5e. Classify the given Cyber crime.	5.1 Kerberos : Working, AS, TGS, SS 5.2 IP Security- Overview, Protocols- AH, ESP, Modes- transport and Tunnel. 5.3 Email security- SMTP, PEM, PGP. 5.4 Public key infrastructure (PKI): Introduction, Certificates, Certificate authority, Registration Authority, X.509/PKIX certificate format. 5.5 Cyber Crime: Introduction, Hacking , Digital Forgery, Cyber Stalking/Harassment, Cyber Pornography , Identity Theft and Fraud , Cyber terrorism, Cyber Defamation. 5.6 Cyber Laws: Introduction, need,

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	5f. Explain the specified Cyber law. 5g. Describe compliance standards for Information Security.	Categories: Crime against Individual, Government, Property. 5.7 Compliance standards: Implementing and Information Security Management System, ISO 27001, ISO 20000, BS 25999, PCI DSS, ITIL framework, COBIT framework.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to Computer and Information Security	12	06	06	02	14
II	User Authentication and Access Control	06	04	04	02	10
III	Cryptography	06	02	04	08	14
IV	Firewall and Intrusion Detection System	12	04	06	08	18
V	Network Security, Cyber Laws and Compliance Standards.	12	06	06	02	14
Total		48	22	26	22	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare journal of practicals.
- Undertake micro-projects.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the

- development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
 - Guide student(s) in undertaking micro-projects.
 - Demonstrate students thoroughly before they start doing the practice.
 - Encourage students to refer different websites to have deeper understanding of the subject.
 - Observe continuously and monitor the performance of students in Lab.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project is group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

- Case Studies in Secure Computing: Achievements and Trends.
- Implement Client/Server communication using cryptography tools in your laboratory.
- Create digital certificate for your departmental/ personal communication.
- Implement communication system using steganography. Encrypt image and message using any cryptography technique.
- Implement communication system using steganography using audio files. Encrypt audiofile and message using any cryptography technique.
- Implement Three Level Password Authentication System.
- Any other micro-projects suggested by subject faculty on similar line.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Computer Security	Dieter Gollmann	Wiley Publication, New Delhi, ISBN : 978-0-470-74115-3
2	Cryptography and Network Security	Atul Kahate	McGraw Hill Education, New Delhi ISBN: 978-1-25-902988-2
3	Cyber Laws And IT Protection	Harish Chander	PHI Publication, New Delhi, 2012 ISBN: 978-81-203-4570-6
4	Implementing Information Security based on ISO 27001 / ISO 27002 (Best Practice)	Alan Calder	Van Haren Publishing ISBN-13: 978-9087535414 ISBN-10: 9087535414



14. SOFTWARE/LEARNING WEBSITES

- a) <http://nptel.ac.in/courses/106105162/>
- b) https://www.tutorialspoint.com//computer_security/computer_security_quick_guide.htm
- c) <http://learnthat.com/introduction-to-network-security/>
- d) <https://freevideolectures.com/course/3027/cryptography-and-network-security>
- e) <https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-858-computer-systems-security-fall-2014/video-lectures/>
- f) <http://stylesuxx.github.io/steganography/>
- g) <https://smartninja-pgp.appspot.com/>
- h) <http://www.cyberlawsindia.net/cyber-india.html>
- i) <https://www.upcounsel.com/cyber-law>
- j) <http://cyberlaws.net/cyber-law/>



Program Name : Computer Engineering Program Group
Program Code : CO/CM/CW
Semester : Sixth
Course Title : Data Warehousing with Mining Techniques
Course Code : 22621

1. RATIONALE

Data mining and warehousing are the essential components of decision support systems for the modern days in industry and business. These techniques enable students to take better and faster decisions. The objective of this course is to introduce students to various Data Mining and Data Warehousing concepts and techniques. This course introduces principles, algorithm, architecture, design and implementation of data mining and data warehousing techniques. Learning this course would improve the employment potential of students in the information management sector.

2. COMPETENCY

The aim of this course is to help the student develop required skills so that they are able to acquire following competency:

- Use Data mining techniques for data analysis to maintain Data warehouse.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Establish scope and necessity of Data Mining for various applications.
- Establish scope and necessity of Data warehouse for various applications.
- Use concept of data mining components and techniques in designing data mining systems.
- Use data mining tools for different applications.
- Apply basic Statistical calculations on Data.

4. TEACHING AND EXAMINATION SCHEME

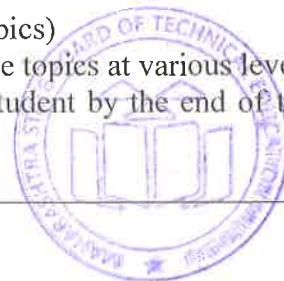
Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the



course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

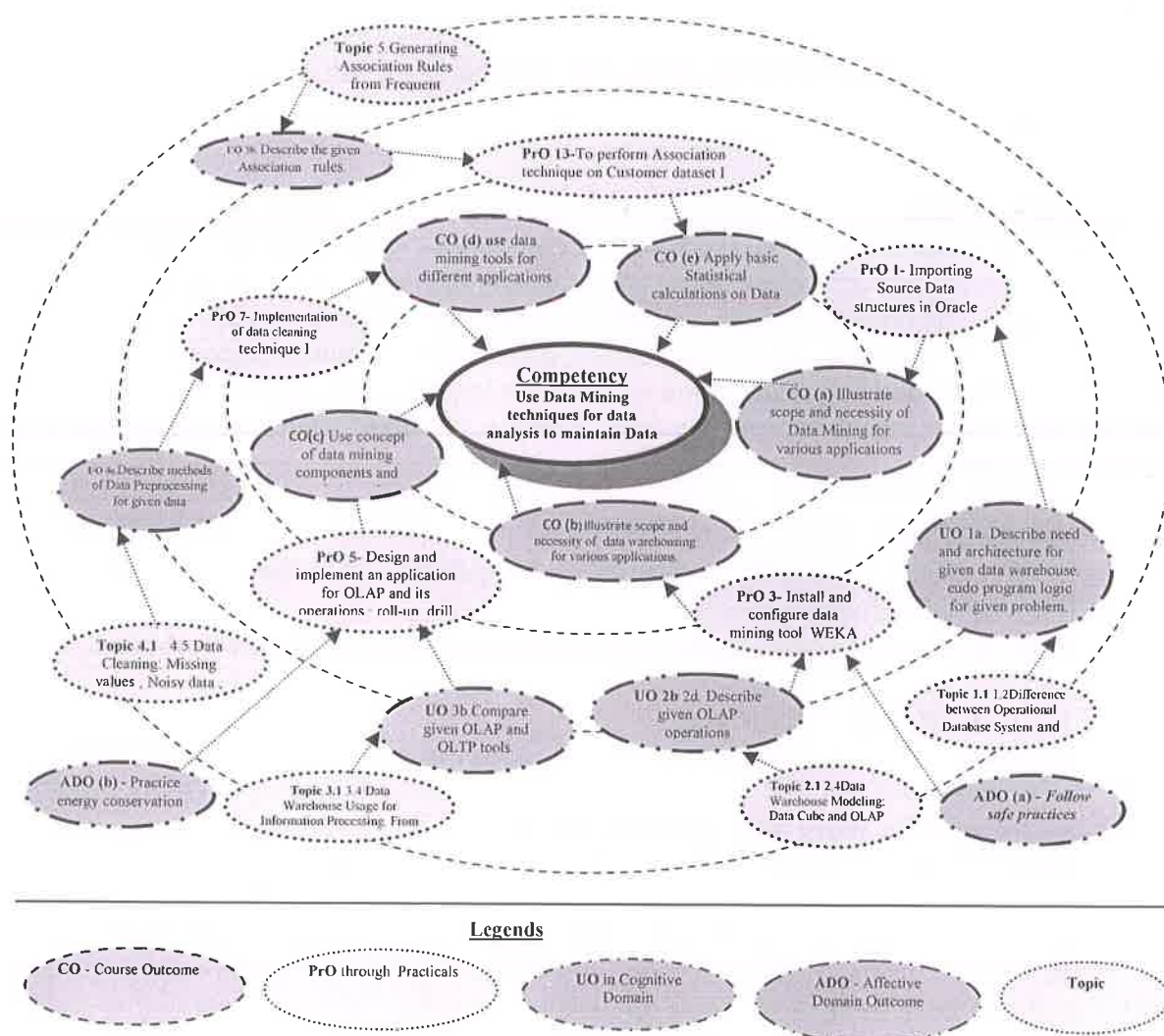


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Install Oracle Database Server and client.	I	02
2	Import Source Data structures in Oracle	I	02
3	Develop Target Data structures in Oracle	II	02
4	Install data mining tool WEKA. Study the GUI explorer on WEKA	II	02
5	Develop an application for OLAP and its operations: roll-up, drill down.	III	02
6	Develop an application for OLAP and its operations: Slice and dice.	III	02
7	Implement data cleaning technique I (Data Preprocessing --Finding and replacing Missing value in sample Dataset.)	IV	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
8	Implement data cleaning technique II (Data Transformation - Transforming data from one format to another format on sample data set)	IV	02
9	Preprocess dataset WEATHER.arff including creating an ARFF file and reading it into WEKA, and using the WEKA Explorer. Part - I	IV	02
10	Preprocess dataset WEATHER.arff including creating an ARFF file and reading it into WEKA, and using the WEKA Explorer. Part - II	IV	02
11	Demonstration of preprocessing on dataset Customer.arff includes creating an ARFF file and reading it into WEKA, and using the WEKA Explorer. Attributes Selection and Normalization.	IV	02
12	Demonstration of preprocessing on dataset Customer.arff includes creating an ARFF file and reading it into WEKA, and using the WEKA Explorer. Draw various graphs using WEKA	IV	02
13	Perform Association technique on Customer dataset I. (Implementing Apriori algorithm on customer dataset.)	V	02
14	Perform Association technique on Customer dataset II. (Using classification algorithm of KNN on sample dataset)	V	02
15	Apply clustering technique on Customer dataset I. (Using K-means clustering on sample customer dataset.)	V	02
16	Apply clustering technique on Customer dataset II. (Using K-means clustering on sample weather dataset)	V	02
Total			32

Note

- A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. All the above listed practical need to be performed compulsorily, so that the student reaches the 'Applying Level' of Blooms's 'Cognitive Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO are to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Correctness of implementation of algorithm	40
2	Analysis and implementation ability	20
3	Quality of input and output displayed (messaging and formatting)	10
4	Answer to sample questions	20
5	Submit report in time	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Work collaboratively in team
- Follow ethical practices.



The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year.
- 'Organization Level' in 2nd year.
- 'Characterization Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practicals, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. S. No.
	Computer system (Any computer system with basic configuration)	All
	Oracle Client and server	
	Data Mining tool : WEKA	

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed to develop UOs in cognitive domain for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Introduction to Data Warehousing	1a. Describe need and architecture for the given data warehouse. 1b. Explain the benefits of data warehousing of the given application. 1c. Describe the given Data warehouse Models. 1d. Describe Extraction, Transformation and Loading for the given data warehouse 1e. Describe Metadata Repository for the given data warehouse.	1.1 Data warehousing, Difference between Operational Database System and Data warehouse. 1.2 Need for data warehousing. 1.3 A Multi tiered Architecture of data warehousing. 1.4 Data Warehouse Models: Enterprise Warehouse, Data Mart, and Virtual Warehouse. 1.5 Extraction, Transformation, and Loading. 1.6 Metadata Repository. 1.7 Benefits of Data warehousing.



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit– II Data Warehouse Modeling and Online Analytical Processing I	2a. Describe Data Cube and OLAP for the given data warehouse. 2b. Explain Schemas for Multidimensional data models for the given data warehouse. 2c. Compare Stars, Snowflakes and Schema models for the given data warehouse on the basis of the given criteria. 2d. Describe the given OLAP operations 2e. Explain the benefits of the given OLAP tool.	2.1 Data Warehouse Modeling: Data Cube and OLAP, Data Cube: A Multidimensional Data Model. 2.2 Stars, Snowflakes, and Fact Constellations. 2.3 OLAP : Need of OLAP, OLAP Guidelines 2.4 Typical OLAP Operations
Unit– III Data Warehouse Designing and Online Analytical Processing II	3a. Describe design Process for the given data warehouse. 3b. Compare the given OLAP and OLTP tools, based on the given criteria. 3c. Design the given Data warehouse. 3d. Explain Bitmap and Join Index for the given OLAP. 3e. Compare OLAP server Architectures for the given data warehouse.	3.1 Data Warehouse Design and Usage. 3.2 A Business Analysis Framework for Data Warehouse Design. 3.3 Data Warehouse Design Process 3.4 Data Warehouse Usage for Information Processing. From Online Analytical Processing to Multi-dimensional Data Mining 3.5 Data Warehouse Implementation- Efficient Data Cube Computation: An Overview. 3.6 Indexing OLAP Data: Bitmap Index and Join Index, Efficient Processing of OLAP Queries 3.7 OLAP Server Architectures: ROLAP Versus MOLAP versus HOLAP
Unit-IV Introduction to Data Mining	4a. Explain concept of Data Mining. 4b. Describe the given data mining steps 4c. Explain Major issues for the given data. 4d. Explain the given data objects and attributes types. 4e. Describe methods of Data Preprocessing for the given data. 4f. Explain data cleaning process for the given data.	4.1 Introduction to Data Mining: Mining Steps in the process of knowledge discovery of Database (KDD) . 4.2 What Kind of data can be mined? Major issues in data mining. 4.3 Data Objects and Attributes types. 4.4 Data Preprocessing: Why Preprocess the data? Major Tasks in Data Preprocessing. 4.5 Data Cleaning: Missing values , Noisy data , Data cleaning as a process.



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit –V Mining Frequent Patterns and Cluster Analysis	5a. Define the Itemsets for the given data. 5b. Describe the given Association Rules. 5c. Explain clustering methods for the given data 5d. Analyze Apriori Algorithm for the given data.	5.1 Mining Frequent Patterns: Basic Concepts: Market Basket Analysis, Frequent Itemsets, Closed Itemsets, and Association Rules 5.2 Frequent Itemsets Mining Methods: The Apriori Algorithm, Finding Frequent Itemsets Using Candidate Generation. 5.3 Generating Association Rules from Frequent Itemsets. 5.4 What is Cluster Analysis? Requirements for Cluster Analysis 5.5 Overview of Basic Clustering Methods. 5.6 General Applications of Clustering.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to Data Warehousing	06	02	02	04	08
II	Data Warehouse Modeling and Online Analytical Processing	10	02	04	06	12
III	Data Warehouse Designing and Online Analytical Processing	10	04	06	08	18
IV	Introduction to Data Mining	12	02	08	08	18
V	Mining Frequent Patterns and Cluster Analysis	10	02	04	08	14
Total		48	12	24	34	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare journal of practicals.
- Undertake micro-projects.



11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Guide student(s) in undertaking micro-projects.
- Demonstrate students thoroughly before they start doing the practice.
- Encourage students to refer different websites to have deeper understanding of the subject.
- Observe continuously and monitor the performance of students in Lab.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

- Perform Association technique on Customer dataset /Agriculture dataset /
- Weather dataset.
- Create the data warehouse for any medical shop having 2 or more branches.
- Predict traffic conditions for allocating more buses on various routes by bus controller.
- Predict Job opportunities in Computer /IT field looking into the work generated last year.
- Design a data mart or data warehouse for any organization.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Data mining concepts and techniques	Han, Jiawei and Micheline Kamber.	Morgan Kaufmann Publications. Elsevier, 2012, ISBN: 978-0123814791
2	Data warehousing, data mining and OLAP	Berson, Alex	McGraw Hill New Delhi 2008. ISBN-13: 978-0070062726.

S. No.	Title of Book	Author	Publication
3	The Data warehouse life cycle tool Kit	Kimball, .Ralph	John Wiley Third Edition ISBN: 978-0-471-20024-6
4	Data Based Management	Dr. Rajendra Kawle	Devraj Publication, ISBN- 978-93-86492-00-5

14. SOFTWARE/LEARNING WEBSITES

- a) <https://docs.oracle.com/>
- b) <https://www.analyticsvidhya.com/learning-paths-data-science-business-analytics-business-intelligence-big-data/weka-gui-learn-machine-learning/>
- c) <https://www.guru99.com/online-analytical-processing.html>
- d) https://www.tutorialspoint.com/dwh/dwh_relational_olap.htm
- e) <https://www.tutorialride.com/big-data-analytics/stream-cluster-analysis.htm>



Program Name : Diploma in Computer Engineering Group/ Diploma in Mechanical /Chemical Engineering /Diploma in Electronics Engineering Group/ Diploma in Fashion & Clothing

Program Code : CO/CM/CW/DC/EJ/ET/EN/EX/EQ/IE/ME/CH

Semester : Sixth

Course Title : Entrepreneurship Development

Course Code : 22032

1. RATIONALE

Globalisation, liberalization and privatization along with revolution in information technology have opened up new opportunities transforming lives of masses. In this context, there is immense opportunity of establishing manufacturing, service, trading, marketing and consultancy enterprises by diploma engineer. Our fast growing economy provides ample scope for diploma engineers to succeed as an entrepreneur. Entrepreneurship requires distinct skill sets which are attempted to be developed through this course. To begin with, this course aims to develop the competency and the related outcomes in order to start small enterprises.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Develop project proposals to launch small scale enterprises.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

- Identify your entrepreneurial traits.
- Identify the business opportunities that suits you.
- Use the support systems to zero down to your business idea.
- Develop comprehensive business plans.
- Prepare plans to manage the enterprise effectively.

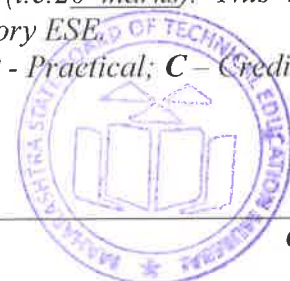
4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
2	-	2	4	--	--	--	--	--	--	--	50@	20	50~	20	100	40

@ : Internal examination

(~): For the **practical only courses**, the PA has two components under practical marks i.e. the assessment of practicals (seen in section 6) has a weightage of 60% (i.e.30 marks) and micro-project assessment (seen in section 11) has a weightage of 40% (i.e.20 marks). This is designed to facilitate attainment of COs holistically, as there is no theory ESE.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment



5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

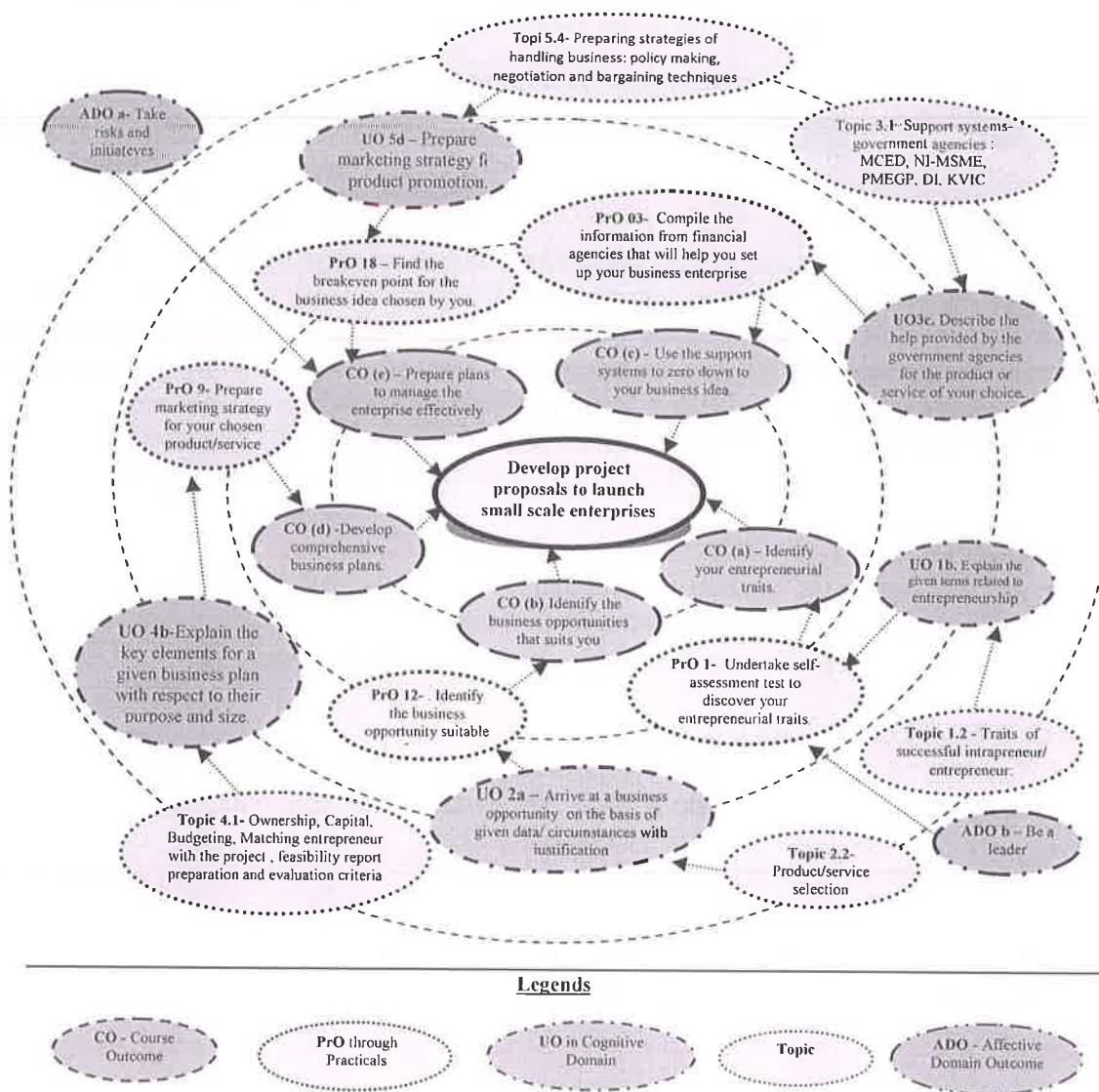


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Submit a profile summary(about500words) of a successful entrepreneur indicating milestone achievements.	I	02*
2	Undertake SWOT analysis to arrive at your business idea of a product/service.	I	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
3	Generate business ideas(product/service) for intrapreneurial and entrepreneurial opportunities through brainstorming.	II	02*
4	Undertake self-assessment test to discover your entrepreneurial traits.	II	02*
5	Identify the business opportunity suitable for you.	II	02
6	Arrange an exhibition cum sale of products prepared out of waste.	II	02
7	Survey industries of your stream, grade them according to the level of scale of production, investment, turnover, pollution to prepare a report on it.	II	02*
8	Visit a bank/financial institution to enquire about various funding schemes for small scale enterprise.	III	02*
9	Collect loan application forms of nationalise banks/other financial institutions.	III	02*
10	Compile the information from financial agencies that will help you set up your business enterprise.	III	02*
11	Compile the information from the government agencies that will help you set up your business enterprise.	III	02*
12	Prepare Technological feasibility report of a chosen product/service.	III	02*
13	Prepare financial feasibility report of a chosen product/service.	III	02*
14	Craft a vision statement and enabling mission statements for your chosen enterprise.	III	02
15	Prepare a set of short term,medium and long term goals for starting a chosen small scale enterprise	III	02*
16	Prepare marketing strategy for your chosen product/service.	IV	02*
17	Compile information about various insurance schemes covering different risk factors.	IV	02
18	Organize a funfair of your class and write a report of profit/loss	V	02
19	Find the breakeven point for the business idea chosen by you.	V	02
20	Arrange a discussion session with your institute's pass out students who are successful entrepreneurs.	V	02
21	Prepare a business plan for your chosen small scale enterprise	V	02*
	Total		42

