

MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION

Diploma Programme in **Electrical Engineering**

I – Scheme

Programme Educational Objectives (PEOs) *(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 Electrical engineering related broad-based problems adapting professional ethics.
- PEO 2. Adapt state-of-the-art Electrical 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 (POs) given by NBA. *(What s/he will be able to do at the entry point of industry soon after the diploma programme)*

- PO 1. **Basic knowledge:** Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad-based Electrical engineering problems.
- PO 2. **Discipline knowledge:** Apply Electrical engineering knowledge to solve broad-based electrical engineering related problems.
- PO 3. **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Electrical engineering problems.
- PO 4. **Engineering tools:** Apply relevant Electrical 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 the field of Electrical engineering.
- PO 6. **Environment and sustainability:** Apply Electrical 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 Electrical 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 Electrical engineering and allied industry.

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

- PSO 1. Electrical Equipment:** Maintain various types of rotating and static electrical equipment.
- PSO 2. Electric Power Systems:** Maintain different types of electrical power systems.

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/CI/PS/CM/CO/IE/CW/DE/EJ/EN/EQ/ET/EX/IE/MU/EE/EP/EU/IS/IC/AE/IG/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, PI, EG, EE, EP, EU, CH, PS, DC, IC, TX)		EGM	22002	2	—	4	6	—	—	—	—	—	—	—	50@	20	50	20	100	40	100
	Engineering Graphics (For DE, CI, ET, EN, EX, EQ, IC, IE, IS, VL, CI, 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, PI, EG, EE, EP, EU, CH, PS)		WPM	22004	—	—	4	4	—	—	—	—	—	—	—	50@	20	50	20	100	40	100
	Workshop Practice (For CI, CM, CW, IF)		WPC	22005	—	—	4	4	—	—	—	—	—	—	—	50@	20	50	20	100	40	100
	Workshop Practice (For DE, EI, ET, EN, EX, EQ, IC, IE, IS, VL)		WPE	22006	—	—	4	4	—	—	—	—	—	—	—	50@	20	50	20	100	40	100
	Workshop Practice (For IC, 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 declared 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 "Defined" for that semester.



Program Name : All Institutes of Diploma in Engineering and Technology

Program Date : COURSE STRUCTURE SUBJECT CODE: ENGLISH DIPLOMA IN ENGINEERING
TECHNOLOGY

Semester : First

Course Title : English

Course Code : 27101

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 or find translators 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 a statutory compulsory. 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 competencies through various learning/teaching 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.
- Score on a comprehension passages.
- Compose dialogues and paragraphs for different situations.
- Use to enter words as per context.
- Deliver prepared speeches to express ideas, thoughts and emotions.