Note:

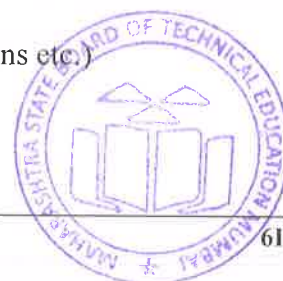
- A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

Sample Products that can be manufactured under SME

- Badges cloth embroidered and metals



2. Bags of all types i.e. made of leather, cotton, canvas and jute etc. including kit bags, mail bags, sleeping bags and water-proof bag
3. Bandage cloth
4. Basket cane (Procurement can also be made from State Forest Corpn. and State Handicrafts Corporation)
5. Bath tubs of plastic
6. Battery Charger
7. Belt leather and straps
8. Bolts and Nuts
9. Boot Polish
10. Brooms
11. Domestic Brushes of different types
12. Buckets of all types of plastic
13. Button of all types
14. Chappals and sandals
15. Cleaning Powder
16. Cloth Covers for domestic use
17. Cloth Sponge
18. Coir mattress cushions and matting
19. Cotton Pouches
20. Curtains mosquito
21. Domestic Electric appliances as per BIS Specifications: Toaster Electric, Elect. Iron, Hot Plates, Elect. Mixer, Grinders Room heaters and convectors and ovens
22. Dust Bins of plastic
23. Dusters Cotton all types except the items required in Khadi
24. Electronic door bell
25. Emergency Light (Rechargeable type)
26. Hand drawn carts of all types
27. Hand gloves of all types
28. Hand numbering machine
29. Hand Pump
30. Hand Tools of all types
31. Handles wooden and bamboo (Procurement can also be made from State Forest Corpn. and State Handicrafts Corporation)
32. Haver Sacks
33. Honey
34. Invalid wheeled chairs.
35. Iron (dhobi)
36. Lamp holders
37. Letter Boxes
38. Nail Cutters
39. Oil Stoves (Wick stoves only)
40. Paper conversion products, paper bags, envelopes, Ice-cream cup, paper cup and saucers and paper Plates
41. Pickles, Chutney and Pappads
42. Pouches for various purposes
43. Safe meat and milk
44. Safety matches
45. Safety Pins (and other similar products like paper pins, staples pins etc.)
46. Shoe laces



47. Sign Boards painted
48. Soap Liquid
49. Spectacle frames
50. Steel Chair
51. Umbrellas
52. Utensils all types

Sample Services that can be offered under SME

1. Marketing Consultancy
2. Industrial Consultancy
3. Equipment Rental & Leasing
4. Typing Centres
5. Photocopying Centres (Zeroxing)
6. Industrial photography
7. Industrial R & D Labs.
8. Industrial Testing Labs.
9. Desk Top publishing
10. Advertising Agencies
11. Internet Browsing/Setting up of Cyber Cafes
12. Auto Repair, services and garages
13. Documentary Films on themes like Family Planning, Social forestry, energy conservation and commercial advertising
14. Laboratories engaged in testing of raw materials, finished products
15. 'Servicing Industry' Undertakings engaged in maintenance, repair, testing or electronic/electrical equipment/ instruments i.e. measuring/control instruments servicing of all types of vehicles and machinery of any description including televisions, tape recorders, VCRs, Radios, Transformers, Motors, Watches.
16. Laundry and Dry Cleaning
17. X-Ray Clinic
18. Tailoring
19. Servicing of agriculture farm equipment e.g. Tractor, Pump, Rig, Boring Machines.
20. Weigh Bridge
21. Photographic Lab
22. Blue printing and enlargement of drawing/designs facilities
23. ISD/STD Booths
24. Teleprinter/Fax Services
25. Sub-contracting Exchanges (SCXs) established by Industry Associations.
26. Coloured or Black and White Studios equipped with processing laboratory.
27. Ropeways in hilly areas.
28. Installation and operation of Cable TV Network:
29. Operating EPABX under franchises
30. Beauty Parlours
31. Creches.

S. No.	Performance Indicators	Weightage in %
1	Leadership skills	20
2	Team work	20
3	Lateral/creative thinking	10
4	Observations and recording	10
5	Self learning	20



S. No.	Performance Indicators	Weightage in %
6	Answer the sample questions	10
7	Submission of report in time	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safe practices
- Practice good housekeeping
- Practice energy conservation
- Demonstrate working as a leader/a team member
- Maintain tools and equipment
- Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	Seminar Hall equipped with conference table, chairs and multimedia facilities	All
2	Modern desktop Computer with internet connection.	All

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (In cognitive domain)	Topics and Sub-topics
Unit – I Entrepreneurship Development - Concept and Scope	1a. Describe the procedure to evaluate your entrepreneurial traits as a career option for the given product to be manufactured or services to be rendered. 1b. Explain the given terms related to Entrepreneurship	1.1 Entrepreneurship as a career 1.2 Traits of successful intrapreneur/ entrepreneur: consistency, creativity, initiative, independent decision making, assertiveness, persuasion, persistence, information seeking, handling business communication, commitment to work contract, calculated risk taking. 1.3 Entrepreneurship : scope in local and

Unit	Unit Outcomes (In cognitive domain)	Topics and Sub-topics
	1c. Describe the salient features of the resources required for starting the specified enterprise. 1d. Identify the characteristics for a given type of enterprise.	global market. 1.4 Intrapreneur and entrepreneur 1.5 Types of enterprises and their features : manufacturing, service and trading. 1.6 Steps in setting up of a business.
Unit – II Entrepreneurial Opportunities and selection process	2a. Arrive at a business opportunity on the basis of given data/circumstances with justification. 2b. Describe the scheme(s) offered by the government for starting the specified enterprise. 2c. Suggest a suitable place for setting up the specified enterprise on the basis of given data/circumstances with justification. 2d. Suggest the steps for the selection process of an enterprise for the specified product or service with justification. 2e. Describe the market study procedure of the specified enterprise.	2.1 Product/Service selection: Process, core competence, product/service life cycle, new product/ service development process, mortality curve, creativity and innovation in product/ service modification / development. 2.2 Process selection: Technology life cycle, forms and cost of transformation, factors affecting process selection, location for an industry, material handling. 2.3 Market study procedures: questionnaire design, sampling, market survey, data analysis 2.4 Getting information from concerned stakeholders such as Maharashtra Centre for Entrepreneurship Development[MCED], National Institute for Micro, Small and Medium Enterprises [NI-MSME], Prime Minister Employment Generation Program [PMEGP], Directorate of Industries[DI], Khadi Village Industries Commission[KVIC]
Unit – III Support Systems	3a. Describe the support system required for the specified enterprise. 3b. Describe the help provided by the government agencies for the specified product/service. 3c. Describe the help provided by the non-governmental agencies for the specified product/service. 3d. Compute the breakeven point for the specified	3.1 Categorisation of MSME, ancillary industries 3.2 Support systems- government agencies: MCED, NI-MSME, PMEGP,DI, KVIC 3.3 Support agencies for entrepreneurship guidance, training, registration, technical consultation, technology transfer and quality control, marketing and finance. 3.4 Breakeven point, return on investment and return on sales.



Unit	Unit Outcomes (In cognitive domain)	Topics and Sub-topics
	business enterprise, stating the assumptions made.	
UNIT IV Business Plan Preparation	4a. Justify the importance of the business plan for the given product/service. 4b. Explain the key elements for the given business plan with respect to their purpose/size 4c. Prepare the budget for the given venture. 4d. Prepare the details of the given component of the given startup business plan.	4.1 Sources of Product for Business : Feasibility study 4.2 Ownership, Capital, Budgeting, Matching entrepreneur with the project , feasibility report preparation and evaluation criteria 4.3 Business plan preparation
Unit –V Managing Enterprise	5a. Justify the USP of the given product/ service from marketing point of view. 5b. Formulate a business policy for the given product/service. 5c. Choose the relevant negotiation techniques for the given product/ service with justification. 5d. Identify the risks that you may encounter for the given type of business/enterprise with justification. 5e. Describe the role of the incubation centre for the given product/service.	5.1 Unique Selling Proposition [U.S.P.]: Identification, developing a marketing plan. 5.2 Preparing strategies of handling business: policy making, negotiation and bargaining techniques. 5.3 Risk Management: Planning for calculated risk taking, initiation with low cost projects, integrated futuristic planning, angel investors, venture capitalist. 5.4 Incubation centres: Role and procedure.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Develop two products from household waste (attach photographs).
- Download product development and innovative films from internet.
- Prepare a collage for 'Traits of successful entrepreneurs'.
- Invite entrepreneurs, industry officials, bankers for interaction.
- Identify your hobbies and interests and convert them into business idea.



- f. Convert your project work into business.
- g. Choose a product and design a unique selling proposition, brand name, logo, advertisement (print, radio, television), jingle, packing, packaging, label for it.
- h. Develop your own website. Share your strengths and weakness on it. Declare your time bound goals and monitor them on the website.
- i. Choose any advertisement and analyse its good and bad points.
- j. Decide any product and analyse its good and bad features.
- k. Select any product and prepare its cost sheet.
- l. Choose any product and study its supply chain.
- m. Arrange brainstorming sessions for improvement of any product.
- n. Study schemes for entrepreneurship promotion of any bank.
- o. Visit industrial exhibitions, trade fairs and observe nitty-gritty of business.
- p. Open a savings account and build your own capital.
- q. Organise industrial visit and suggest modifications for process improvement.
- r. Interview at least four entrepreneurs or businessman and identify Charms of entrepreneurship and Traits of successful entrepreneurs.
- s. Analyse case studies of any two successful entrepreneurs.
- t. Perform a survey and identify local resources available for setting up of an enterprise.
- u. Engage in marketing of products.
- v. Carry out a demand supply gap analysis for a particular product.
- w. Organise a prototype development competition.
- x. Arrange fairs, events in the institute and try for sponsorships.
- y. Select any performance criteria and continuously compete with yourself.
- z. On any performance criteria continuously compete with others.
- aa. Foresee your dream and make a long term plan for its accomplishment.
- bb. Dream for something unique and make a write-up.
- cc. Read articles, books on creativity.
- dd. Using morphological analysis technique, reduce cost or increase quality of a product.
- ee. Conduct a market survey for a project. Collect data on machinery specifications, price, output/hr, power consumption, manpower requirement, wages, raw material requirement, specification, price, competitor's product price, features, dealer commissions, marketing mix.
- ff. Prepare a business plan and organize a business plan competition.
- gg. Select a social cause, set objectives, plan and work for its accomplishment.
- hh. Videograph as many as possible from the above and upload on your website, YouTube, facebook.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- a. Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- b. '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c. About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs/UOs through classroom presentations (see implementation guideline for details).
- d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.



- e. Use Flash/Animations to explain various maintenances techniques.
- f. Guide student(s) in undertaking micro-projects.
- g. Instructors should emphasise more on deductive learning. Students should learn to recognise, create, shape opportunities, and lead teams for providing economic-social value to society.
- h. Business simulations should be used to enhance behavioural traits of successful intrapreneurs and entrepreneurs amongst students. Emphasis should be on creating entrepreneurial society rather than only setting up of enterprise.
- i. They must be encouraged to surf on net and collect as much information as possible.
- j. Each student should complete minimum twenty activities from the suggested list. Minimum possible guidance should be given for the suggested activities.
- k. Students should be promoted to use creative ideas, pool their own resources, finish their presentation, communication and team skills.
- l. Alumni should be frequently invited for experience sharing, guiding and rewarding students.
- m. Display must be arranged for models, collages, business plans and other contributions so that they motivate others.

11. SUGGESTED MICRO-PROJECTS

One Business Plan as a micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he should submit it by the end of the semester to develop the industry oriented COs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation in the middle of the semester and one at the end of the semester before submission of the project proposal incorporating the concepts taught during semester. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course.

- a. Choose any advertisement and analyse its good and bad points.
- b. Decide any product and analyse its good and bad features.
- c. Select any product and prepare its cost sheet.
- d. Choose any product and study its supply chain.
- e. Arrange brainstorming sessions for improvement of any product.
- f. Study schemes for entrepreneurship promotion of any bank.
- g. Visit industrial exhibitions, trade fairs and observe nitty-gritty of business.
- h. Open a savings account and build your own capital.
- i. Organise industrial visit and suggest modifications for process improvement.

12. SUGGESTED LEARNING RESOURCES

S. No.	Title of Books	Author	Publication
1	The Entrepreneurial Instinct : How Everyone Has the Innate Ability to Start a Successful Small Business	Mehta, Monica	McGraw-Hill Education, New Delhi, 2012, ISBN 978-0-07-179742-9
2	Entrepreneurship	Hisrich, R. D.	McGraw-Hill Education, New Delhi, 2013 ISBN-13: 978-1259001635
3	Part I Readings in Entrepreneurship Education	Sareen, S.B.	Entrepreneurship Development Institute of India (EDI), GOI.

S. No.	Title of Books	Author	Publication
			Ahmedabad, 2016; ISBN: 978-0078029196 ..
4	Reading Material of Entrepreneurship Awareness Camp	Gujral, Raman	Entrepreneurship Development Institute of India (EDI), GOI, 2016 Ahmedabad,
5	Product Design and Manufacturing	Chitale, A K	PHI Learning, New Delhi, 2014; ISBN: 9788120348738
6	Entrepreneurship Development Small Business Entrepreneurship	Charantimath, Poornima	Pearson Education India, New Delhi; ISBN: 9788131762264
7	Entrepreneurship Development: Special edition for MSBTE	CPSC, Manila	Tata Mc-Graw Hill, New Delhi,
8	Entrepreneurship and Small Business Management	Khanka, S.S.	S.Chand and Sons, New Delhi, ISBN: 978-93-5161-094-6
9	Entrepreneurship Development	S, Anil Kumar	New Age International, New Delhi, ISBN: 9788122414349

13. SUGGESTED SOFTWARE/LEARNING WEBSITES

1	MCED Books links	http://www.mced.nic.in/UdyojakSpecial.aspx?linktype=Udyojak
2	MCED Product and Plan Details	http://www.mced.nic.in/allproduct.aspx
3	The National Institute for Entrepreneurship and Small Business Development Publications	http://niesbud.nic.in/Publication.html
4	Courses : The National Institute for Entrepreneurship and Small Business Development	http://niesbud.nic.in/docs/1standardized.pdf
5	Entrepreneur.com	https://www.entrepreneur.com/lists
6	GOVT. SPONSORED SCHEMES	https://www.nabard.org/content1.aspx?id=23andcatid=23andmid=530
7	NABARD - Information Centre	https://www.nabard.org/Tenders.aspx?cid=501andid=24
8	NABARD – What we Do	http://www.nabard.org/content1.aspx?id=8andcatid=8andmid=488
9	Market Review	http://www.businessstoday.in/markets
10	Start Up India	http://www.startupindia.gov.in/pdf/file.php?title=Startup%20India%20Action%20Planandtype=Actionandq=Action%20Plan.pdfandcontent_type=Actionandsubmenupoint=action
11	About - Entrepreneurship Development Institute of India (EDII)	http://www.ediindia.org/institute.html
12	EDII - Centres	http://www.ediindia.org/centres.html
13	EDII - Publications	http://www.ediindia.org/publication.html
14	Business Plans: A Step-by-Step Guide	https://www.entrepreneur.com/article/247574
15	The National Science and Technology Entrepreneurship Development Board (NSTEDB)	http://www.nstedb.com/index.htm

16	NSTEDB - Training	http://www.nstedb.com/training/training.htm
17	Tata Exposures	http://www.tatasocial-in.com/project-exposure
18	Ministry Of Micro, Small And Medium EnterpriseS	http://www.dcmsme.gov.in/schemes/TEQUPD etail.htm
19	List of Business Ideas for Small Scale Industry	https://smallb.sidbi.in/%20thinking-starting- business/big-list-business-ideas-small-business
20	Thinking of Entrepreneurship	https://smallb.sidbi.in/entrepreneurship- stage/thinking-entrepreneurship
21	List of services for Small Scale Industry	http://www.archive.india.gov.in/business/Indus- try_services/illustrative.php
22	NSIC Schemes and Services	http://www.nsic.co.in/SCHSERV.ASP



Program Name : All Branches of Diploma in Engineering and Technology.
Program Code : CE/CR/CS/CH/CM/CO/IF/CW/DE/EJ/EN/EQ/ET/EX/IE/
MU/EE/EP/EU/IS/IC/AE/FG/ME/PG/PT/DC/TX/TC
Semester : Sixth
Course Title : Capstone Project – Execution & Report Writing
Course Code : 22060

1. RATIONALE

This course on 'Capstone Project–Execution and Report Writing' is the continuation of the previous semester course on 'Capstone Project–Planning'. So, in this semester, the students are to implement the detailed Capstone Project Plan, which they have prepared in the preceding semester. Therefore, to successfully complete this Capstone Project by the end of this semester, it is necessary to incorporate the suggestions of the guide/examiners of the preceding semester. Hence, it is of utmost importance for the student to again re-capitulate and comprehend the importance, concept and need of the 'Capstone Projects' which are well explained in the 'Capstone Project–Planning' course in the previous semester.

Often, the jobs in the industry, which the diploma holders will come across when they join it and will be in the form of small or large projects. Such projects are generally an integration of the various types of skills which cut across the three major domains of learning i.e. cognitive, psychomotor and affective domain which must have acquired during their journey from first semester to the last semester. Hence, it is essential that students are also given an opportunity to do large projects which require more time compared to the micro-projects in order to develop and integrate the highly essential industry oriented competencies and associated skills in the students. Therefore, in this semester the 'Capstone Project – Execution and Report Writing' will continue to integrate some more additional competencies along with those in the previous semester and hence build up greater confidence to face such situations in the world of work.

2. COMPETENCY

The course should be taught and implemented with the aim to develop the required course outcomes (COs) so that students will acquire following competency needed by the industry:

- **Implement the Capstone Project Plan to solve the identified problem/task faced by industry/user related to the concerned occupation by integrating the various types of skills acquired during the programme.**

3. COURSE OUTCOMES (COs)

Depending upon the nature of the projects undertaken, the following could be some of the major course outcomes that could be attained, although, in case of some projects few of the following course outcomes may not be applicable.

- a) Implement the planned activity individually and/or as team.
- b) Select, collect and use required information/knowledge to solve the identified problem.
- c) Take appropriate decisions based on collected and analysed information.
- d) Ensure quality in product.
- e) Incorporate energy and environment conservation principles.
- f) Consider the ethical issues related to the project (if there are any).
- g) Assess the impact of the project on society (if there is any).
- h) Communicate effectively and confidently as a member and leader of team.



- i) Prepare project report after performing due plagiarism check using appropriate tools.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
-	-	4	4	-	-	-	-	-	-	-	50#	20	50~	20	100	40

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment

5. Course details

As the implementation of the Capstone project progresses and which has to be submitted at the end of project work, one of the outputs of this course is a detailed **Project Report** that is continuously prepared by the student. There will also be regular progressive assessment by the teacher as per the criteria no 7 on the basis of rubrics mentioned in **Appendix –C** and in the formats as shown in **Appendix-B** and also for the end-of-semester examination.

5.1 Guidelines for Capstone Project–Execution and Report Writing

- The students would like to revise the ‘Capstone Project – Plan’ based on the feedback received in the fifth semester examination.
- This revised ‘Capstone Project – Plan’ would be again approved by the project guide. As soon as the revised plan is approved by the teacher, the student will begin to work according to it and would also continue to maintain a dated ‘**Project Diary**’ for the whole semester. This is a sort of a ‘weekly diary’ indicating all the activities conducted by the student every week in the semester to complete the project. This ‘Project Diary’ should be got signed by the teacher at regular intervals for progressive assessment. If this is maintained sincerely and truthfully by the student, it will be very helpful in compiling the **Final Project Report** at the end of the semester by him/her.

6. Project report

During the final Semester, the student will prepare a 'Project Report' in continuation with the activities conducted in fifth semester under Project Planning having following sub-titles:

Suggested contents of the Project report

- Title page (with name of team members and mentor teacher)
- Certificate (in the Format given in this document as annexure A)
- Acknowledgements (this may need revision at the end of the final semester)
- Abstract (in one paragraph not more than 150 words)
- Content Page

Chapters

- Chapter–1 Introduction (background of the Industry or User based Problem/Task)
- Chapter–2 Literature Survey (to finalise and define the Problem Statement)
- Chapter–3 Scope of the project
- Chapter–4 Methodology
- Chapter-5 Details of designs, working and processes



6. Chapter-6 Results and Applications
7. Chapter-7 Conclusions And future scope
8. Appendix (if any)
9. References and Bibliography

Note:

- i. The report should contain as many diagrams, figures and charts etc as relevant for the project.
- ii. Originality of the report (written in own words) would be given more importance rather than quality of printing and use of glossy paper or multi-colour printing

7. ASSESSMENT OF PROJECT WORK

Project work has two components, first is Progressive Assessment (PA), while another is End Semester Examination (ESE).

7.1. Progressive Assessment (PA) Guidelines and Criteria

Project guide is supposed to carry out this assessment. It is a continuous process, during which for developing desired qualities in the students, faculty should orally give **informal feedback** to students about their performance and interpersonal behaviour while guiding them on their project work every week. Following criteria should be considered while assessing students informally or formally during different stages of the project work.

The following factors need consideration for both Capstone Project-Planning and Capstone Project-Execution and Report Writing.

- a) Students should be assessed during the project work so that students can also get feedback for further improvement.
- b) It should be kept in mind that project work is mainly experiential learning and it is not the research work, so emphasis should be on work based learning or learning from experience and development of attitudes and skills as mentioned in course outcomes. So focus of assessment should also be on learning from the process of completing project work rather than on novelty or innovation in the project work.
- c) For progressive assessment at the end, students should be asked to give the power point presentation before group of teachers and junior students (so that junior students may also get awareness about the major project work they have to carry out in future)
- d) The students would be awarded marks for their efforts (In some cases it may happen that due to some reasons such as unavailability of some material or component or some other resources, students may not be able to complete the project, but they have tried their best, in such cases students would be given appropriate marks if they have done enough efforts.)
- e) The students would not be awarded marks if they have completed the project by getting done the work from market or some professionals (taking some help and guidance is different as compared to getting the work or maximum part of the work completed from others on payment basis).
- f) Originality of the report (written in own words) would be given more importance.
- g) The Project Guide will assure the quality of project done by his group.



Criteria of Marks for PA for Capstone Project -Execution and Report Writing.

S. No.	Criteria	Marks
1	Project Proposal /Identification	10
2	Punctuality and overall contribution	
3	Project Diary	
4	Execution of Plan during sixth semester	20
5	Project Report including documentation	15
6	Presentation	05
Total		50

7.2 END SEMESTER EXAMINATION (ESE)

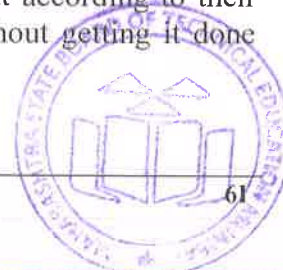
Evaluation shall be carried out according to following criteria. For each project, students from the concerned group should be asked to make presentation of their project , in front of the external and internal examiners which should be followed by question answer session to ascertain the contribution made by each student.

Criteria of Marks for ESE for Capstone Project -Execution and Report Writing

S. No.	Criteria	Marks
1	Project Proposal	05
2	Punctuality and overall contribution	
3	Project diary	
4	Execution of Plan during sixth semester	10
5	Project Report including documentation	10
6	Presentation	10
7	Question and Answer	15
Total		50

8. SPECIAL TEACHING STRATEGIES (If any)

- Teacher's should not spoon feed the students and let them try on their own at different stages of the project work and even first let them strive hard and only when efforts of students have failed, then teacher should guide them. Guidance should be in initially in the form of clues or hints rather than complete explanation, detailed explanation should be given only when students are not able to work based on clues/hints. The role of teacher should be limited to guide and facilitator
- Teachers should help students in selecting a topic which is relevant and challenging (but within capacity) for students according to their abilities.
- Teachers should come out of the mindset that there should be compulsorily some innovation and novelty in the project work. Because as discussed earlier, project is mainly opportunity for work based or experiential learning, the aim of which is to develop higher order cognitive skills and attitudes. Project at diploma level is not research or innovation.* The main thing teachers have to ensure is that students choose a task or problem for their project work which is challenging but according to their capability i.e. a task which they can complete on their own without getting it done from market.



- d) Teachers should ensure that students prepare the project plan in as much detail as possible, since this way only they would learn the importance of planning and how to do the detail planning. Teachers should allow students to proceed ahead only when they have detailed plan with them.
- e) Teachers should motivate students to maintain project document project diary and project report. They should explain benefits of these activities to students and also train them in these activities, because most of them may be doing this first time.
- f) Project Guide should ensure that students submit chapter of report one by one to him/her as per schedule and should check the content of the chapters. The Project guide should monitor that schedule is maintained and report writing is not left till last few weeks. It should not be a problem since first three chapters of the report should have been written in fifth semester itself.
- g) Teachers should also encourage students to openly discuss their weaknesses and shortcomings. Teachers should develop confidence in students that admitting mistakes and weaknesses helps in improving them.
- h) Teachers should continuously discuss with students about working of group and progress in the project and from this discussion should identify their personal qualities (both strengths and weaknesses) and suggest to them ways for improving those qualities.
- i) Internal as well as external examiners should reward students for original work and efforts of students even if they are not fully successful or not able to complete the project in comparison to those students who have taken paid help from others to complete their project.

Appendix–A

CERTIFICATE

This is to certify that Mr./Ms.....
fromInstitute having Enrolment No:
has completed project of final year having title during the
academic year 20__-20__. The project completed by individually/ in a group consisting
of..... persons under the guidance of the Faculty Guide.

.....
.....
Name & Signature of Guide:

Telephone:.....



Appendix-B**PROGRESSIVE ASSESSMENT (PA) OF CAPSTONE PROJECT – EXECUTION
AND REPORT WRITING****Evaluation Sheet for Internal Assessment****Name of Student:****Name of Programme:**..... **Semester: Sixth****Course Title:** Capstone Project : Execution and Report Writing **Code:22060.****Title of the Capstone Project:****A. POs addressed by the Capstone Project (Mention only those predominant POs)**

- a)
- b)
- c)
- d)

B. COs addressed by the Capstone Project (Mention only those predominant POs)

- a)
- b)
- c)
- d)

C. OTHER LEARNING OUTCOMES ACHIEVED THROUGH THIS PROJECT**1. Unit Outcomes (Cognitive Domain)**

- a)
- b)
- c)
- d)

2. Practical Outcomes (in Psychomotor Domain)

- a)
- b)
- c)
- d)

3. Affective Domain Outcomes

- a)
- b)
- c)
- d)



PROGRESSIVE ASSESSMENT (PA) Sheet		
S. No.	Criteria	Marks
1	Project Proposal /Identification	10
2	Punctuality and overall contribution	
3	Project Diary	
4	Execution of Plan during sixth semester	20
5	Project Report including documentation	15
6	Presentation	05
Total		50

Appendix–B

Suggested Rubric for Capstone Project – Execution and Report Writing

S. No.	Characteristic to be assessed	Poor	Average	Good	Excellent
1	Problem/Task Identification (Project Title)	Relate to very few POs Scope of Problem not clear at all	i. Related to some POs ii. Scope of Problem/Task vague	i. Take care of at-least Three POs ii. Scope of Problem/task not very specific	• Take care of more than three POs ii. Scope of problem/task very clear
2	Literature Survey /Industrial Survey	Not more than ten sources (primary and secondary), very old reference	At-least 10 relevant sources, at least 5 latest	At –least 15 relevant sources, most latest	About 20 relevant sources, most latest
3	Project proposal	Methods are not appropriate, All steps not mentioned, Design of prototype not started (if applicable).	Appropriate plan but not in much detail. Plan B for critical activities not mentioned. Time line is not developed. Design of Prototype is not complete. (if applicable)	Appropriate and detailed plan with Plan B for critical activities mentioned, but clarity is not there in methods, time line is given but not appropriate. Design of prototype is not detailed (if applicable)	Appropriate and detailed plan with Plan B for critical activities mentioned, clarity in methods with time line, Detailed design of prototype (if applicable)
4	Project Diary	Entries for most weeks are missing. There is no proper sequence and details are not correct.	Entries for some weeks are missing, details are not appropriate, not signed regularly by the guide.	Entries were made every week but are not in detail. Signed and approved by guide every week	Entries were made every week in detail, signed and approved by guide every week
5	Final Report Preparation	Very short, poor quality sketches, Details about methods, material, precaution and conclusions	Detailed, correct and clear description of methods, materials, precautions and	Conclusions. Sufficient Graphic Description.	Very detailed, correct, clear description of methods, materials, precautions and conclusions. Enough tables,

S. No.	Characteristic to be assessed	Poor	Average	Good	Excellent
		omitted, some details are wrong			charts and sketches
6	Presentation	Major information is not included, information is not well organized .	Includes major information but not well organized and not presented well	Includes major information and well organized but not presented well	Well organized, includes major information ,well presented
7	Defense	Could not reply to considerable number of question.	Replied to considerable number of questions but not very properly	Replied properly to considerable number of question.	Replied to most of the questions properly

Appendix C Suggestive Project Diary format

Week no:
Activities planned:
Activities Executed:
Reason for delay if any
Corrective measures adopted
Remark and Signature of the Guide





Maharashtra State Board Of Technical Education, Mumbai

Teaching And Examination Scheme For Post S.S.C. Diploma Courses

Program Name : Diploma in Electronics & Tele-Communication, Diploma in Electronics, Diploma in Communication Technology, Diploma in Communication Engineering, Diploma in Electronics Engineering

Program Code : EJ/EN/EQ/ET/EX

With Effect From Academic Year: 2017 - 18

Duration of Program : 6 Semesters

Duration : 16 Weeks

Semester : Sixth

Scheme - I

S. N.	Course Title	Course Abbre- viation	Course Code	Teaching Scheme			Credit (L+T+P)	Examination Scheme												Grand Total	
				L	T	P		Theory						Practical							
								Exam Duration in Hrs.	ESE		PA		Total		ESE		PA		Total		
									Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks		Min Marks
1	Management	MAN	22509	3	-	-	3	90 Min	70*#	28	30*	00	100	40	--	--	--	--	--	--	100
2	Computer Networking and Data Communication	CND	22634	3	-	2	5	3	70	28	30*	00	100	40	25#	10	25	10	50	20	150
3	Emerging Trends in Electronics	ETE	22636	3	-	-	3	90 Min	70*#	28	30*	00	100	40	--	--	--	--	--	--	100
4	Elective – II (Select Any One)																				
	Mechatronics	MEC	22643	3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150
	Optical Network and Satellite Communication	ONS	22647	3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150
5	Entrepreneurship Development	EDE	22032	2	-	2	4	--	--	--	--	--	--	--	50@	20	50~	20	100	40	100
6	Capstone Project - Execution & Report Writing	CPE	22060	-	-	4	4	--	--	--	--	--	--	--	50#	20	50~	20	100	40	100
7	VLSI with VHDL	VWV	22062	2	-	2	4	--	--	--	--	--	--	--	25#	10	25	10	50	20	50
Total				16	-	12	28	--	280	--	120	--	400	--	175	--	175	--	350	--	750

Student Contact Hours Per Week: **28 Hrs.**

Medium of Instruction: **English**

Theory and practical periods of 60 minutes each.

Total Marks : **750**

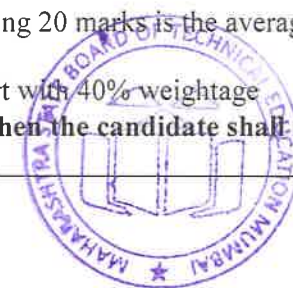
Abbreviations: ESE- End Semester Exam, PA- Progressive Assessment, L - Lectures, T - Tutorial, P - Practical

@ Internal Assessment, # External Assessment, *# On Line Examination, ^ Computer Based Assessment

* Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain LOs required for the attainment of the COs.

~ For the courses having ONLY Practical Examination, the PA marks. Practical Part - with 60% weightage and Micro-Project Part with 40% weightage

➤ **If Candidate not securing minimum marks for passing in the “PA” part of practical of any course of any semester then the candidate shall be declared as “Detained” for that semester.**



Program Name : Diploma in Automobile Engineering / Civil Engineering Group /
Electronics Engineering Group / Diploma in Plastic Engineering /
Diploma in Production Engineering / Diploma in Fashion &
Clothing Technology/ Computer Engineering Group

Program Code : AE/CE/CR/CS/ DE/EJ/ET/EN/EX/EQ/IS/IC/IE/PG/PT/DC/
CO/CM/CW/IF

Semester : Sixth

Course Title : Management

Course Code : 22509

1. RATIONALE

An engineer has to work in industry with human capital and machines. Therefore, managerial skills are essential for enhancing their employability and career growth. This course is therefore designed to provide the basic concepts in management principles, safety aspects and Industrial Acts.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Use relevant managerial skills for ensuring efficient and effective management.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

- Use basic management principles to execute daily activities.
- Use principles of planning and organising for accomplishment of tasks.
- Use principles of directing and controlling for implementing the plans.
- Apply principles of safety management in all activities.
- Understand various provisions of industrial acts.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	-	3	90 Min	70*#	28	30*	00	100	40	--	--	--	--	--	--

(*#) Online Theory Examination.

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain. COs required for the attainment of the Cos. (*#): Online examination



Legends: *L*-Lecture; *T* – Tutorial/Teacher Guided Theory Practice; *P* - Practical; *C* – Credit, *ESE* - End Semester Examination; *PA* - Progressive Assessment

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

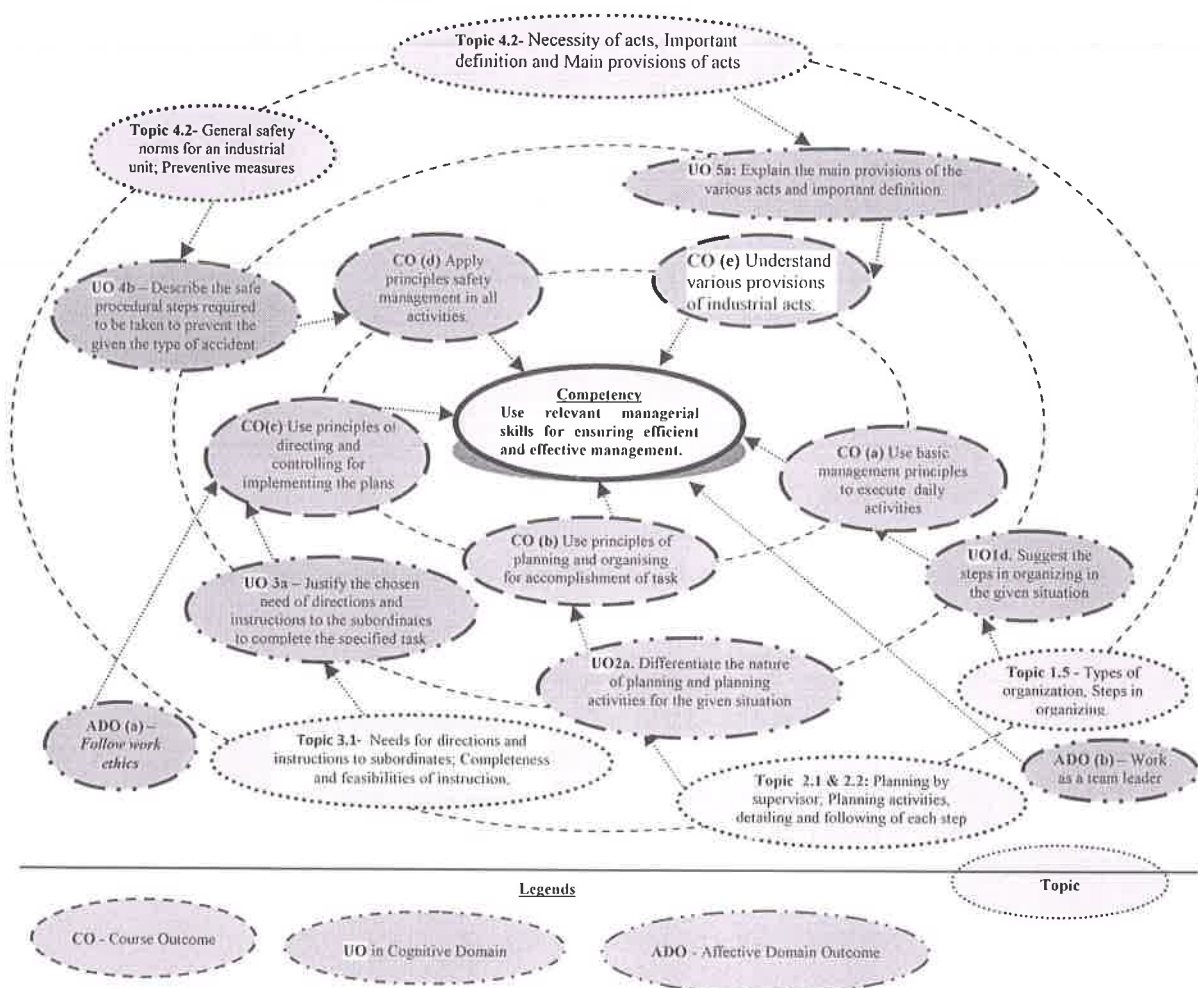


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

- Not applicable -

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

- Not applicable -

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Introduction to management concepts and managerial skills	1a. Differentiate the concept and principles of management for the given situation. 1b. Explain functions of management for given situation. 1c. Compare the features of the given types of planning 1d. Suggest the steps in organizing in the given situation. 1e. Suggest suitable type of organization for the given example. 1f. Identify the functional areas of management for the given situation 1g. Suggest suitable managerial skills for given situation with justification	1.1 Definitions of management, role and importance of management. 1.2 Management characteristics and principles, levels of management and their functions; management, administration and organization, relation between management and administration. 1.3 Functions of management: planning, organizing, leading/directing, staffing and controlling. 1.4 Types of planning and steps in planning 1.5 Types of organization, Steps in organizing 1.6 Functional areas of management. 1.7 Managerial skills.
Unit – II Planning and organizing at supervisory level	2a. Differentiate the nature of planning and planning activities for the given situation. 2b. Suggest the step wise procedure to complete the given activity in the shop floor. 2c. Prepare materials and manpower budget for the given production activity. 2d. Describe with block diagrams the organization of the physical resources required for the given situation. 2e. Describe the human needs to satisfy the job needs for the specified situation. 2f. List the tasks to be done by the concerned individuals for completing the given activity.	Planning at supervisory level 2.1 Planning by supervisor. 2.2 Planning activities, detailing and following of each step. 2.3 Prescribing standard forms for various activities. 2.4 Budgeting for materials and manpower. Organizing at supervisory level 2.5 Organizing the physical resources. 2.6 Matching human need with job needs. 2.7 Allotment of tasks to individuals and establishing relationship among persons working in a group
Unit– III Directing and Controlling at supervisory level	3a. Justify the chosen need of directions and instructions to the subordinates to complete the specified task. 3b. Select the feasible set of instructions to complete the given simple task, with justification 3c. Predict the possible mistakes for completing the given simple activity. 3d. Describe the managerial control	Directing at supervisory level 3.1 Needs for directions and instructions to subordinates; Completeness and feasibilities of instructions 3.2 Personal counselling advanced predictions of possible mistakes. 3.3 Elaborating decisions, laying disciplinary standards in overall working Controlling at supervisory level



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	actions and remedial measures required to be taken for completing the given task successfully.	3.4 Managerial control; Understanding team and link between various departments in respect of process and quality standards; Steps in control process 3.5 Controlling methods; Control over the performance in respect of quality, quantity of production, time and cost. Measuring performance, comparing with standards, correcting unfavorable deviations.
Unit – IV Safety Management	4a. State the general safety norms required to be taken in the given case. 4b. Suggest preventive measures of plant activities in the given situation. 4c. Describe the safe procedural steps required to be taken to prevent the given the type of accident. 4d. Prepare a work permit in to conduct the given maintenance activity. 4e. Explain the causes of the specified type of accident in the given situation. 4f. Prepare the specifications of the firefighting equipment required for the given type of fire.	4.1 Need for safety management measures 4.2 General safety norms for an industrial unit; Preventive measures. 4.3 Definition of accident, types of industrial accident; Causes of accidents; 4.4 Fire hazards; Fire drill. 4.5 Safety procedure 4.6 Work permits.
Unit – V Legislative Acts	5a. Explain the purpose of the act 5b. Explain the main provisions of the various acts and important definition.	5.1 Necessity of acts, Important definition and Main provisions of acts. 5.2 Industrial Acts: a. Indian Factory Act b. Industrial Dispute Act c. Workman Compensation Act d. Minimum Wages Act

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to management	12	06	06	04	16

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
	concepts and managerial skills					
II	Planning and organizing at supervisory level	08	04	06	04	14
III	Directing and controlling at supervisory level	08	04	06	04	14
IV	Safety Management	08	04	06	04	14
V	Legislative Acts	12	02	06	04	12
Total		48	20	30	20	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Write assignments based on the theory taught in classrooms. Assignments consist of ten questions having long answers including charts, symbols, drawing, observations etc.
- Prepare/Download information about various industrial acts.
- Visit to any Manufacturing industry and prepare a report consisting of:
 - Organization structure of the organization/ Dept.
 - Safety measures taken in organization.
 - Mechanism to handle the disputes.
 - Any specific observation you have noticed.
- Give seminar on relevant topic.
- Undertake micro-projects.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Guide student(s) in undertaking micro-projects.
- Demonstrate students thoroughly before they start doing the practice.



- g. Encourage students to refer different websites to have deeper understanding of the subject.
- h. Observe continuously and monitor the performance of students in Lab.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

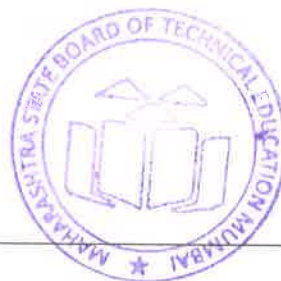
- a. Study of management principles applied to a small scale industry.
- b. Study of management principles applied to a medium scale industry.
- c. Study of management principles applied to a large scale industry.
- d. Prepare case studies of Safety measures followed in different types of organization.
- e. Study of measures to be taken for ensuring cyber security.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Management and entrepreneurship	Veerabhadrapa, Havinal	New age international publishers, New Delhi, 2014: ISBN: 978-81-224-2602-1
2	Principles of management	Chaudhry omvir Singh prakash	New Age international publishers, 2012, New Delhi ISBN: 978-81-224-3039-4
3	Industrial Engineering and management	Dr. O. P. Khanna	Dhanpath ray and sons, New Delhi
4	Industrial Engineering and management	Banga and Sharma	Khanna Publication, New Delhi

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

- a. <https://www.versesolutions.com/>
- b. <https://www.books.google.co.in/books?isbn=817758412X>
- c. <https://www. www.educba.com> › Courses › Business › Management



Program Name : Electronics Engineering Programme Group
Program Code : DE/EJ/ET/EN/EX/EQ
Semester : Sixth
Course Title : Computer Networking and Data Communication
Course Code : 22634

1. RATIONALE

Data communication deals with the transmission of digital data through a network. Many applications like Airline Reservations, Railway reservations, e-banking, e-governance, Online Shopping, e-learning can be managed by a single click. Diploma Engineers should be able to select, classify, install, troubleshoot and maintain different industrial data communication networks. This course gives the important concepts and techniques related to data communication and enable students to maintain and troubleshoot computer networks.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Maintain computer network systems.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

- Maintain wired computer network topologies.
- Use the relevant network model for the specified data communication system.
- Maintain relevant transmission medium and modem for data transmission.
- Analyze error detection/correction and flow control of data in the data network.
- Configure the network component and assign IP address.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25#	10	25	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map..



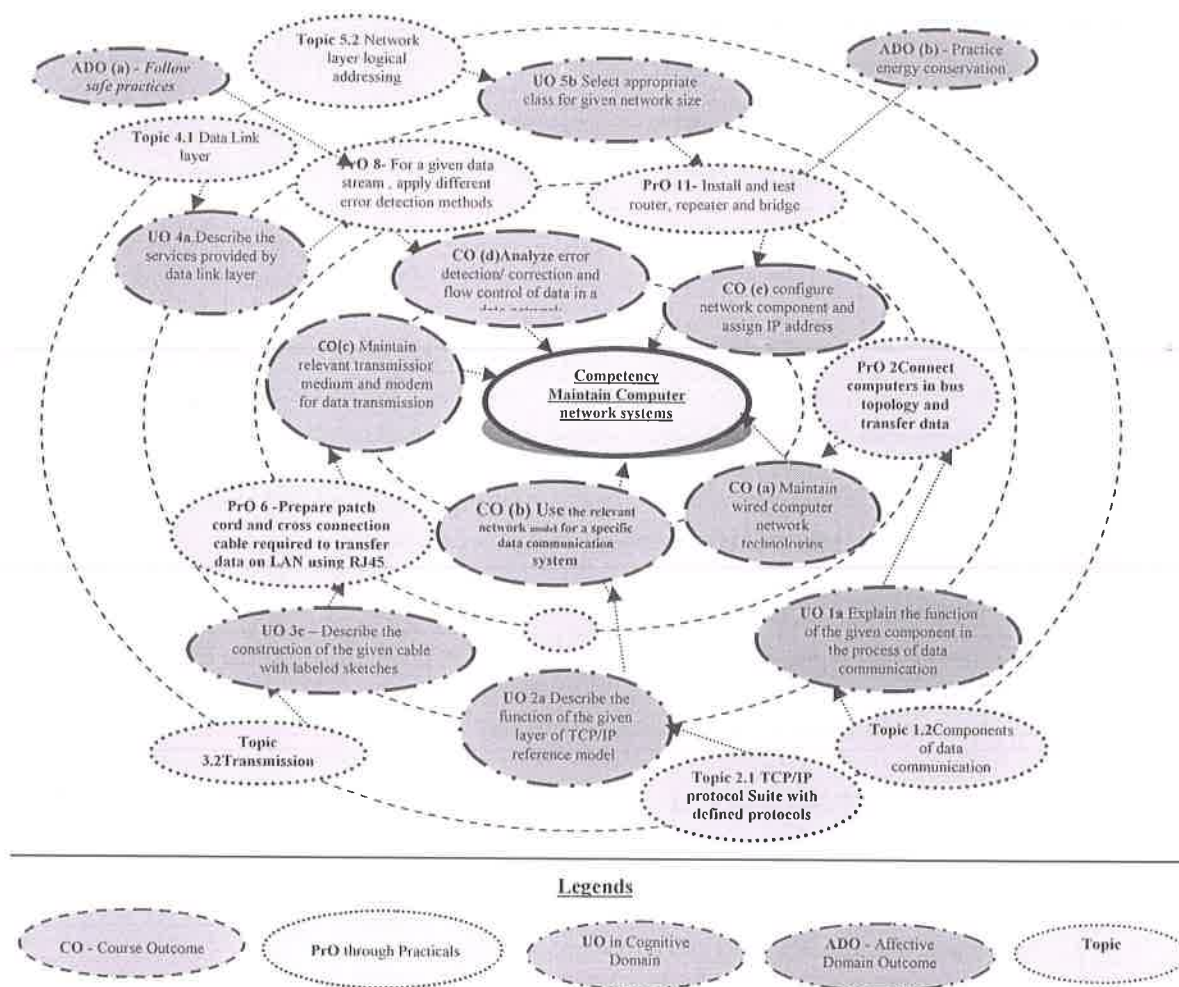


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Analyse the type of network topology used in your lab and prepare technical specifications for it.	I	02*
2	Connect computers in bus topology and transfer the data.	I	02
3	Connect computers in star topology and test the performance.	I	02*
4	Install/configure/Test Peer to Peer LAN and sharing of resources.	I	02*
5	Configure Point to Point network in laboratory.	I	02
6	Prepare patch cord and cross connection cables, use to connect the devices on the LAN.	III	02*
7	Using a Hub/ Switch Install a LAN network consisting of 6 computers	III	02
8	Locate the error bit in the given data stream by applying the different error detection methods.	IV	02*
9	Correct the error in a given data stream by applying the different error correction methods.	IV	02
10	Use route command to test the performance of the given network.	V	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
11	Install and test Router, Repeater and Bridge	V	02*
12	Assign IP address to the PC connected to the internet.	V	02*
13	Configure/Test Internet connectivity.	V	02*
14	Use FTP protocol to transfer file from one system to another system.	V	02*
15	Install and configure a Firewall for the network security.	V	02
16	Interconnect two PCs using RS232 cable and transfer data as null modem configuration.	V	02
Total			32

Note

- A suggestive list of **PrOs** is given in the above table. More such **PrOs** can be added to attain the **COs** and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each **PrO** is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental setup.	20
2	Setting and operation.	20
3	Safety measures.	10
4	Observation and recording.	10
5	Interpretation of result and conclusion.	20
6	Answer to sample questions.	10
7	Submission of report in time.	10
Total		100

The above **PrOs** also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical Practices.

The **ADOs** are not specific to any one **PrO**, but are embedded in many **PrOs**. Hence, the acquisition of the **ADOs** takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the **ADOs** according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organizing Level' in 2nd year



- 'Characterizing Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. S. No.
1	Client Machines (Computers with windows / Linux and latest configuration) with Printer: Laser jet	1 to 15
2	Network Tool kit: clamping, crimping tool, network tester, line tester	1 to 15
3	Network Accessories: RJ 45, UTP cable, T connector, Optical Fiber, Coaxial Cable, Modem, various connectors, 1000Mbps NIC.	1 to 15
4	UPS system 6KVA online.	1 to 15
5	Router, Repeater, Bridges: Latest configuration	10,11
6	Computer Hub 8/ 16 node with console port	1 to 15
7	Modem – Latest configuration	13
8	Ethernet Switch 4/8/16/24/32	1 to 15
9	LAN Cable (CAT6, CAT5)	1 to 15
10	Coaxial Cable, UTP Cable, STP Cable, Fiber Optic Cable	1 to 15
11	Firewall with high security and high storage	14,15
12	MS office latest version	1 to 15
13	Antivirus Software (online protection with firewall securities)	1 to 15
14	RS 232 cable and connector	16

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Fundamentals of Data Communication and network topology	1a. Explain the function of the given component in the process of data Communication. 1b. Describe the given data transmission method with its frame format 1c. Explain the given source of noise and its effect 1d. Design computer network considering particular topology. 1e. Classify networks on the basis of the given parameter.	1.1 Data communication and its characteristics 1.2 Components of data communication Transmitter, Receiver, Medium, Message, Protocol. Standards, Standard organizations. Basic block diagram of data communication system 1.3 Data Transmission: Serial, Parallel Synchronous, Asynchronous, Isochronous transmission 1.4 Transmission characteristics: Signaling rate, data rate, bit rate, baud rate 1.5 Need of computer networks, Network criteria, advantages of networking 1.6 Network topologies: Mesh, Star, Bus, Tree, Ring and Hybrid topologies - Schematic diagram, working, advantages, disadvantages and applications 1.7 Network Classification: Based on Transmission Technologies:



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		Point to-point, Multipoint, Broadcast Based on physical size(scale): PAN, BAN, LAN, MAN, WAN, VPN Based on Architecture: Peer to Peer, Client Server, advantages of Client Sever over Peer-to-Peer Model.
Unit– II Network Models	2a. Describe the function of the given layer of TCP/IP Reference model. 2b. Explain the relationship of layers with addresses in TCP/IP. 2c. Differentiate between various addressing schemes in TCP/IP. 2d. Describe the functions of the given layer of OSI Reference model.	2.1 TCP/IP protocol suite with define protocols in respective Layers: Physical layer, Data Link Layer, Network Layer, Transport Layer, Application Layer 2.2 Addressing in TCP/IP: Physical, logical, Port and specific 2.3 The ISO-OSI model: Physical layer, Data Link Layer, Network Layer, Transport Layer, Session Layer, Presentation Layer, Application Layer.
Unit– III Physical layer	3a. Describe the principle of given multiplexing technique. 3b. Select the transmission media for transmitting given signal for the given application. 3c. Describe the construction of the given cable with labeled sketches. 3d. Compare different types of Transmission medium on the basis of given parameter 3e. Explain with sketches the working of the given type of modem 3f. Compare different Multiplexing/Switching techniques on the basis of the given parameters.	3.1 Multiplexing: Basic concept, Frequency-Division Multiplexing, Wavelength-Division Multiplexing, Synchronous Time-Division Multiplexing, Statistical Time- Division Multiplexing 3.2 Transmission medium: classification based on electromagnetic wave spectrum 3.3 Guided Media -Twisted pair (UTP,STP) cable -connector, Coaxial cable - connector, Fiber-optic cable - connector, performance and applications 3.4 Unguided Media -Radio waves, microwaves, Infrared and their applications 3.5 Modems: classifications : Broadband modem, DSL –ADSL,HDSL,VDSL 3.6 Switching: Circuit-switched networks, Packet switched networks –Datagram approach, virtual circuit approach.
Unit– IV Data link layer	4a. Describe the services provided by Data Link Layer. 4b. Describe the technique of the given error control method with examples. 4c. Explain with sketches the given type of flow	4.1 Data link layer: Flow and Error control 4.2 Error control : Types of errors : single bit and Burst errors Error detection and correction –Hamming code, linear block code, CRC, checksum 4.3 Flow control: Framing, Flow and Error control, Noiseless and Noisy Channels – stop-and-wait protocol, Stop and wait



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	control used in the data link layer with justification. 4d. Compare characteristics of given type of Protocol. 4e. Select the appropriate protocol for error free transmission of given data	ARQ protocol 4.4 Sliding window protocol: One bit sliding window protocol, Go-Back-N ARQ, Selective Repeat ARQ 4.5 Point to point Protocol: service provided by PPP, Frame format PPP and Transition phases of PPP.
Unit- V Network, Transport and Application layer	5a. Justify the function of the given network device. 5b. Select appropriate class for given network size. 5c. Differentiate between class full and class less addressing 5d. Explain the role of NAT in address depletion. 5e. Explain the given type of Routing. 5f. Describe the services provided by transport layer/ network layer/Application layer. 5g. Describe the given type of network security technique.	5.1 Network devices: Repeater, Hub, Bridge, Switches, Router, Gateway 5.2 Network layer Logical addressing: IPv4 Addresses: address space Notations, classful and classless addressing, Network address translation(NAT), IPv6 addresses, Need for IPv6, Structure and address space 5.3 Network layer-Multicast Routing Protocols : Unicast, Multicast and Broadcast routing and applications Transport Layer: Process to process delivery, UDP, RTP and SCTP: ports, format, operation and uses 5.4 Application Layer services: Concept of DNS, FTP, 5.5 Network security: Cryptography: it's Components, Block diagram of symmetric and asymmetric cryptography 5.6 Security services: concepts of message and entity security services, Firewall.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Fundamentals of Data Communication and network topology	12	02	08	06	16
II	Network Models	08	--	04	08	12
III	Physical layer	08	04	04	06	14
IV	Data link layer	08	-	04	08	12
V	Network, Transport, Application layer	12	02	06	08	16
Total		48	08	26	36	70



Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare journals based on practical performed in laboratory.
- Follow the safety precautions.
- Prepare specifications of a given communication medium.
- Test the performance of HUB, Switches, router and Servers.
- Library / Internet survey of computer network and data communication.
- Prepare power point presentation or animation for understanding different switching networks.
- Prepare a presentation on TCP/IP reference model and the OSI reference network model
- Visit to any industry to observe the different networks.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**..
- Video programs/YouTube may be used to teach various topics and sub topics.
- Demonstrate students thoroughly before they start doing the practice.
- Encourage students to refer different book and websites to have deeper understanding of the subject.
- Observe continuously and monitor the performance of students in Lab.
- Encourage students to use front/rear panel control of electronic instruments.
- Encourage students to visit nearby electronic instruments repair workshop units or manufacturing industries.
- Instruct students to safety concern of handling electronic instruments and also to avoid any damage to the electronic instruments.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the **Only one micro-project** is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so



that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

- A network proposal has to be developed for a bank. The bank has a main office, which is located in London, and has 5 branch offices located at Paris, California, Mumbai, Dubai and Singapore. The bank has an application server, which is used by its customers across the world for online transactions. All the branches have high speed internet connection. There are approximately 100 users in each of the branch offices and 200 users in the main office.
- Prepare a proposal to develop a network system that links two branch offices of an organization. The two branches are separated by a distances of 10 Km. Make appropriate assumption while preparing the proposal.
- Interconnect two PCs using RS232 cable. Write the step by step procedure to transfer a file from one computer to another computer through RS232 link and implement .
- Prepare a hardware specification required to develop a wireless LAN for a cyber-cafe for 20 users.
- Develop a Bluetooth network of 5 devices namely laptop, mobile phone, speaker, keyboard, printer (piconet) and transfer files from one device to another. Configure your laptop / mobile as a hot spot for internet access.
- Prepare a detailed report on application of computer network in a Mall / railway reservation system.
- Visit a CISCO based laboratory/ any other networking laboratory and prepare a report of the various networking equipments and the networking facility

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Computer Networks.	Tanenbaum, A.S	Pearson Education, New Delhi, India, Fourth Edition, 2011 ISBN : 9788131787571
2	Data Communication and Networking	Forouzan, Behrouz A	McGraw Hill, Education New Delhi, 2015; ISBN 9780072967753
3	Introduction to Data Communications and Networking	Tomasi, W.	Pearson Education, New Delhi, India, 2007 ISBN : 9788131709306
4	Data and Computer Communications	Stallings, W.	Prentice Hall India, 10 th Edition, 2013 ISBN : 9780133506488
5	Data Communications and Networks	Godbole, A.S. ; Kahate, A.	Tata McGraw Hill, New Delhi, India, Second Edition, 2011 ISBN (13) : 9780071077705
6	Computer Networks	Kurose, James F. ; Ross, Keith W.	Pearson Education, New Delhi, India, Third Edition, 2011 ISBN : 9788177588781



S. No.	Title of Book	Author	Publication
7	Data Communications and Computer Networks	ISRD Group	Tata McGraw Hill, New Delhi, India, First Edition, 2006 ISBN (13) : 9780070616820

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

- a. <https://www.youtube.com/watch?v=hAopORgAcbQ>
- b. nptel.ac.in/courses/106105081/2
- c. https://www.ics.uci.edu/~magda/Courses/netsys270/ch1_v1.pp
- d. https://www.ics.uci.edu/~magda/Courses/netsys270/ch2_v1.ppt
- e. https://www.youtube.com/watch?v=gJ5h4_0mlll
- f. https://www.tutorialspoint.com/principles_of_communication/principles_of_communication_multiplexing.htm
- g. https://www2.rivier.edu/faculty/vriabov/CS553_ST7_Ch08-Multiplexing.pp
- h. https://www.ics.uci.edu/~magda/Courses/netsys270/ch6_1_v1.ppt
- i. https://www.ics.uci.edu/~magda/Courses/netsys270/ch7_1_v1.ppt
- j. nptel.ac.in/courses/106105082/19
- k. nptel.ac.in/courses/106105082/17
- l. <http://www.nptel.iitm.ac.in/courses>
- m. nptel.ac.in/courses/106106157/52



Program Name : Electronics Engineering Programme Group
Program Code : DE/EJ/ET/EN/EX/EQ/IE/IS/IC/
Semester : Sixth
Course Title : Emerging Trends in Electronics
Course Code : 22636

1. RATIONALE

Every technological area is developing at an exponential rate. New applications are coming up and it is mandatory for all technologists to be well versed in these developments to survive and provide satisfactory and quality services to the society and industry. This course aims to prepare the diploma graduates to be conversant with such emerging trends. The main areas in which such developments are encompass Smart systems, Digital Factory and Communication. The course gives an introduction of these areas and helps the students to apply emerging trends.

2. COMPETENCY

Aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Use the trending practices in Electronics fields.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

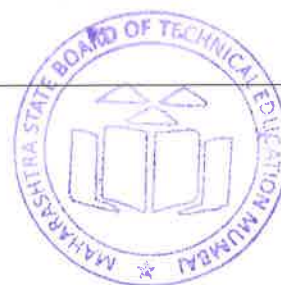
- Suggest the relevant computing systems/processor for specific type of application.
- Suggest the relevant components for the emerging application/s.
- Suggest different telecom network for given application.
- Suggest the relevant IoT technologies for Digital Factory.
- Suggest the different electronic systems for smart world.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	-	3	90 Min	70*#	28	30*	00	100	40	--	--	--	--	--	--

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the Cos(*#): On Line ESE

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P -Practical; C – Credit, ESE –End Semester Examination; PA - Progressive Assessment #-External Assessment



5. COURSE MAP (with sample COs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

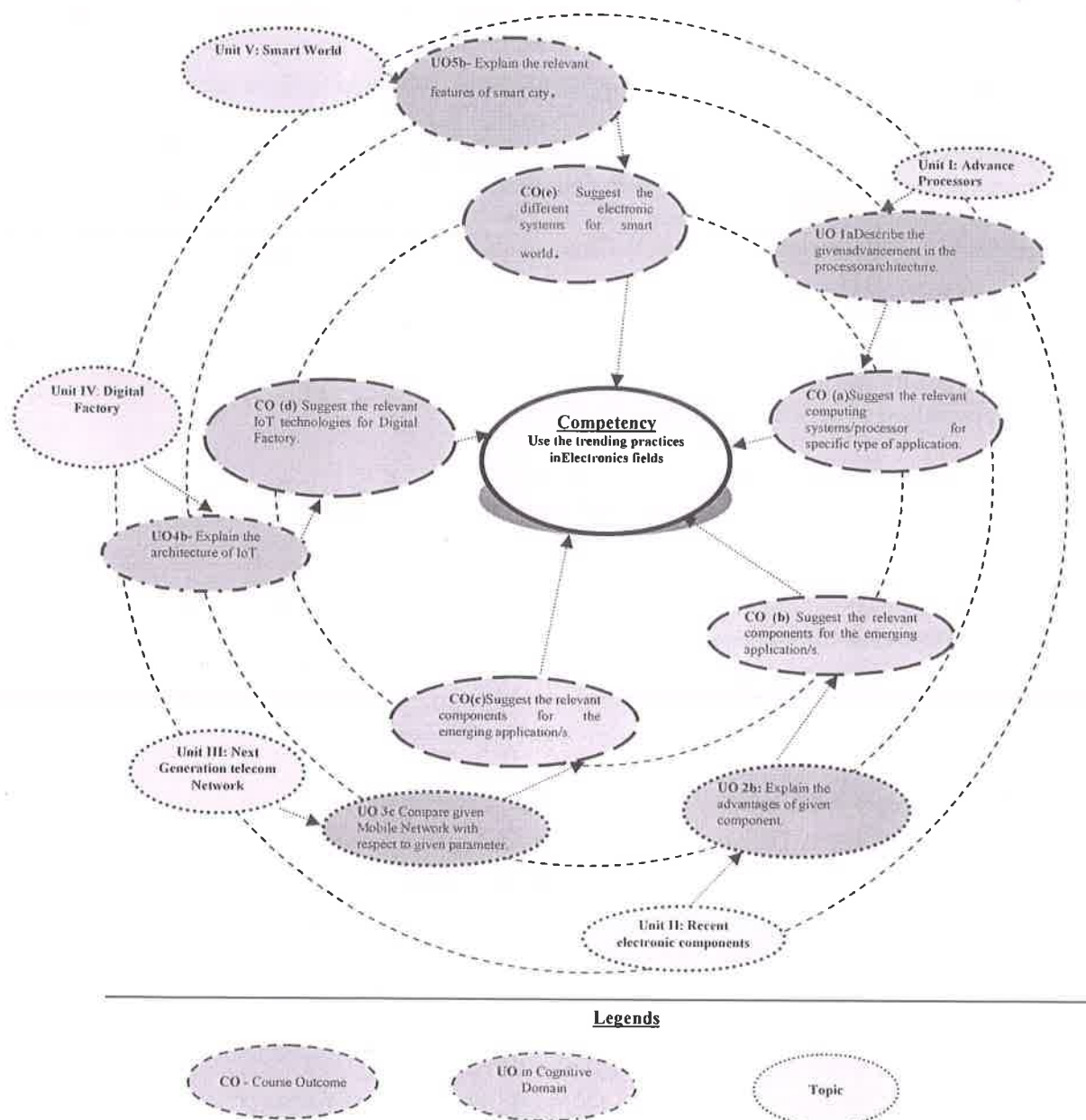


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES: Not Applicable

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED: Not Applicable



8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit– I Advance Processors	1a. Describe the given advancement in the processor architecture. 1b. Describe the given features of Arduino board. 1c. Describe the given function in Arduino IDE. 1d. Describe the given feature of the ARM7 processors. 1e. Compare the given salient features of ARM 7 and ARM 7TDMI processors.	1.1 Advances in processor architecture: RISC, Pipelining and Superscalar concepts, advantages and Applications. 1.2 Arduino: Introduction, Compatible R2/R3 Uno board Features. Atmega 328: Introduction, pin description. 1.3 Arduino IDE: Features, Sketch: C,C++ functions setup(), loop(), pinMode(), digitalWrite(), digitalRead() and delay() 1.4 Arduino Interfacing: LED, Relay, DC motor. 1.5 ARM: Introduction, Features of ARM7 and ARM7TDMI, advantages, applications. Versions of ARM processor only features.
Unit – II Recent Electronic Components	2a. State features of given component. 2b. Explain the advantages of given component. 2c. Explain the concept of SMD and soldering method	2.1 Flexible PCB: Features and Applications 2.2 Battery [Li-ion, nuclear] :Concepts and Applications 2.3 Memristor, Organic LED: Concepts, Features and Applications 2.4 Surface Mount Device: Concepts, advantages, Applications and Reflow soldering method.
Unit– III Next Generation telecom Network	3a. Explain the function of given Network components. 3b. Describe the Spectrum in Telecom sector. 3c. Compare given Mobile Network with respect to given parameter. 3d. Explain the given component used in FTTH. 3e. Explain the Multi Protocol Label Switching in NGN core. 3f. Describe the features of OTN and PON.	3.1 NGN architecture: Features, Functional block diagram, Network components: Media Gateway, Media Gateway Controller, and Application Server. 3.2 NGN Wireless Technology: Telecom network Spectrum: Types [licensed and unlicensed], Mobile Network Evolution (2G to 5G), Comparative features, 3.3 Fiber to the Home (FTTH): Features, Architecture And Components: Optical Line Termination (OLT), Optical Network Unit (ONU). 3.4 NGN Core: Features, Multi Protocol Label Switching (MPLS): Concepts, Features and Advantages.



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		3.5 Next generation transmission system: Optical Transport Network variants: Synchronous Transfer Module STM1, STM4, STM16, STM64 and STM256 Features: bit rates and capacity .Passive Optical Network: BPON, Ethernet PON, Gigabit PON features.
Unit– IV Digital Factory	4a. Explain the principle of IoT used in given application. 4b. Explain the architecture of IoT. 4c. Explain the importance of Industrial revolution I4.0.	4.1 Internet of Things IoT: Introduction, principles and features of Cyber Physical system Components [Sensors, Edge-Gateways, Cloud]. 4.2 Architectures [Sensor to cloud various data routes: sensor-PLC-SCADA-cloud, sensor-server-cloud, sensor-edge gateway-cloud], Applications in Automotive/ Discrete Manufacturing; Telecom Industry; Agro Industries 4.3 I4.0/IIoT/ Smart Manufacturing: Introduction/ Evolution from I1.0 to I4.0, Applications and benefits of I4.0, Compare I3.0 with I4.0, Architecture of I4.0
Unit– V Smart World	5a. Explain the working principle of given electronic system in smart home. 5b. Explain the relevant features of smart city. 5c. Explain the mechanism of city surveillance in smart city. 5d. Explain the given Network component functions.	5.1 Evolution of smart home. 5.2 Basic requirements and components for Smart Home: Video Monitoring, Security and Alarm, Door control, Heating Ventilation and Air Conditioning control (HVAC), Smart lighting, Smart metering and Web controlling appliances. 5.3 Basic requirements for Smart City: Smart Transportation, Smart Healthcare, Smart waste, Smart physical safety/Security (IP based CCTV, Fire and Gas detection, Fire extinguishers) and Smart education. 5.4 IOT/M2M Network architecture: Conceptual diagram Domains for operation: Application domain, Network domain, M2M device domain. Network components: functions of Sensors, Access devices, Gateways, Access Protocols. Communication Network and Application server.



Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTIONPAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Advance Processors	10	02	06	08	16
II	Recent Electronic Components	08	02	04	04	10
III	Next Generation Telecom Network	12	04	04	08	16
IV	Digital Factory	10	04	06	06	16
V	Smart world	08	02	04	06	12
	Total	48	14	24	32	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

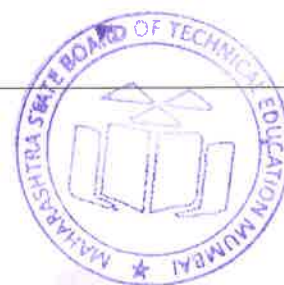
Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages (one activity by each group), also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare a report on proposed features of Smart city.
- Prepare a power point presentation on IoT/IIoT applications.
- Prepare report on visit to nearby telecom exchange/industry.
- Perform Group discussion on new Electronic Components.
- Prepare a comparative chart of recent processors.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are suggested strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About *15-20% of the topics/sub-topics* which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
- Guide student(s) in undertaking micro-projects.



- f. Show video demonstration on safety precautions.
- g. Demonstrate the actions and care to be taken.
- h. Arrange a visit to Electronic industry.
- i. Arrange expert lecture of industry person.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the year. In the first two years, the micro-project is group-based. In the third year the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs as applicable. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

- a. Prepare a report on existing automation in an industry and suggest improvements.
- b. Prepare a report on Smart City.
- c. Build arduino based project for smart home.
- d. Build arduino based project for smart city.
- e. Prepare a report on Smart city surveillance systems.
- f. Prepare report on electronic systems in Disaster Management.
- g. Present a power point presentation on upcoming 5G technology.
- h. Prepare a report on automatic electronic components assembly machines.
- i. Conduct a survey and prepare a report on various EDA tools.
- j. Prepare an application report on AR VR Technologies.
- k. Prepare a report on Artificial Intelligence.
- l. Prepare a report on Machine Learning.
- m. Prepare report on electronic home security systems.
- n. Prepare report on fire and gas detection and deluge systems.
- o. Prepare report on ATM security systems.

13. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Sustainable Smart Cities in India: Challenges and Future Perspectives	Poonam Sharma, Swati Rajput,	Spinger; ISBN 978-3-319-47145-7
2	The ABC of Fiber Optics Communication	Sudhir Warier	Artech House Boston London ISBN 13: 978-1-63081-414-4
3	IoT Fundamentals: Networking Technologies Protocols and use cases for IoT	David Hanes, Gonzalo Salguein	Cisco Press. ISBN 13: 978-1-58714-456-1



Sr. No.	Title of Book	Author	Publication
4	The AVR Microcontroller and Embedded Systems using Assembly and C.	MuhammadAli Mazidi	MicroDigitalEd.com ISBN-13:078-0997925968
5	ARM Assembly Language Programming & Architecture	Muhammad Ali Mazidi, Sarmad Naimi	MicroDigitalEd.com ISBN-13: 978-0997925906

14. SUGGESTED SOFTWARE/LEARNING WEBSITES:

Sr No	Theory topic /sub topic	Web site
1	Unit– I Advance Processors (Advances in processor architecture)	https://slideplayer.com/slide/8290583/
2	Unit– I Advance Processors (Arduino)	http://www.hobbytronics.co.uk/arduino-uno-r3
3	Unit– I Advance Processors (Arduino)	https://www.arduino.cc/en/Guide/HomePage
4	Unit– Advance Processors(ARM)	http://www.microdigitaled.com
5	Unit– Advance Processors (ARM)	https://en.wikipedia.org/wiki/ARM7
6	Unit – II Recent Electronic Components (Flexible PCB)	https://en.wikipedia.org/wiki/Flexible_circuit
7	Unit – II Recent Electronic Components (SMT)	https://www.electronics-notes.com/articles/electronic_components/surface-mount-technology-smd-smt/what-is-smt-primer-tutorial.php
8	Unit– III Next Generation telecom Network	TRAI official website: www.trai.gov.in
9	Unit– III Next Generation telecom Network	https://www.itu.int/rec/dologin_pub.asp?lang=e&id=T-REC-Y.2012-200609-S!!PDF-E&type=items
10	Unit– IV Digital Factory (IoT)	https://en.wikipedia.org/wiki/Internet_of_things
11	Unit– IV Digital Factory	http://dot.gov.in/sites/default/files/National%20Telecom%20M2M%20Roadmap.pdf
12	Unit– IV Digital Factory	http://www.tec.gov.in/technical-reports/
13	Unit– IV Digital Factory (I4.0/IIoT)	http://i40today.com/
14	Unit– V Smart World	http://tec.gov.in/pdf/M2M/Design%20Planning%20Smart%20Cities%20with%20IoT%20ICT.pdf



Program Name : Electronics Engineering Programme Group
Program Code : DE/EJ/ET/EN/EX/EQ/IE
Semester : Sixth
Course Title : Mechatronics
Course Code : 22643

1. RATIONALE

Mechatronics is a rapidly developing interdisciplinary field of engineering, which comprises the development of various computers integrated electro-mechanical systems. It is an integration of mechanical engineering, electrical & electronics engineering, computer engineering, control and instrumentation engineering. This integration facilitates the production of complex engineering systems with a high level of performance, reliability at affordable price. Due to these aspects, industrial sector is rapidly adopting such integrated systems. To adopt such systems, industries are in need of the diploma engineers to install, operate and maintain these systems.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Install, Operate and Maintain various types of mechatronic systems.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

- Install and Maintain the sensors and transducers of mechatronics systems.
- Install and Maintain CNC Machine.
- Install and Maintain pneumatic components in mechatronic systems.
- Install and Maintain hydraulic components in mechatronic systems.
- Install and Maintain different components of robotic systems.

4. TEACHING AND EXAMINATION SCHEME

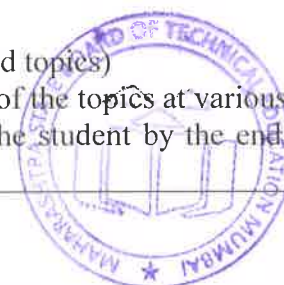
Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P -Practical; C – Credit, ESE -End Semester Examination; PA - Progressive Assessment

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the



course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

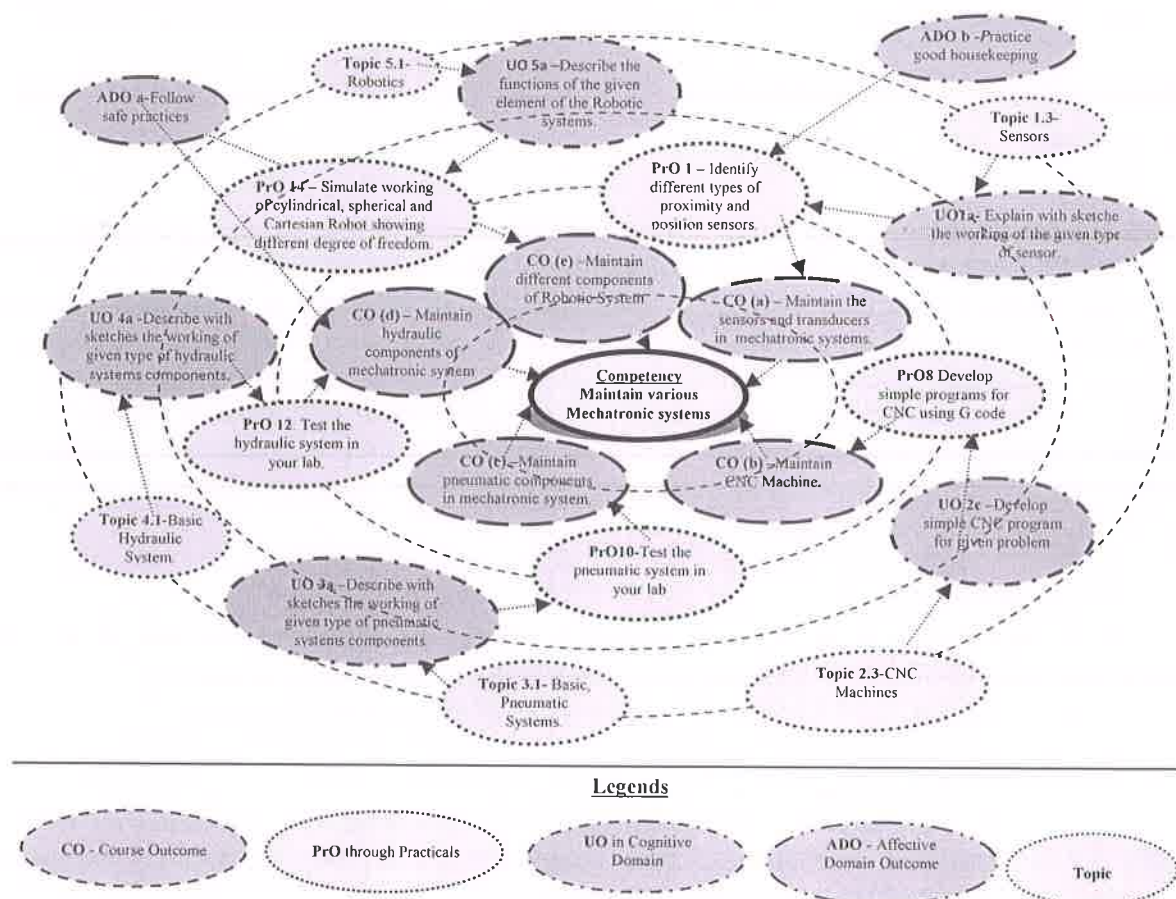


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals' in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency:

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Identify different types of proximity and position sensors.	I	02
2	Choose the appropriate sensors for the given applications.	I	02*
3	Use relevant transducer for velocity, motion, acceleration and torque sensors for the specified applications.	I	02
4	Measure the speed of the given motor using stroboscope sensor.	I	02*
5	Identify various components of translational mechanical system	II	02
6	Identify various components of rotational mechanical system	II	02
7	Identify various components of electrical system.	II	02*
8	Develop simple programs for CNC using G code and M code.(open source software)	II	02*
9	Troubleshoot pneumatic system of mechatronic systems.	III	02
10	Test the pneumatic system available in your Lab.	III	02*
11	Troubleshoot hydraulic system of mechatronic systems.	IV	02
12	Test the hydraulic system available in your Lab.	IV	02*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
13	Troubleshoot different mechanical actuators of mechatronic systems	IV	02
14	Simulate the working of cylindrical, spherical and Cartesian robot showing different degree of freedoms.	V	02
15	Simulate the working of pick and place robot. (Matlab / simulink software)	V	02*
16	Demonstrate the working of Automated Guide Vehicle (Virtual Lab / Demonstration in Industry/Videos).	V	02
17	Demonstrate the working of Anti-lock Braking System (ABS) (Virtual Lab / Demonstration in Industry/Videos).	V	02*
Total			34

Note

- A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

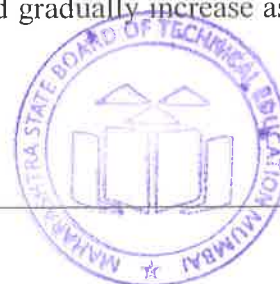
S.No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and Recording	10
5	Interpretation of result and Conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Practice energy conservation.
- Work as a leader/a team member.
- Follow ethical Practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organisation Level' in 2nd year



- 'Characterization Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

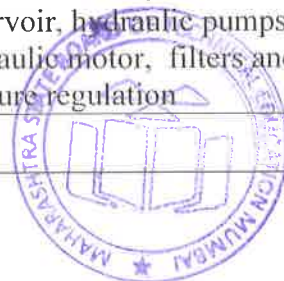
S. No.	Equipment Name with Broad Specifications	PrO. No.
1	Sensors, transducers and signal conditioners demonstration boards.	01, 02 ,03 and 04
2	Small physical models of different types of system (if not available use virtual labs or any other relevant sources).	05 to 07
3	CNC machine.	08
4	Pneumatic system component trainer kit.	09, 10
5	Hydraulic system component trainer kit.	11, 12, 13
6	Small robotics model/proto type/ (or virtual lab).	14, 15
7	AGV and ABS simulation (small physical model or virtual lab)	16, 17

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit- I Sensors for Mechatronics system.	1a. Describe with sketches the function of the given type(s) of sensors and transducers. 1b. Compare the given types of sensors based on given criteria. 1c. Explain with sketches the working of the given type(s) of sensor. 1d. Justify the need for the signal conditioning circuits in the given mechatronics system. 1e. Describe the troubleshooting procedure for the specified problem of the given type of sensor or transducers.	1.1 Mechatronics system architecture: Sensors, signal conditioners, PLC/ Embedded controllers, pneumatic, hydraulic and electrical actuators. 1.2 Introduction to Real Time Mechatronics System: Block diagram & Functions: Real time mechatronics system (Flexible Manufacturing System: FMS), Computer Integrated Machines: CIM)) 1.3 Sensors: Construction, principle of operation and application) <ol style="list-style-type: none"> Proximity and position Sensors: Photo electric sensors, Hall Effect sensors, optical encoder, eddy current proximity sensor, inductive sensor, capacitive sensor. Velocity Sensors: Electromagnetic transducers, Tacho generators Motion Sensors: Stroboscope, pyro electric sensors. Acceleration sensors: strain gauge accelerometer, piezoelectric accelerometer, LVDT accelerometer. Pressure sensors: load cells

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		<p>vi. Torque sensors : Torque measurement using strain gauge, torque measurement using torsion bar (optical method, capacitive method, proximity sensor method, stroboscope method).</p> <p>1.4 Signal conditioners: Need of isolators, filters, amplifiers, fluid amplifiers, optical amplifiers and data converters in mechatronics systems.</p>
Unit –II Basic Mechatronics systems.	<p>2a. Describe with sketches the building blocks of the given system model.</p> <p>2b. Built a model from given system component.</p> <p>2c. Develop simple CNC programs for given problem.</p> <p>2d. Describe with sketches general configuration of CNC systems.</p>	<p>2.1 Basic System Models: Introduction, mechanical system building blocks – Translational and Rotational system building up a mechanical system model ,Electrical system building blocks - building up a model for an electrical system.</p> <p>2.2 System Models: Introduction, rotational-translational systems, electro-mechanical systems – System components & function. (No mathematical modelling)</p> <p>2.3 CNC Machines: General configuration of CNC system, advantages of CNC, part programming of CNC machines, G codes and M codes, small application programs, CNC based drilling machine.</p>
Unit-III Pneumatic System	<p>3a. Explain the working of given type of pneumatic system components.</p> <p>3b. Explain the working principle of given type(s) of pneumatic actuator.</p> <p>3c. Identify the use of given type(s) of pneumatic component.</p> <p>3d. Describe the procedure to maintain the given type(s) of pneumatic system component.</p>	<p>3.1 Basic Pneumatic Systems: Basic, Pneumatic system circuit, Air compressors, filters and regulators, air treatment, valves</p> <p>3.2 Actuators : Principle of operation of linear actuators (single acting cylinder, double acting cylinder) rotary actuators(rotating vane, gear type) and direction control valves (poppet valve, spool valve)</p> <p>3.3 Pneumatic System: Applications, Advantages and Limitations.</p>
Unit-IV Hydraulic System	<p>4a. Explain the working of given type of hydraulic system components.</p> <p>4b. Explain the working principle of given type(s) of hydraulic actuator.</p> <p>4c. Explain with sketches the working</p>	<p>4.1 Basic Hydraulic systems: primary components of hydraulic systems: Reservoir, hydraulic pumps, Hydraulic motor, filters and pressure regulation</p>



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	<p>of the given mechanical actuating system.</p> <p>4d. Identify the use of given type(s) of Hydraulic system components.</p> <p>4e. Describe the procedure to maintain the given type(s) of Hydraulic system components.</p>	<p>4.2 Actuators :Principle of operation of linear actuators (single acting cylinder, double acting cylinder) rotary actuators(rotating vane, rack and pinion type)</p> <p>4.3 Mechanical Motion Element: cams, gear, belt , rack and pinion and bearings (principle of operation and application)</p> <p>4.4 Hydraulic System: Applications, Advantages and Limitation</p>
Unit – V Robotics and Mechatron ics Applicatio ns	<p>5a. Describe with sketches the functions of the given element of the Robotic systems.</p> <p>5b. Explain with sketches the given degree of freedom for a robot.</p> <p>5c. Explain with sketches the working of the given robotics application.</p> <p>5d. Compare the given types of robot on the basis of degree of freedom, construction, end effectors used and applications.</p> <p>5e. Describe the procedure to maintain the given robotic system for the specified application.</p>	<p>5.1 Robotics: Block diagram and function of each component (sensors, drive system, control system, end effectors), construction and degrees of freedom of cylindrical, spherical and Cartesian robots, applications of robot.</p> <p>5.2 Microcontroller based antilock brake system.</p> <p>5.3 Microcontroller based pick and place robot.</p> <p>5.4 Microcontroller based car park barrier system.</p> <p>5.5 AGV (Automated Guided Vehicle): Basic concept, block diagram, role of mechatronic in guided vehicle</p>

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Sensors for Mechatronics system.	14	06	08	06	20
II	Basic Mechatronics systems.	06	02	04	04	10
III	Pneumatic System	10	04	06	04	14
IV	Hydraulic System	10	04	06	04	14
V	Robotics & Mechatronics Applications	08	04	04	04	12
Total		48	20	28	22	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual

distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare manuals based on practical performed in laboratory.
- Give seminar on relevant topic.
- Library/Internet survey regarding different data books and manuals.
- Prepare power point presentation on "Mechatronic Systems".
- Undertake a market survey of different manufacturer of "Mechatronic Systems".

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Guide student(s) in undertaking micro-projects.
- Use Flash/Animations to explain working of control system.
- Use open source simulation software modules to perform different applications of pneumatic, hydraulic system.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

- Design a microcontroller based robotarm to pick and place ferrous material from one place to another place (zero to 180 degree).



- b) Design a microcontroller based AVCS for speed control and mirror adjustment for car. (Use relevant speed measurement sensor for speed control and simple small dc motor for mirror adjustment)
- c) Design a controller based ABS (Use of linear actuator).
- d) Design a small model for hydraulic system.
- e) Design a small model for pneumatic system.
- f) Design a model to demonstrate the use of any one velocity sensor.
- g) Demonstrate the use of any one motion sensor using simulation.
- h) Demonstrate the use of any one pneumatic actuator using simulation.
- i) Demonstrate the use of any one mechanical actuator using simulation.

Note: To implement above micro project actual physical model or simple computer simulation is expected.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Mechatronics - Integrated Mechanical electronic systems.	Ramachandran, K. P.; Vijayaraghavan, G. K.; Balasundaram, M.S.	Wiley-India, New Delhi First edition, 2008 ISBN: 978-81-265-1837-1
2	Mechatronics	Bolton, W.	Pearson Education, New Delhi, 2003, 3 rd Edition, ISBN: 0131216333
3	Mechatronics	Rajput, R. K.	S. Chand & Co. Ltd. New Delhi, 1 st Edition, ISBN: 81-219-2859-1
4	Mechatronics	Singh, M. D.; Joshi, J. G.	PHI Learning Private Limited, New Delhi, 2006, ISBN: 8120329864

14. SOFTWARE/LEARNING WEBSITES

- a) Automation studio (educational version).
- b) Autosar (educational version)
- c) Mechatronics - www.youtube.com/mechatronics
- d) www.nptel.ac.in/downloads/112103174/
- e) Basics of Mechatronics - https://www.youtube.com/watch?v=Ro_tFv1iH6g.
- f) Simulation of Mechatronics systems - www.youtube.com/watch?v=DbGTwvyT_Co.
- g) Understanding control system - www.youtube.com/watch?v=pVAY2zOy0vU.
- h) AVCS – Cruise Control - <https://www.youtube.com/watch?v=zq1RSDNRh3Q>.
- i) CNC machine - <https://www.youtube.com/watch?v=-Qn-KCU4cWU>
- j) System variations - www.youtube.com/watch?v=G4OLOjY4MpQ.
- k) ABS - www.youtube.com/watch?v=NCkwnm_IsPc.



Program Name : Electronics Engineering Programme Group
Program Code : DE/EJ/ET/EN/EX/EQ
Semester : Sixth
Course Title : Optical Network and Satellite Communication
Course Code : 22647

1. RATIONALE

Optical communication technology is developing at very fast pace. Cost trends for fiber vs copper, better transmission quality, high data rate, large band width and reduction in fiber maintenance expense are the major reasons for fast adaptation of this mode of communication. Today in different communication scenarios satellite applications plays important role. The knowledge of satellite communication systems and equipment is very essential. This course will facilitate students to apply the basic principles of optical communication system and satellite communication system to maintain different types of applications based on it.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain optical communication networks.
- Maintain satellite communication systems.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

- Interpret the functions of the various blocks of optical fiber communication system.
- Measure the optical fiber cable parameters.
- Select relevant architecture of optical networks for the given application.
- Select uplink and downlink frequencies for various satellite services.
- Maintain Satellite services.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme													
L	T	P		Theory								Practical					
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)



This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

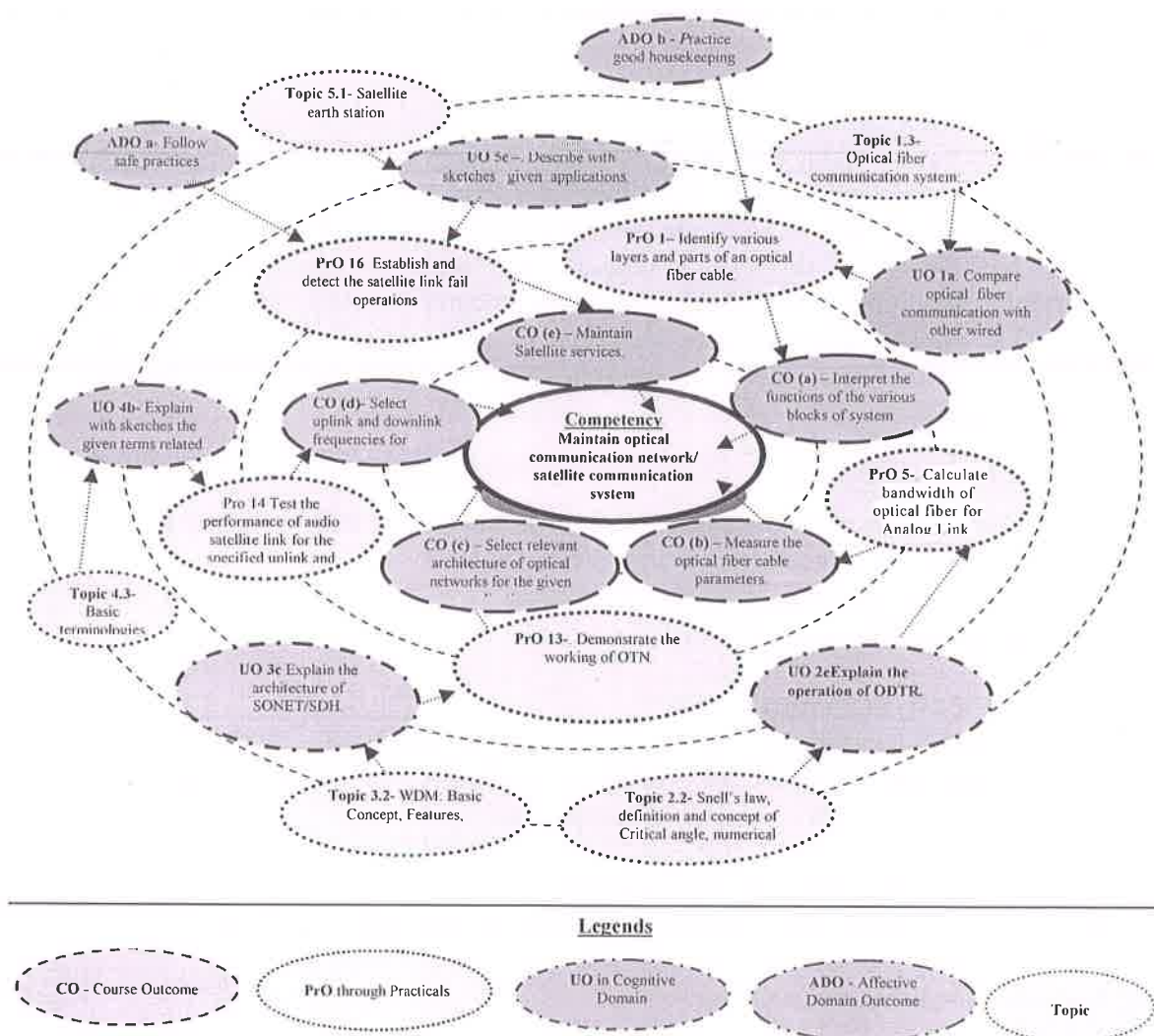


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency:

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Identify various layers and parts of an optical fiber cable.	I	02*
2	Test the performance of Pulse width modulator and demodulator (PWM) where optical fiber cable is used as transmission media.	I	02*
3	Test the performance of the given photo-diode (Detector) use LED as an optical source.	I	02
4	Test performance of given photo-diode (Detector) use LASER as optical source.	I	02*
5	Calculate bandwidth of optical fiber for Analog Link.	II	02
6	Observe the change in power level of optical fiber due to cleaning	II	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	effects in the fiber.		
7	Calculate Numerical Aperture (NA) and acceptance angle for the given optical fiber cable.	II	02*
8	Connect the given Optic cable with relevant optical connector and test the performance of cable.	II	02
9	Measure attenuation losses for the given length of optical fiber cable.	II	02
10	Measure bending losses of the given optical fiber optic cable.	II	02*
11	Demonstrate attenuation losses for the given length of optical fiber cable with the help of OTDR. (Virtual lab/ Demonstration in industry/videos can be used in case of non-availability of the splicing machine in the lab)	II	02
12	Join optical fiber cables using Splicing machines. (Virtual lab/ Demonstration in industry/ videos can be used in case of non-availability of the splicing machine in the lab)	II	02
13	Demonstrate the working of OTN. (Virtual lab/ Demonstration in industry/ videos can be used in case of non-availability in the lab)	III	02*
14	Test the performance of audio satellite link for the specified uplink and downlink frequency.	IV	02*
15	Develop a program using a relevant simulation tool to calculate the time period of a satellite for the given velocity and altitude based on Kepler's third law.	IV	02
16	Detect the satellite link fail operations and re-establish the link.	V	02
17	Establish a link to transmit and receive three separate signals (audio, video, tone) simultaneously through satellite link.	V	02
TOTAL			34

Note

- A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S.No.	Performance Indicators	Weightage in %
a.	Preparation of experimental set up	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		100



The above PrOs also comprise of the following social skills/ attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- a) Follow safety practices.
- b) Practice good housekeeping.
- c) Practice energy conservation.
- d) Work as a leader/a team member.
- a) Follow ethical Practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organisation Level' in 2nd year
- 'Characterisation Level' in 3rd year

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

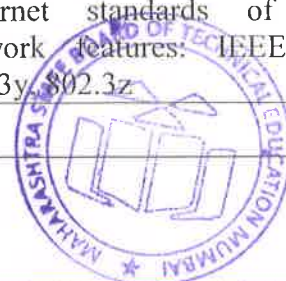
S. No.	Equipment Name with Broad Specifications	PrO. No.
1.	CRO/Digital storage oscilloscope: 60MHz/100MHz/200MHz bandwidth, 500MS/s to 1GS/s real-time sample rate, 50GS/s sample rate for repetitive waveforms, High resolution color LCD display	2,3,4,5
2.	DMM: DC, 0-1.5/3Amp, 0-2.5/5 Amp, 0-5/10Amp, 0-150/300V, 0-250/500V, 0-75/150V AC-0-1000V, 0-10A	2,3,4,5
3.	Power Supply Type: DC, 0- 30 V, 0 - 3A	2,3,4,5
4.	Fiber Optic Trainer kit	1,2,3,4,5,7
5.	Fiber optic cable tester	2,3,4,5
6.	Optical fiber Power meter	6,8,9
7.	Lux meter: Display: 3 1/2 digit 18mm (0.7") /LCD •Ranges: 1 to 50,000 LUX /Over-input: indication of " 1 " /Sampling Time: 0.5 second /Repeatability: $\pm 2\%$ /Temperature Characteristic: $\pm 0.1\%$ /? •Accuracy: $\pm 4\%$ rdg $\pm 0.5\%$ f.s	3,4,5
8.	OTDR-Attenuation resolution-0.001 dB, Attenuation measurement linearity 0.05 dB, Distance measurement accuracy $\pm (0.5 + \text{resolution} + 5 \times 10^{-5} \times L)$ m	8,9,10, 11,12
9.	PC - Processor - dual core @ 2.4 GHz (i5 or i7 Intel processor or equivalent AMD), RAM - 4 GB, Hard Drive - 320 GB 5400 RPM hard drive, OS- win7/10	11,12, 13
10.	Spectrum Analyzer- frequency range- 2.4 to 2.495GHz, Resolution – 26KHz to 3MHz, resolution BW-58.036 to 812.500KHz	14,15,16,17
11.	Splicing, Cutting and trimming tool of plastic fiber optic cables	6,12
12.	Fiber optic cleaning kit	6
13.	Satellite Trainer Kit (ST2272)/ (STC 24): Up linking frequency 2414-	15,16,17,18

S. No.	Equipment Name with Broad Specifications	PrO. No.
	/2432/2450/2468 MHz, 4 MHz clock frequency, PIC16F84 - 8 Bit RISC processor based PLL, 16 MHz Bandwidth, FM Modulation of Audio and Video 5/ 5.5/ 8 MHz Audio and Video Modulation, Detachable Dish Antenna, Radiated Power output 25 mW (approx.), 4 downlink frequencies 2414 /2432/2450/2468 MHz	
14.	RF Signal Generator, 9 kHz to 3 GHz, Output Power @1 GHz, -127 dBm to +13 dBm AM, FM, PM Analog I/Q Input Pulse, Frequency Modulation-Maximum Deviation @1 GHz, 20 Hz to 100 kHz	2

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit –I Fundamentals of Fiber Optic Communication	1a. Describe construction and features of Optical fiber. 1b. Compare working of optical fiber for given mode and index profile. 1c. Explain the block diagram of Optical fiber communication system. 1d. Explain the working principle of given optical source and detector.	1.1 Optical fiber communication: Advantages, Disadvantages, applications 1.2 Construction of fiber optic cable 1.3 Classification based on modes of propagation of light and index profile. 1.4 optical fiber communication system: Block diagram. 1.5 Optical components: Sources and Detectors
Unit– II Optical Losses	2a. Explain the given terms related to optical theory. 2b. Calculate acceptance angle, critical angle and numerical aperture of the given optical fiber cable. 2c. Explain the step by step procedure of given splicing techniques 2d. Describe the different types of Optical fiber losses. 2e. Explain the operation of ODTR.	2.1 Reflection, refraction, Total internal reflection (TIR), Snell's law, critical angle, numerical aperture, acceptance angle and acceptance cone - (numerical on above concepts) 2.2 Splicing techniques- Fusion splice, V-groove splice and elastic tube splice 2.3 Losses in optical fiber: Absorption loss, scattering loss, dispersion loss, radiation loss, coupling loss. 2.4 OTDR: Working Principle, Block diagram, Specification, Application
Unit-III Optical network.	3a. Describe working principle of the optical network components. 3b. Explain the concept of WDM. 3c. Explain the architecture of SONET/SDH. 3d. Describe the given type of Ethernet standard.	3.1 Optical Network Components Use and Features: Amplifiers, Splitter, Optical Switches, 3.2 WDM: Basic Concept, Features. 3.3 SONET/SDH: Architecture and Hierarchy. 3.4 Ethernet standards of Optical network features: IEEE 802.3j, 802.3y, 802.3z



Unit –IV Overview of Satellite Systems.	4a. Describe with sketches the working principles of the given type of satellite. 4b. Explain with sketches the given terms related to satellite and orbit. 4c. Explain the parameters with respect to the given type of satellite orbit. 4d. Explain Kepler's law of planetary motion with respect to the given criteria.	4.1 Working principle, concepts and basic components of Satellite system : Earth segment, Space segment, active and passive satellite, geostationary and geosynchronous satellites 4.2 Frequency allocations for satellite services, Uplink and downlink frequency, satellite frequency bands 4.3 Basic terminologies used in satellite communication: latitude, longitude, look angle, elevation angle, station keeping, propagation delay time , velocity, look angle and footprint 4.4 Communication Satellite orbits and its types: LEO, MEO, elliptical orbit and GEO, parameters and characteristics of various orbits 4.5 Kepler's law, Apogee and Perigee Heights, Orbit Perturbations, Effects of a non spherical earth, Atmospheric drag, effect of eclipse on satellite motion
Unit-V Satellite segments and Services	5a. Describe with sketches the functions of the given sub-system of the satellite earth station. 5b. Describe the given type of control systems associated with the Satellite. 5c. Describe with sketches given applications	5.1 Satellite earth station: Block diagram; Antenna subsystem, LNA, Power subsystem, Telemetry Tracking and Command (TTAC) subsystem, Attitude Control, Spinning satellite stabilization, Momentum wheel stabilization, Station Keeping, Thermal control Transponder: Single, double conversion and regenerative type 5.2 Space link: Equivalent Isotropic Radiated Power(EIRP), Transmission Losses : Free-space transmission loss, Feeder losses, Antenna misalignment losses, Fixed atmospheric and ionosphere losses 5.3 Satellite Applications: GPS: : Global positioning system (GPS) : concept, working principle, transmitter and receiver VSAT: Overview, architecture, working principle, applications

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Fundamentals of Fiber Optic Communication	08	02	04	06	12
II	Optical Losses	12	04	06	06	16
III	Optical network	08	02	06	06	14
IV	Overview of Satellite Systems	08	02	04	06	12
V	Satellite segments and Services	12	02	06	08	16
Total		48	12	26	32	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Visit any industry nearby to your house/college and observe the use of optical devices.
- List out the specification of various optical devices used in the industries.
- Undertake Internet survey for various optical fiber cables available in market.
- Observe various splicing techniques used in industries.
- Visit any earth station nearby to your house/college and observe the function of different components of satellite system and submit report on it.
- Write report on various antennas and modulation techniques used for television signal transmission.
- Visit ISRO website and collect the information related to satellite launching and submit report on it.
- Collect the information related to Indian satellites program.
- Prepare report on satellite applications.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Guide student(s) in undertaking micro-projects.



- f) Virtual lab or videos can be use in case of non availability of equipment for mentioned experiments.
- g) Correlate subtopics with application of instrumentation.
- h) Use proper equivalent analogy to explain different optics concepts.
- i) Use Flash/Animations to explain the process of light transmission through various types of fiber optic cable
- j) Use open source models to explain working of the fiber optic connectors.
- k) Use Flash/Animations to explain satellite communication.
- l) Use different websites to explain satellite communication systems

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. For all semesters, the micro-project are group-based to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

- a) Using LED as optical source, photodiode as optical detector and plastic fiber cable make prototype optical communication system.
- b) Make flow diagram of Fiber to Home (FTH).
- c) Test the performance of PWM using copper cable and compare it with result of experiment no 02.
- d) Prepared survey report to compare technical specification of different types of optical sources and detectors.
- e) Undertake a survey for different types of optical cables, give its specification and application.
- f) Undertake a survey of different OTDRs available in market, along with their specifications.
- g) Prepared report on splicing techniques used at RailTel, Reliance and BSNL or any other such organization.
- h) Monitor an optical networking used for cable service provider (TV and internet) and prepared report.
- i) Prepare an Internet based report on the different types of launch vehicles used for satellite launching.
- j) Prepare the chart to indicate applications of various satellite frequency bands (L, S, C, X, Ku and Ka band).
- k) Prepare a survey report on the different types of antennas used for Satellite communication.
- l) Conduct an Internet survey and prepare a detail report on GPS and its applications.
- m) Prepare a report on VSAT communication based on visit and Internet survey.
- n) Visit a satellite centre/ pool lab having satellite set up and prepare a report on all the components and its functions.

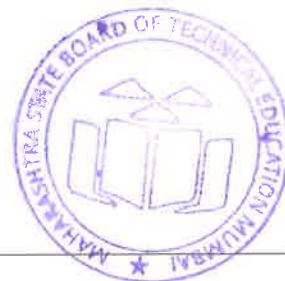


13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Electronic communications Systems: Fundamentals Through Advanced	Tomasi, Wayne	Pearson Education India, New Delhi ISBN-13: 978-8131719534
2	Fiber Optic Communication	Kolimbiris, Harold	Pearson Prentice Hall, New Delhi, 2004; ISBN 978-81-317-1588-8
3	The ABCs of Fiber Optic Communication	Warier, Sudhir	ARTECH HOUSE, Canton street Norwood, MA, ISBN 9781630814144
4	Fiber Optic Communication	Kieser, Gerd	Mc Graw Hill Higher Education, New Delhi, 2013, ISBN: 9781259006876,
5	Data Communications and Networking	Forouzan, Behrouz A.	Mc Graw Hill Higher Education, New Delhi, 2013, ISBN: 9781259064753,
6	Optical Fiber Communications Principles and practice	Senior, John M.	Pearson Education Limited, New Delhi, 2010, ISBN: 9788131732663,
7	Satellite Communications	Roddy Dennis	Tata McGraw-Hill, New Delhi, fourth edition, 2017 ISBN-13: 978-0070077850
8	Satellite Communication	Katiyar, Sapna	Katson publications, 3 rd edition 2013 ISBN-978-93-5014-481-7
9	Satellite communication concepts and applications	Rao Raja K. N.	PHI learning Private limited, New Delhi, second edition, 2012 ISBN-978-81-203-4725-0
10	Satellite communication systems, techniques and technology	Gerard Maral, Bousquet Michel, Zhili Sun	Wiley publication, New Delhi n 5th Edition, 2009 ISBN: 978-0-470-71458-4

14. SOFTWARE/LEARNING WEBSITES

- a) Optical wavelength bands:
http://www.bbcmag.com/2008issues/june08/BBP_June08_OtoL.pdf
- b) For virtual lab :- <http://iitg.vlab.co.in/?sub=59&brch=269>
- c) For virtual lab :- <http://vlab.co.in/>
- d) LED data sheet:-http://www1.futureelectronics.com/doc/EVERLIGHT%C2%A0334-15_T1C1-4WYA.pdf
- e) For fiber cleaning video :<https://www.youtube.com/watch?v=MMmRdFs96JY>
- f) http://www.netes.com.tr/upload_x/dosyalar/93DA75C4C94A4B78E5E09EDBB038F0AA.pdf
- g) <https://recommendedforyou.xyz/books/g4/25739?q=Satellite%20communication%20ab%20manual>
- h) <http://istc.co.in>
- i) <https://www.isro.gov.in/>
- j) <https://www.nasa.gov/>
- k) <http://www.satcoms.org.uk/satellite/vsat-tutorials.asp?>



Program Name : Diploma in Computer Engineering Group/ Diploma in Mechanical /Chemical Engineering /Diploma in Electronics Engineering Group/ Diploma in Fashion & Clothing

Program Code : CO/CM/CW/DC/EJ/ET/EN/EX/EQ/IE/ME/CH

Semester : Sixth

Course Title : Entrepreneurship Development

Course Code : 22032

1. RATIONALE

Globalisation, liberalization and privatization along with revolution in information technology have opened up new opportunities transforming lives of masses. In this context, there is immense opportunity of establishing manufacturing, service, trading, marketing and consultancy enterprises by diploma engineer. Our fast growing economy provides ample scope for diploma engineers to succeed as an entrepreneur. Entrepreneurship requires distinct skill sets which are attempted to be developed through this course. To begin with, this course aims to develop the competency and the related outcomes in order to start small enterprises.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Develop project proposals to launch small scale enterprises.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

- Identify your entrepreneurial traits.
- Identify the business opportunities that suits you.
- Use the support systems to zero down to your business idea.
- Develop comprehensive business plans.
- Prepare plans to manage the enterprise effectively.

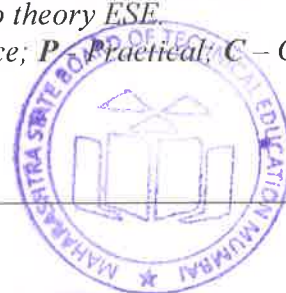
4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme											
L	T	P		Theory						Practical					
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total
			Max		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
2		2	4							50@	20	50~	20	100	40

@ : Internal examination

(~): For the **practical only courses**, the PA has two components under practical marks i.e. the assessment of practicals (seen in section 6) has a weightage of 60% (i.e. 30 marks) and micro-project assessment (seen in section 11) has a weightage of 40% (i.e. 20 marks). This is designed to facilitate attainment of COs holistically, as there is no theory ESE.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P- Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment



5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

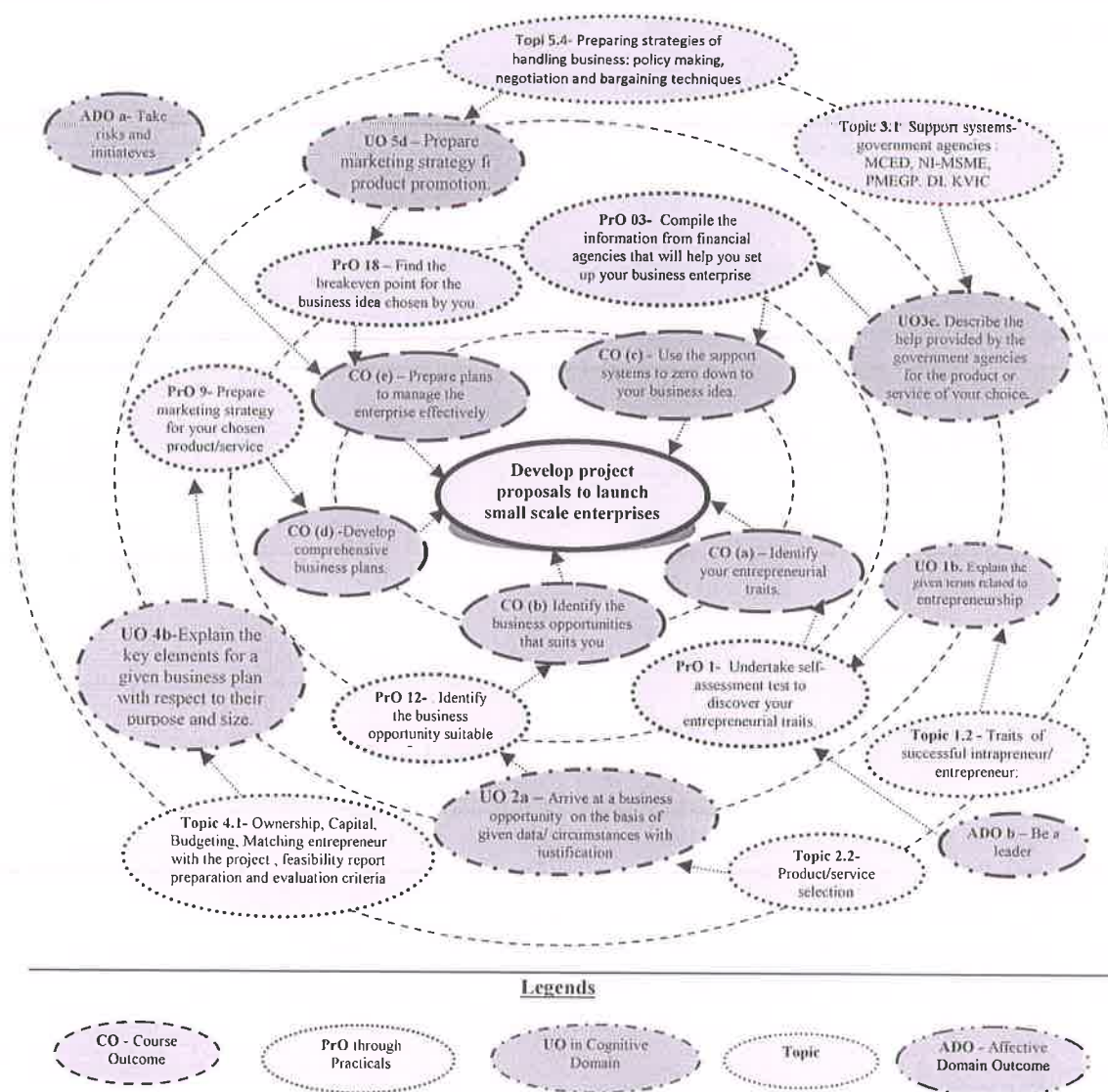


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Submit a profile summary(about500words) of a successful entrepreneur indicating milestone achievements.	I	02*
2	Undertake SWOT analysis to arrive at your business idea of a product/service.		02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
3	Generate business ideas(product/service) for intrapreneurial and entrepreneurial opportunities through brainstorming.	II	02*
4	Undertake self-assessment test to discover your entrepreneurial traits.	II	02*
5	Identify the business opportunity suitable for you.	II	02
6	Arrange an exhibition cum sale of products prepared out of waste.	II	02
7	Survey industries of your stream, grade them according to the level of scale of production, investment, turnover, pollution to prepare a report on it.	II	02*
8	Visit a bank/financial institution to enquire about various funding schemes for small scale enterprise.	III	02*
9	Collect loan application forms of nationalise banks/other financial institutions.	III	02*
10	Compile the information from financial agencies that will help you set up your business enterprise.	III	02*
11	Compile the information from the government agencies that will help you set up your business enterprise.	III	02*
12	Prepare Technological feasibility report of a chosen product/service.	III	02*
13	Prepare financial feasibility report of a chosen product/service.	III	02*
14	Craft a vision statement and enabling mission statements for your chosen enterprise.	III	02
15	Prepare a set of short term,medium and long term goals for starting a chosen small scale enterprise	III	02*
16	Prepare marketing strategy for your chosen product/service.	IV	02*
17	Compile information about various insurance schemes covering different risk factors.	IV	02
18	Organize a funfair of your class and write a report of profit/loss	V	02
19	Find the breakeven point for the business idea chosen by you.	V	02
20	Arrange a discussion session with your institute's pass out students who are successful entrepreneurs.	V	02
21	Prepare a business plan for your chosen small scale enterprise	V	02*
Total			42

Note:

- A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

Sample Products that can be manufactured under SME

- Badges cloth embroidered and metals



2. Bags of all types i.e. made of leather, cotton, canvas and jute etc. including kit bags, mail bags, sleeping bags and water-proof bag
3. Bandage cloth
4. Basket cane (Procurement can also be made from State Forest Corpn. and State Handicrafts Corporation)
5. Bath tubs of plastic
6. Battery Charger
7. Belt leather and straps
8. Bolts and Nuts
9. Boot Polish
10. Brooms
11. Domestic Brushes of different types
12. Buckets of all types of plastic
13. Button of all types
14. Chappals and sandals
15. Cleaning Powder
16. Cloth Covers for domestic use
17. Cloth Sponge
18. Coir mattress cushions and matting
19. Cotton Pouches
20. Curtains mosquito
21. Domestic Electric appliances as per BIS Specifications: Toaster Electric, Elect. Iron, Hot Plates, Elect. Mixer, Grinders Room heaters and convectors and ovens
22. Dust Bins of plastic
23. Dusters Cotton all types except the items required in Khadi
24. Electronic door bell
25. Emergency Light (Rechargeable type)
26. Hand drawn carts of all types
27. Hand gloves of all types
28. Hand numbering machine
29. Hand Pump
30. Hand Tools of all types
31. Handles wooden and bamboo (Procurement can also be made from State Forest Corpn. and State Handicrafts Corporation)
32. Haver Sacks
33. Honey
34. Invalid wheeled chairs.
35. Iron (dhobi)
36. Lamp holders
37. Letter Boxes
38. Nail Cutters
39. Oil Stoves (Wick stoves only)
40. Paper conversion products, paper bags, envelopes, Ice-cream cup, paper cup and saucers and paper Plates
41. Pickles, Chutney and Pappads
42. Pouches for various purposes
43. Safe meat and milk
44. Safety matches
45. Safety Pins (and other similar products like paper pins, staples pins etc.)
46. Shoe laces



47. Sign Boards painted
48. Soap Liquid
49. Spectacle frames
50. Steel Chair
51. Umbrellas
52. Utensils all types

Sample Services that can be offered under SME

1. Marketing Consultancy
2. Industrial Consultancy
3. Equipment Rental & Leasing
4. Typing Centres
5. Photocopying Centres (Zeroxing)
6. Industrial photography
7. Industrial R & D Labs.
8. Industrial Testing Labs.
9. Desk Top publishing
10. Advertising Agencies
11. Internet Browsing/Setting up of Cyber Cafes
12. Auto Repair, services and garages
13. Documentary Films on themes like Family Planning, Social forestry, energy conservation and commercial advertising
14. Laboratories engaged in testing of raw materials, finished products
15. 'Servicing Industry' Undertakings engaged in maintenance, repair, testing or electronic/electrical equipment/ instruments i.e. measuring/control instruments servicing of all types of vehicles and machinery of any description including televisions, tape recorders, VCRs, Radios, Transformers, Motors, Watches.
16. Laundry and Dry Cleaning
17. X-Ray Clinic
18. Tailoring
19. Servicing of agriculture farm equipment e.g. Tractor, Pump, Rig, Boring Machines.
20. Weigh Bridge
21. Photographic Lab
22. Blue printing and enlargement of drawing/designs facilities
23. ISD/STD Booths
24. Teleprinter/Fax Services
25. Sub-contracting Exchanges (SCXs) established by Industry Associations.
26. Coloured or Black and White Studios equipped with processing laboratory.
27. Ropeways in hilly areas.
28. Installation and operation of Cable TV Network:
29. Operating EPABX under franchises
30. Beauty Parlours
31. Creches.

S. No.	Performance Indicators	Weightage in %
1	Leadership skills	20
2	Team work	20
3	Lateral/creative thinking	10
4	Observations and recording	10
5	Self learning	20



S. No.	Performance Indicators	Weightage in %
6	Answer the sample questions	10
7	Submission of report in time	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safe practices
- Practice good housekeeping
- Practice energy conservation
- Demonstrate working as a leader/a team member
- Maintain tools and equipment
- Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

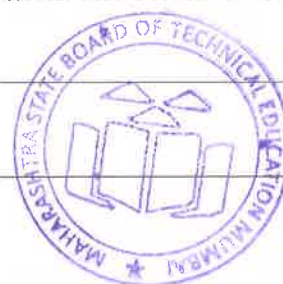
S. No.	Equipment Name with Broad Specifications	PrO. No.
1	Seminar Hall equipped with conference table, chairs and multimedia facilities	All
2	Modern desktop Computer with internet connection.	All

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (In cognitive domain)	Topics and Sub-topics
Unit – I Entrepreneurship Development - Concept and Scope	1a. Describe the procedure to evaluate your entrepreneurial traits as a career option for the given product to be manufactured or services to be rendered. 1b. Explain the given terms related to Entrepreneurship	1.1 Entrepreneurship as a career 1.2 Traits of successful intrapreneur/ entrepreneur: consistency, creativity, initiative, independent decision making, assertiveness, persuasion, persistence, information seeking, handling business communication, commitment to work contract, calculated risk taking 1.3 Entrepreneurship : scope in local and

Unit	Unit Outcomes (In cognitive domain)	Topics and Sub-topics
	1c. Describe the salient features of the resources required for starting the specified enterprise. 1d. Identify the characteristics for a given type of enterprise.	global market. 1.4 Intrapreneur and entrepreneur 1.5 Types of enterprises and their features : manufacturing, service and trading. 1.6 Steps in setting up of a business.
Unit – II Entrepreneurial Opportunities and selection process	2a. Arrive at a business opportunity on the basis of given data/circumstances with justification. 2b. Describe the scheme(s) offered by the government for starting the specified enterprise. 2c. Suggest a suitable place for setting up the specified enterprise on the basis of given data/circumstances with justification. 2d. Suggest the steps for the selection process of an enterprise for the specified product or service with justification. 2e. Describe the market study procedure of the specified enterprise.	2.1 Product/Service selection: Process, core competence, product/service life cycle, new product/ service development process, mortality curve, creativity and innovation in product/ service modification / development. 2.2 Process selection: Technology life cycle, forms and cost of transformation, factors affecting process selection, location for an industry, material handling. 2.3 Market study procedures: questionnaire design, sampling, market survey, data analysis 2.4 Getting information from concerned stakeholders such as Maharashtra Centre for Entrepreneurship Development[MCED], National Institute for Micro, Small and Medium Enterprises [NI-MSME], Prime Minister Employment Generation Program [PMEGP], Directorate of Industries[DI], Khadi Village Industries Commission[KVIC]
Unit – III Support Systems	3a. Describe the support system required for the specified enterprise. 3b. Describe the help provided by the government agencies for the specified product/service. 3c. Describe the help provided by the non-governmental agencies for the specified product/service. 3d. Compute the breakeven point for the specified	3.1 Categorisation of MSME, ancillary industries 3.2 Support systems- government agencies: MCED, NI-MSME, PMEGP, DI, KVIC 3.3 Support agencies for entrepreneurship guidance, training, registration, technical consultation, technology transfer and quality control, marketing and finance. 3.4 Breakeven point, return on investment and return on sales.



Unit	Unit Outcomes (In cognitive domain)	Topics and Sub-topics
	business enterprise, stating the assumptions made.	
UNIT IV Business Plan Preparation	4a. Justify the importance of the business plan for the given product/service. 4b. Explain the key elements for the given business plan with respect to their purpose/size 4c. Prepare the budget for the given venture. 4d. Prepare the details of the given component of the given startup business plan.	4.1 Sources of Product for Business : Feasibility study 4.2 Ownership, Capital, Budgeting, Matching entrepreneur with the project , feasibility report preparation and evaluation criteria 4.3 Business plan preparation
Unit –V Managing Enterprise	5a. Justify the USP of the given product/ service from marketing point of view. 5b. Formulate a business policy for the given product/service. 5c. Choose the relevant negotiation techniques for the given product/ service with justification. 5d. Identify the risks that you may encounter for the given type of business/enterprise with justification. 5e. Describe the role of the incubation centre for the given product/service.	5.1 Unique Selling Proposition [U.S.P.]: Identification, developing a marketing plan. 5.2 Preparing strategies of handling business: policy making, negotiation and bargaining techniques. 5.3 Risk Management: Planning for calculated risk taking, initiation with low cost projects, integrated futuristic planning, angel investors, venture capitalist. 5.4 Incubation centres: Role and procedure.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Develop two products from household waste (attach photographs).
- Download product development and innovative films from internet.
- Prepare a collage for 'Traits of successful entrepreneurs'.
- Invite entrepreneurs, industry officials, bankers for interaction.
- Identify your hobbies and interests and convert them into business idea.



- f. Convert your project work into business.
- g. Choose a product and design a unique selling proposition, brand name, logo, advertisement (print, radio, television), jingle, packing, packaging, label for it.
- h. Develop your own website. Share your strengths and weakness on it. Declare your time bound goals and monitor them on the website.
- i. Choose any advertisement and analyse its good and bad points.
- j. Decide any product and analyse its good and bad features.
- k. Select any product and prepare its cost sheet.
- l. Choose any product and study its supply chain.
- m. Arrange brainstorming sessions for improvement of any product.
- n. Study schemes for entrepreneurship promotion of any bank.
- o. Visit industrial exhibitions, trade fairs and observe nitty-gritty of business.
- p. Open a savings account and build your own capital.
- q. Organise industrial visit and suggest modifications for process improvement.
- r. Interview at least four entrepreneurs or businessman and identify Charms of entrepreneurship and Traits of successful entrepreneurs.
- s. Analyse case studies of any two successful entrepreneurs.
- t. Perform a survey and identify local resources available for setting up of an enterprise.
- u. Engage in marketing of products.
- v. Carry out a demand supply gap analysis for a particular product.
- w. Organise a prototype development competition.
- x. Arrange fairs, events in the institute and try for sponsorships.
- y. Select any performance criteria and continuously compete with yourself.
- z. On any performance criteria continuously compete with others.
- aa. Foresee your dream and make a long term plan for its accomplishment.
- bb. Dream for something unique and make a write-up.
- cc. Read articles, books on creativity.
- dd. Using morphological analysis technique, reduce cost or increase quality of a product.
- ee. Conduct a market survey for a project. Collect data on machinery specifications, price, output/hr, power consumption, manpower requirement, wages, raw material requirement, specification, price, competitor's product price, features, dealer commissions, marketing mix.
- ff. Prepare a business plan and organize a business plan competition.
- gg. Select a social cause, set objectives, plan and work for its accomplishment.
- hh. Videograph as many as possible from the above and upload on your website, YouTube, facebook.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- a. Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- b. '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c. About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs/UOs through classroom presentations (see implementation guideline for details).
- d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.



- e. Use Flash/Animations to explain various maintenances techniques.
- f. Guide student(s) in undertaking micro-projects.
- g. Instructors should emphasise more on deductive learning. Students should learn to recognise, create, shape opportunities, and lead teams for providing economic-social value to society.
- h. Business simulations should be used to enhance behavioural traits of successful intrapreneurs and entrepreneurs amongst students. Emphasis should be on creating entrepreneurial society rather than only setting up of enterprise.
- i. They must be encouraged to surf on net and collect as much information as possible.
- j. Each student should complete minimum twenty activities from the suggested list. Minimum possible guidance should be given for the suggested activities.
- k. Students should be promoted to use creative ideas, pool their own resources, finish their presentation, communication and team skills.
- l. Alumni should be frequently invited for experience sharing, guiding and rewarding students.
- m. Display must be arranged for models, collages, business plans and other contributions so that they motivate others.

11. SUGGESTED MICRO-PROJECTS

One Business Plan as a micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he should submit it by the end of the semester to develop the industry oriented COs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation in the middle of the semester and one at the end of the semester before submission of the project proposal incorporating the concepts taught during semester. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course.

- a. Choose any advertisement and analyse its good and bad points.
- b. Decide any product and analyse its good and bad features.
- c. Select any product and prepare its cost sheet.
- d. Choose any product and study its supply chain.
- e. Arrange brainstorming sessions for improvement of any product.
- f. Study schemes for entrepreneurship promotion of any bank.
- g. Visit industrial exhibitions, trade fairs and observe nitty-gritty of business.
- h. Open a savings account and build your own capital.
- i. Organise industrial visit and suggest modifications for process improvement.

12. SUGGESTED LEARNING RESOURCES

S. No.	Title of Books	Author	Publication
1	The Entrepreneurial Instinct : How Everyone Has the Innate Ability to Start a Successful Small Business	Mehta, Monica	McGraw-Hill Education, New Delhi, 2012, ISBN 978-0-07-179742-9
2	Entrepreneurship	Hisrich, R. D.	McGraw-Hill Education, New Delhi, 2013 ISBN-13: 978-1259001635
3	Part I Readings in Entrepreneurship Education	Sareen, S.B.	Entrepreneurship Development Institute of India (EDI), GOI,

S. No.	Title of Books	Author	Publication
			Ahmedabad, 2016; ISBN: 978-0078029196 ..
4	Reading Material of Entrepreneurship Awareness Camp	Gujral, Raman	Entrepreneurship Development Institute of India (EDI), GOI, 2016 Ahmedabad,
5	Product Design and Manufacturing	Chitale, A K	PHI Learning, New Delhi, 2014; ISBN: 9788120348738
6	Entrepreneurship Development Small Business Entrepreneurship	Charantimath, Poornima	Pearson Education India, New Delhi; ISBN: 9788131762264
7	Entrepreneurship Development: Special edition for MSBTE	CPSC, Manila	Tata Mc-Graw Hill, New Delhi,
8	Entrepreneurship and Small Business Management	Khanka, S.S.	S.Chand and Sons, New Delhi, ISBN: 978-93-5161-094-6
9	Entrepreneurship Development	S, Anil Kumar	New Age International, New Delhi, ISBN: 9788122414349

13. SUGGESTED SOFTWARE/LEARNING WEBSITES

1	MCED Books links	http://www.mced.nic.in/UdyojakSpecial.aspx?linktype=Udyojak
2	MCED Product and Plan Details	http://www.mced.nic.in/allproduct.aspx
3	The National Institute for Entrepreneurship and Small Business Development Publications	http://niesbud.nic.in/Publication.html
4	Courses : The National Institute for Entrepreneurship and Small Business Development	http://niesbud.nic.in/docs/1standardized.pdf
5	Entrepreneur.com	https://www.entrepreneur.com/lists
6	GOVT. SPONSORED SCHEMES	https://www.nabard.org/content1.aspx?id=23andcatid=23andmid=530
7	NABARD - Information Centre	https://www.nabard.org/Tenders.aspx?cid=501andid=24
8	NABARD – What we Do	http://www.nabard.org/content1.aspx?id=8andcatid=8andmid=488
9	Market Review	http://www.businessstoday.in/markets
10	Start Up India	http://www.startupindia.gov.in/pdf/file.php?title=Startup%20India%20Action%20Planandtype=Actionandq=Action%20Plan.pdfandcontent_type=Actionandsubmenupoint=action
11	About - Entrepreneurship Development Institute of India (EDII)	http://www.ediindia.org/institute.html
12	EDII - Centres	http://www.ediindia.org/centres.html
13	EDII - Publications	http://www.ediindia.org/publication.html
14	Business Plans: A Step-by-Step Guide	https://www.entrepreneur.com/article/247574
15	The National Science and Technology Entrepreneurship Development Board (NSTEDB)	http://www.nstedb.com/index.htm



16	NSTEDB - Training	http://www.nstedb.com/training/training.htm
17	Tata Exposures	http://www.tatasocial-in.com/project-exposure
18	Ministry Of Micro, Small And Medium EnterpriseS	http://www.dcmsme.gov.in/schemes/TEQUPDetail.htm
19	List of Business Ideas for Small Scale Industry	https://smallb.sidbi.in/%20/thinking-starting-business/big-list-business-ideas-small-business
20	Thinking of Entrepreneurship	https://smallb.sidbi.in/entrepreneurship-stage/thinking-entrepreneurship
21	List of services for Small Scale Industry	http://www.archive.india.gov.in/business/Industry_services/illustrative.php
22	NSIC Schemes and Services	http://www.nsic.co.in/SCHSERV.ASP



Program Name : All Branches of Diploma in Engineering and Technology.
Program Code : CE/CR/CS/CH/CM/CO/IF/CW/DE/EJ/EN/EQ/ET/EX/IE/
MU/EE/EP/EU/IS/IC/AE/FG/ME/PG/PT/DC/TX/TC
Semester : Sixth
Course Title : Capstone Project – Execution & Report Writing
Course Code : 22060

1. RATIONALE

This course on 'Capstone Project–Execution and Report Writing' is the continuation of the previous semester course on 'Capstone Project–Planning'. So, in this semester, the students are to implement the detailed Capstone Project Plan, which they have prepared in the preceding semester. Therefore, to successfully complete this Capstone Project by the end of this semester, it is necessary to incorporate the suggestions of the guide/examiners of the preceding semester. Hence, it is of utmost importance for the student to again re-capitulate and comprehend the importance, concept and need of the 'Capstone Projects' which are well explained in the 'Capstone Project–Planning' course in the previous semester.

Often, the jobs in the industry, which the diploma holders will come across when they join it and will be in the form of small or large projects. Such projects are generally an integration of the various types of skills which cut across the three major domains of learning i.e. cognitive, psychomotor and affective domain which must have acquired during their journey from first semester to the last semester. Hence, it is essential that students are also given an opportunity to do large projects which require more time compared to the micro-projects in order to develop and integrate the highly essential industry oriented competencies and associated skills in the students. Therefore, in this semester the 'Capstone Project – Execution and Report Writing' will continue to integrate some more additional competencies along with those in the previous semester and hence build up greater confidence to face such situations in the world of work.

2. COMPETENCY

The course should be taught and implemented with the aim to develop the required course outcomes (COs) so that students will acquire following competency needed by the industry:

- **Implement the Capstone Project Plan to solve the identified problem/task faced by industry/user related to the concerned occupation by integrating the various types of skills acquired during the programme.**

3. COURSE OUTCOMES (COs)

Depending upon the nature of the projects undertaken, the following could be some of the major course outcomes that could be attained, although, in case of some projects few of the following course outcomes may not be applicable.

- Implement the planned activity individually and/or as team.
- Select, collect and use required information/knowledge to solve the identified problem.
- Take appropriate decisions based on collected and analysed information.
- Ensure quality in product.
- Incorporate energy and environment conservation principles.
- Consider the ethical issues related to the project (if there are any).
- Assess the impact of the project on society (if there is any).
- Communicate effectively and confidently as a member and leader of team.



- i) Prepare project report after performing due plagiarism check using appropriate tools.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme													
L	T	P		Theory								Practical					
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
-	-	4	4	--	--	--	--	--	--	--	50#	20	50~	20	100	40	

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment

5. Course details

As the implementation of the Capstone project progresses and which has to be submitted at the end of project work, one of the outputs of this course is a detailed **Project Report** that is continuously prepared by the student. There will also be regular progressive assessment by the teacher as per the criteria no 7 on the basis of rubrics mentioned in **Appendix –C** and in the formats as shown in **Appendix-B** and also for the end-of-semester examination.

5.1 Guidelines for Capstone Project–Execution and Report Writing

- The students would like to revise the ‘Capstone Project – Plan’ based on the feedback received in the fifth semester examination.
- This revised ‘Capstone Project – Plan’ would be again approved by the project guide. As soon as the revised plan is approved by the teacher, the student will begin to work according to it and would also continue to maintain a dated ‘**Project Diary**’ for the whole semester. This is a sort of a ‘weekly diary’ indicating all the activities conducted by the student every week in the semester to complete the project. This ‘Project Diary’ should be got signed by the teacher at regular intervals for progressive assessment. If this is maintained sincerely and truthfully by the student, it will be very helpful in compiling the **Final Project Report** at the end of the semester by him/her.

6. Project report

During the final Semester, the student will prepare a 'Project Report' in continuation with the activities conducted in fifth semester under Project Planning having following sub-titles:

Suggested contents of the Project report

- Title page (with name of team members and mentor teacher)
- Certificate (in the Format given in this document as annexure A)
- Acknowledgements (this may need revision at the end of the final semester)
- Abstract (in one paragraph not more than 150 words)
- Content Page

Chapters

- Chapter–1 Introduction (background of the Industry or User based Problem/Task)
- Chapter–2 Literature Survey (to finalise and define the Problem Statement)
- Chapter–3 Scope of the project
- Chapter–4 Methodology
- Chapter-5 Details of designs, working and processes



6. Chapter-6 Results and Applications
7. Chapter-7 Conclusions And future scope
8. Appendix (if any)
9. References and Bibliography

Note:

- i. The report should contain as many diagrams, figures and charts etc as relevant for the project.
- ii. Originality of the report (written in own words) would be given more importance rather than quality of printing and use of glossy paper or multi-colour printing

7. ASSESSMENT OF PROJECT WORK

Project work has two components, first is Progressive Assessment (PA), while another is End Semester Examination (ESE).

7.1. Progressive Assessment (PA) Guidelines and Criteria

Project guide is supposed to carry out this assessment. It is a continuous process, during which for developing desired qualities in the students, faculty should orally give **informal feedback** to students about their performance and interpersonal behaviour while guiding them on their project work every week. Following criteria should be considered while assessing students informally or formally during different stages of the project work.

The following factors need consideration for both Capstone Project-Planning and Capstone Project-Execution and Report Writing.

- a) Students should be assessed during the project work so that students can also get feedback for further improvement.
- b) It should be kept in mind that project work is mainly experiential learning and it is not the research work, so emphasis should be on work based learning or learning from experience and development of attitudes and skills as mentioned in course outcomes. So focus of assessment should also be on learning from the process of completing project work rather than on novelty or innovation in the project work.
- c) For progressive assessment at the end, students should be asked to give the power point presentation before group of teachers and junior students (so that junior students may also get awareness about the major project work they have to carry out in future)
- d) The students would be awarded marks for their efforts (In some cases it may happen that due to some reasons such as unavailability of some material or component or some other resources, students may not be able to complete the project, but they have tried their best, in such cases students would be given appropriate marks if they have done enough efforts.)
- e) The students would not be awarded marks if they have completed the project by getting done the work from market or some professionals (taking some help and guidance is different as compared to getting the work or maximum part of the work completed from others on payment basis).
- f) Originality of the report (written in own words) would be given more importance.
- g) The Project Guide will assure the quality of project done by his group.



Criteria of Marks for PA for Capstone Project -Execution and Report Writing.

S. No.	Criteria	Marks
1	Project Proposal /Identification	10
2	Punctuality and overall contribution	
3	Project Diary	
4	Execution of Plan during sixth semester	20
5	Project Report including documentation	15
6	Presentation	05
Total		50

7.2 END SEMESTER EXAMINATION (ESE)

Evaluation shall be carried out according to following criteria. For each project, students from the concerned group should be asked to make presentation of their project, in front of the external and internal examiners which should be followed by question answer session to ascertain the contribution made by each student.

Criteria of Marks for ESE for Capstone Project -Execution and Report Writing

S. No.	Criteria	Marks
1	Project Proposal	05
2	Punctuality and overall contribution	
3	Project diary	
4	Execution of Plan during sixth semester	10
5	Project Report including documentation	10
6	Presentation	10
7	Question and Answer	15
Total		50

8. SPECIAL TEACHING STRATEGIES (If any)

- Teacher's should not spoon feed the students and let them try on their own at different stages of the project work and even first let them strive hard and only when efforts of students have failed, then teacher should guide them. Guidance should be in initially in the form of clues or hints rather than complete explanation, detailed explanation should be given only when students are not able to work based on clues/hints. The role of teacher should be limited to guide and facilitator
- Teachers should help students in selecting a topic which is relevant and challenging (but within capacity) for students according to their abilities.
- Teachers should come out of the mindset that there should be compulsorily some innovation and novelty in the project work. Because as discussed earlier, project is mainly opportunity for work based or experiential learning, the aim of which is to develop higher order cognitive skills and attitudes. Project at diploma level is not research or innovation.* The main thing teachers have to ensure is that students choose a task or problem for their project work which is challenging but according to their capability i.e. a task which they can complete on their own without getting it done from market.



- d) Teachers should ensure that students prepare the project plan in as much detail as possible, since this way only they would learn the importance of planning and how to do the detail planning. Teachers should allow students to proceed ahead only when they have detailed plan with them.
- e) Teachers should motivate students to maintain project document project diary and project report. They should explain benefits of these activities to students and also train them in these activities, because most of them may be doing this first time.
- f) Project Guide should ensure that students submit chapter of report one by one to him/her as per schedule and should check the content of the chapters. The Project guide should monitor that schedule is maintained and report writing is not left till last few weeks. It should not be a problem since first three chapters of the report should have been written in fifth semester itself.
- g) Teachers should also encourage students to openly discuss their weaknesses and shortcomings. Teachers should develop confidence in students that admitting mistakes and weaknesses helps in improving them.
- h) Teachers should continuously discuss with students about working of group and progress in the project and from this discussion should identify their personal qualities (both strengths and weaknesses) and suggest to them ways for improving those qualities.
- i) Internal as well as external examiners should reward students for original work and efforts of students even if they are not fully successful or not able to complete the project in comparison to those students who have taken paid help from others to complete their project.

Appendix–A

CERTIFICATE

This is to certify that Mr./Ms.....
fromInstitute having Enrolment No:
has completed project of final year having title during the
academic year 20__-20__. The project completed by individually/ in a group consisting
of..... persons under the guidance of the Faculty Guide.

.....
.....
Name & Signature of Guide:

Telephone:.....



Appendix–B**PROGRESSIVE ASSESSMENT (PA) OF CAPSTONE PROJECT – EXECUTION
AND REPORT WRITING****Evaluation Sheet for Internal Assessment**

Name of Student:

Name of Programme:..... **Semester: Sixth**

Course Title: Capstone Project : Execution and Report Writing **Code:22060.**

Title of the Capstone Project:

A. POs addressed by the Capstone Project (Mention only those predominant POs)

- a)
- b)
- c)
- d)

B. COs addressed by the Capstone Project (Mention only those predominant POs)

- a)
- b)
- c)
- d)

C. OTHER LEARNING OUTCOMES ACHIEVED THROUGH THIS PROJECT**1. Unit Outcomes (Cognitive Domain)**

- a)
- b)
- c)
- d)

2. Practical Outcomes (in Psychomotor Domain)

- a)
- b)
- c)
- d)

3. Affective Domain Outcomes

- a)
- b)
- c)
- d)



PROGRESSIVE ASSESSMENT (PA) Sheet		
S. No.	Criteria	Marks
1	Project Proposal /Identification	10
2	Punctuality and overall contribution	
3	Project Diary	
4	Execution of Plan during sixth semester	20
5	Project Report including documentation	15
6	Presentation	05
Total		50

Appendix–B

Suggested Rubric for Capstone Project – Execution and Report Writing

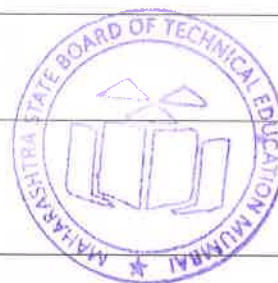
S. No.	Characteristic to be assessed	Poor	Average	Good	Excellent
1	Problem/Task Identification (Project Title)	Relate to very few POs Scope of Problem not clear at all	i. Related to some POs ii. Scope of Problem/Task vague	i. Take care of at-least Three POs ii. Scope of Problem/task not very specific	• Take care of more than three POs ii. Scope of problem/task very clear
2	Literature Survey /Industrial Survey	Not more than ten sources (primary and secondary), very old reference	At-least 10 relevant sources, at least 5 latest	At –least 15 relevant sources, most latest	About 20 relevant sources, most latest
3	Project proposal	Methods are not appropriate, All steps not mentioned, Design of prototype not started (if applicable).	Appropriate plan but not in much detail. Plan B for critical activities not mentioned. Time line is not developed. Design of Prototype is not complete. (if applicable)	Appropriate and detailed plan with Plan B for critical activities mentioned, but clarity is not there in methods, time line is given but not appropriate. Design of prototype is not detailed (if applicable)	Appropriate and detailed plan with Plan B for critical activities mentioned, clarity in methods with time line, Detailed design of prototype (if applicable)
4	Project Diary	Entries for most weeks are missing. There is no proper sequence and details are not correct.	Entries for some weeks are missing, details are not appropriate, not signed regularly by the guide.	Entries were made every week but are not in detail. Signed and approved by guide every week	Entries were made every week in detail, signed and approved by guide every week
5	Final Report Preparation	Very short, poor quality sketches, Details about methods, material, precaution and conclusions	Detailed, correct and clear description of methods, materials, precautions and	Conclusions. Sufficient Graphic Description.	Very detailed, correct, clear description of methods, materials, precautions and conclusions. Enough tables,



S. No.	Characteristic to be assessed	Poor	Average	Good	Excellent
		omitted, some details are wrong			charts and sketches
6	Presentation	Major information is not included, information is not well organized .	Includes major information but not well organized and not presented well	Includes major information and well organized but not presented well	Well organized, includes major information ,well presented
7	Defense	Could not reply to considerable number of question.	Replied to considerable number of questions but not very properly	Replied properly to considerable number of question.	Replied to most of the questions properly

Appendix C Suggestive Project Diary format

Week no:
Activities planned:
Activities Executed:
Reason for delay if any
Corrective measures adopted
Remark and Signature of the Guide



Program Name : Electronics Engineering Programme Group
Program Code : DE/EJ/ET/EN/EX/EQ
Semester : Sixth
Course Title : VLSI with VHDL
Course Code : 22062

1. RATIONALE

In the present scenario of electronics technology, CMOS is a vital important and basic need in the design/development of almost all products in the range from consumer to industrial and telecommunication engineering area. Functional capabilities of this technology leads to advanced Very Large Scale Integration, large density of components, high speed of operation, less area with less power dissipation. Therefore imparting knowledge of VLSI and its tools is need of today. After completion of this course, students will be able to develop applications in the area of digital electronics using VLSI design tools.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain VLSI based electronic circuits .

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

- Develop design flow for the given application using VLSI tools.
- Interpret CMOS technology circuits with their specifications.
- Use relevant VHDL model for given application.
- Debug VHDL program for the given application.
- Maintain FPGA based circuits

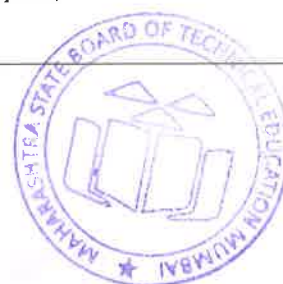
4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
2		2	4								25#	10	25~	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)



This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

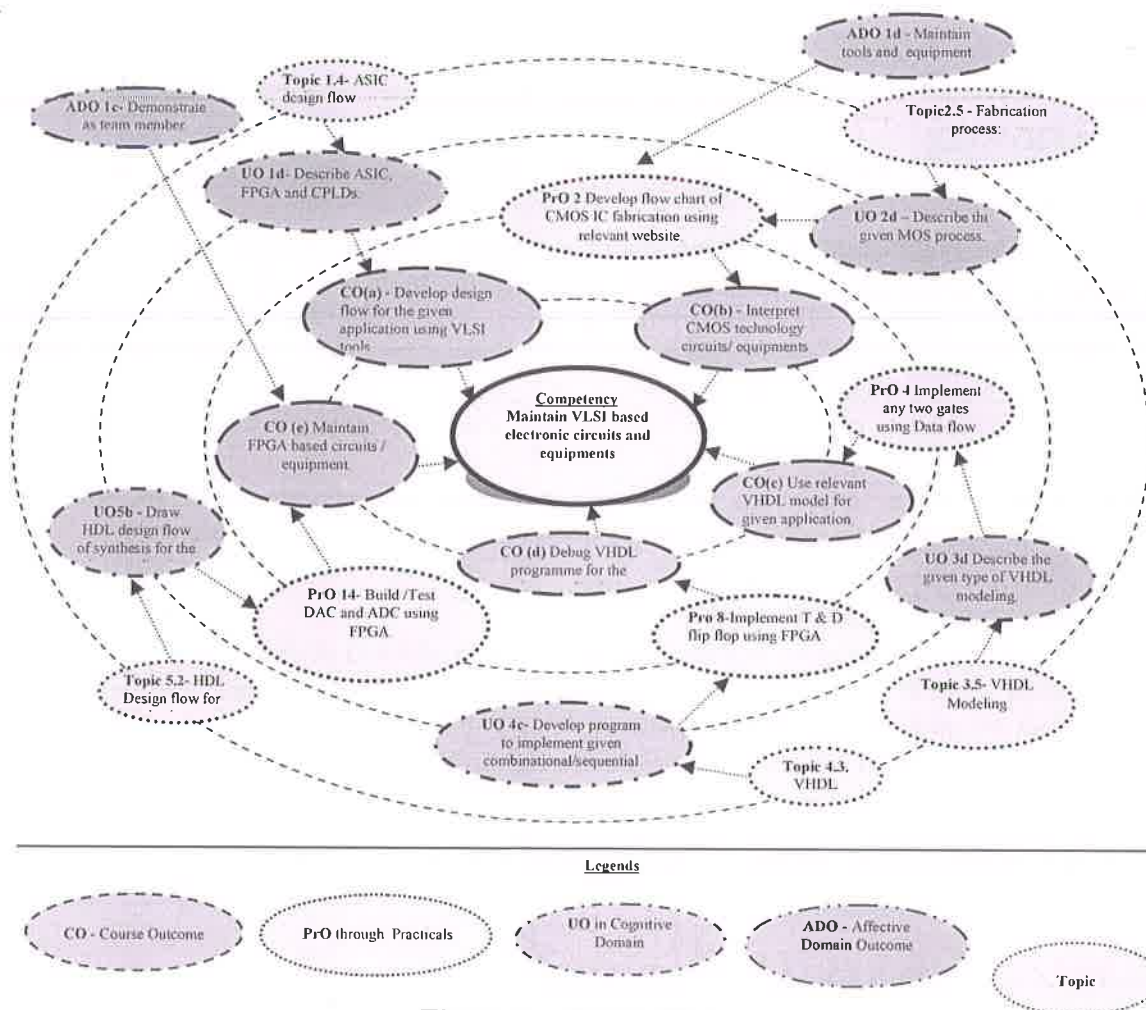


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Identify internal block and pin configuration of FPGA & CPLD using datasheet.	I	02*
2	Develop flow chart of CMOS IC fabrication using relevant website.	II	02*
3	Install EDA tool (VHDL) for VLSI application.	III	02*
4	Implement any two gates using Data flow and Behavioral model.	IV	02*
5	Implement Half /full adder / subtractor using FPGA	IV	02



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
6	Implement 8:1 multiplexer using FPGA	IV	02
7	Implement 1:8 Demultiplexer using FPGA	IV	02
8	Implement T& D-flip-flop using FPGA	IV	02
9	Implement 2:4 Decoder using FPGA	IV	02
10	Implement 8:3 Encoder using FPGA	IV	02
11	Implement up-counter using FPGA	IV	02
12	Implement synchronous counter using FPGA	IV	02
13	Implement binary to gray code converter using FPGA.	IV	02
14	Build /Test DAC using FPGA.	V	02*
15	Implement Stepper motor controller using FPGA.	V	02
16	Implement four Bit ALU or sequence generator using FPGA.	V	02*
	Total		32

Note

- A suggestive list of **PrOs** is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
a.	Preparation of experimental set up	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
	Total	100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:



- 'Valuing Level' in 1st year
- 'Organizing Level' in 2nd year
- 'Characterizing Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. S. No.
1	Personal Computer with latest configuration.	All
2	FPGA trainer kit with accessories.	10-15
3	VLSI trainer kit along with peripherals such as switches, keyboard, LEDs, seven segment display.	1-15
4	VLSI trainer kit along with DAC, ADC trainer kit.	1-15
5	VLSI trainer kit along with stepper motor.	1-15
6	JTAG cable, DMM, Bread Board.	1-16
7	Xilinx/Altera or equivalent EDA tool.	13

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs in cognitive domain for achieving the COs to attain the identified competency.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Advanced Digital Design and ASIC, FPGA, CPLD.	1a. Differentiate between asynchronous and synchronous logic circuit for the given parameters. 1b. Develop the state diagram, state table for the given sequential logic. 1c. Develop model of Moore and Mealy machine of the given Contents. 1d. Describe the given ASIC, FPGA and CPLDs.	1.1 Review of Sequential Logic : Asynchronous and Synchronous, Metastability, Noise margins, Power Fan-out, Skew (Definitions only) 1.2 Moore and Mealy Models, state machine notation, 1.3 Examples on Moore and mealy: counter, sequence detector only 1.4 ASIC design flow 1.5 CPLD - Details of internal block diagram 1.6 FPGA - architecture, details of internal block diagram



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – II CMOS Technology concepts.	2a. Compare the performance of BJT and CMOS for the given parameters. 2b. Draw the simplified CMOS logic of the given gates. 2c. Explain CMOS inverter characteristics with relevant sketch. 2d. Describe the given MOS fabrication process.	2.1 Introduction of BJT and CMOS parameters 2.2 Basic gates using CMOS Inverter, NOR, NAND, MOS transistor switches, transmission gates, CMOS inverter characteristics. 2.3 Complex logic using CMOS 2.4 Estimation of resistance and capacitance layout. 2.5 Fabrication process: Overview of wafer processing, Oxidation, epitaxy, deposition, Ion-Implementation and diffusion, silicon gate process. 2.6 Basics of NMOS, PMOS and CMOS: nwell, pwell, twin tub process.
Unit– III Introduction to VHDL	3a. Describe Hardware description language, its components and programming syntax. 3b. Describe the given VHDL flow elements. 3c. Describe the use of given data type declaration in VHDL. 3d. Describe the given type of VHDL modeling.	3.1 Introduction to HDL: History of VHDL, Pro's and Con's of VHDL 3.2 VHDL Flow elements:-Entity, Architecture, configuration, package, library only definitions. 3.3 Data Types, operators, operations. 3.4 Signal, constant and variables (syntax and use). 3.5 VHDL Modeling: - Data flow, Behavioral, Structural.
Unit– IV VHDL Programming	4a. Develop program using concurrent statements for the given application in VHDL. 4b. Develop program using sequential statements for the given application in VHDL. 4c. Develop program to implement the given combinational /sequential logic circuit using VHDL. 4d. Describe the test bench for the given application in VHDL.	4.1 Concurrent constructs (when, with). 4.2 Sequential Constructs (process, if, case, loop, assert, wait) 4.3 VHDL program to implement Flip Flop, Counter, shift register, MUX, DEMUX, ENCODER, DECODER, MOORE, MEALY machines . 4.4 Test bench and its applications.
Unit– V HDL Simulation and Synthesis.	5a. Describe VHDL simulation for the given application. 5b. Draw HDL design flow of synthesis for the given application. 5c. Describe use of efficient coding styles, optimizing expression, sharing of complex operator.	5.1 Event scheduling, sensitivity list, zero modeling, simulation cycle, comparison of software and hardware description language, delta delay. 5.2 HDL Design flow for synthesis 5.3 Efficient Coding Styles, Optimizing arithmetic expression, sharing of complex operator.



Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to Advanced Digital Design Specific & and ASIC, FPGA, CPLD.	06	Not Applicable as no theory paper			
II	Introduction to CMOS Technology	04				
III	Introduction to VHDL	08				
IV	VHDL Programming.	08				
V	HDL Simulation and Synthesis.	06				
Total		32				

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare the survey report on the VLSI based applications.
- Compare technical specifications and applications of various types of memory, CPLDs, FPGA and Prepare report.
- Refer basic requirement of PC configuration to install VLSI EDA tool.
- Give seminar on any course relevant topic.
- Conduct library / internet survey regarding different data sheet and manuals related CPLD, FPGA.
- Prepare power point presentation on VLSI and their applications.
- Undertake a market survey of companies profile related to VLSI and prepare report.
- Search for video / animations / power point presentation on internet for complex topic related to the course and make a presentation.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.



- c. About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- e. Guide student(s) in undertaking micro-projects.
- f. PPTs/Animations may be used to explain the construction and working of electronic circuits.
- g. Guide students for using data sheets / manuals.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

- a. Prepare report of CMOS fabrication process.
- b. Market Survey related to CMOS IC's and prepare report.
- c. Develop four bit addition/subtraction.
- d. Develop square wave generator of Frequency = 1Hz/ 100Hz.
- e. A shopkeeper requires an alarm system when a customer enters into the shop through exits door. Develop a VLSI based system.
- f. An indication for any maloperation in the given application is to be indicated by blinking of LEDs. Build a VLSI based system for the same.

Note: Use FPGA kit and general purpose PCB for making micro projects

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	VHDL Basics to programming	Gaganpreet Kaur	Pearson Education India, 2011 ISBN 10: 8131732118 ISBN 13: 9788131732113
2	Digital Logic: Application and design	John M. Yarbrough	C.L Engineering, ISBN 10: 0314066756 ISBN 13: 978 0314066756



S. No.	Title of Book	Author	Publication
3	An engineering approach to digital design	William I. Fletcher	Prentice- Hall of India ISBN-13: 978-0132776998 ISBN-10: 0132776995
4	Principles of CMOS VLSI Design: A system perspective	Neil H. E. Weste Kamran Eshraghian	Pearson Education ISBN 10: 0201082225 / ISBN 13: 9780201082227
5	VHDL programming by example	Douglas Perry	Tata Mcgraw-hill; 4 edition (2002) ISBN-10: 0070499446 ISBN-13: 978-0070499447
6	Introduction to VLSI Design	Eugene D. Fabricus	McGraw Hill ISBN-13: 978-0070199484 ISBN-10: 0070199485
7	VLSI design and EDA tools	Sarkar & Sarkar	Scitech Publications (India) Pvt Ltd (December , 2013) ISBN-10: 8183714978 ISBN-13: 978-8183714976
8	Xilinx Manual	Xilinx	www.xilinx.com

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

- <http://rti.etf.bg.ac.rs/rti/ri5rvl/tutorial/TUTORIAL/HTML/HOMEPC.HTM>
- <http://iiiith.vlab.co.in/?sub=21&brch=66&sim=531&cnt=1&lan=en-IN>
- <http://www.vlsiencyclopedia.com/2012/12/loop-statement.html>
- https://books.google.co.in/books?id=RjdYEEY8dJvwC&pg=SA3-PA47&lpg=SA3-PA47&dq=vlsi+next+statement&source=bl&ots=oS8dg9uQL6&sig=KHqaQMlgQ5CWkpC_c8Yfew_7h20&hl=en&sa=X&ved=0ahUKEwjx_5LQk5bLAhVRS04KHcoGDDMQ6AEIPjAH#v=onepage&q=vlsi%20next%20statement&f=false
- <http://only-vlsi.blogspot.in/2007/12/vlsi-design-flow.html>
- <http://www.vhdl.renerta.com/source/vhd00014.htm>
- <http://www.csee.umbc.edu/portal/help/VHDL/summary.html>
- http://vlab.co.in/ba_labs_all.php?id=1