4. TEACHING AND EXAMINATION SCHEME

Sl. No.	Theory	Practical	Examination Scheme													
			Theory							Practical						
			Essay	PSK	PS	Text	ESS	PS	Text	ESS	PS	Text	ESS	PS	Text	ESS
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Legend: 1 = 1 hour, 2 = 2 hours, 3 = 3 hours, 4 = 4 hours, 5 = 5 hours, 6 = 6 hours, 7 = 7 hours, 8 = 8 hours, 9 = 9 hours, 10 = 10 hours, 11 = 11 hours, 12 = 12 hours, 13 = 13 hours, 14 = 14 hours, 15 = 15 hours, 16 = 16 hours, 17 = 17 hours, 18 = 18 hours, 19 = 19 hours, 20 = 20 hours, 21 = 21 hours, 22 = 22 hours, 23 = 23 hours, 24 = 24 hours, 25 = 25 hours, 26 = 26 hours, 27 = 27 hours, 28 = 28 hours, 29 = 29 hours, 30 = 30 hours, 31 = 31 hours, 32 = 32 hours, 33 = 33 hours, 34 = 34 hours, 35 = 35 hours, 36 = 36 hours, 37 = 37 hours, 38 = 38 hours, 39 = 39 hours, 40 = 40 hours, 41 = 41 hours, 42 = 42 hours, 43 = 43 hours, 44 = 44 hours, 45 = 45 hours, 46 = 46 hours, 47 = 47 hours, 48 = 48 hours, 49 = 49 hours, 50 = 50 hours, 51 = 51 hours, 52 = 52 hours, 53 = 53 hours, 54 = 54 hours, 55 = 55 hours, 56 = 56 hours, 57 = 57 hours, 58 = 58 hours, 59 = 59 hours, 60 = 60 hours, 61 = 61 hours, 62 = 62 hours, 63 = 63 hours, 64 = 64 hours, 65 = 65 hours, 66 = 66 hours, 67 = 67 hours, 68 = 68 hours, 69 = 69 hours, 70 = 70 hours, 71 = 71 hours, 72 = 72 hours, 73 = 73 hours, 74 = 74 hours, 75 = 75 hours, 76 = 76 hours, 77 = 77 hours, 78 = 78 hours, 79 = 79 hours, 80 = 80 hours, 81 = 81 hours, 82 = 82 hours, 83 = 83 hours, 84 = 84 hours, 85 = 85 hours, 86 = 86 hours, 87 = 87 hours, 88 = 88 hours, 89 = 89 hours, 90 = 90 hours, 91 = 91 hours, 92 = 92 hours, 93 = 93 hours, 94 = 94 hours, 95 = 95 hours, 96 = 96 hours, 97 = 97 hours, 98 = 98 hours, 99 = 99 hours, 100 = 100 hours, 101 = 101 hours, 102 = 102 hours, 103 = 103 hours, 104 = 104 hours, 105 = 105 hours, 106 = 106 hours, 107 = 107 hours, 108 = 108 hours, 109 = 109 hours, 110 = 110 hours, 111 = 111 hours, 112 = 112 hours, 113 = 113 hours, 114 = 114 hours, 115 = 115 hours, 116 = 116 hours, 117 = 117 hours, 118 = 118 hours, 119 = 119 hours, 120 = 120 hours, 121 = 121 hours, 122 = 122 hours, 123 = 123 hours, 124 = 124 hours, 125 = 125 hours, 126 = 126 hours, 127 = 127 hours, 128 = 128 hours, 129 = 129 hours, 130 = 130 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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			16

Note

i. A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the CUs 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 'Proficiency Level of Course "Psychomotor Domain Taxonomy" as generally required by the industry.

ii. The 'Process' and 'Product' related skills associated with each PrO is to be achieved 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 skilfully.	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/sub-topics is to be taught and assessed in order to develop CUs for achieving the CUs to attain the identified competency.

S. No.	Equipment Name with Brand 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), Graph cards, Sound Cards, Internal Hard Disk Drives, DVD drive, Network Interface Card.	A1
2	LCD Projector with document reader.	All
3	Smart Board with networking.	All

8. UNDERPINNING THEORY COMPONENTS

The following topics/sub-topics should be taught and assessed in order to develop CUs in cognitive domain for achieving the CUs to attain the identified competency.

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



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 syntactical and sentence structure on the given situation/topic. 3c. Explain the theme in given paragraph accurately.	3d. Summarise the given paragraph with correct punctuation 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/paragraphs. 4b. Use relevant words to correct/express for the given themes/situation. 4c. Use the collocations correctly. 4d. Construct sentences using given idioms.	4e. Speak in specified formal situation 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 UOs 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	Applied Grammar	12	02	04	08	14
II	Comprehension	20	05	06	13	24
III	Paragraph and Dialogue Writing	06	02	04	04	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 simple 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/topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but a blend of different types of teaching methods and media that are to be employed to develop the outcomes.
- About 75-80% 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 through classroom presentations (see implementation guideline for details).
- With respect to item No. III 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, at 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, P. Suresh, Srinivas, P. Sathish, I.	Pearson Education, New Delhi, 2009, ISBN: 978-81-317-2100-0
3	English Grammar at Glance	Gnanamurali, M.	S. Chand and Co., New Delhi, 2011, ISBN: 9788121920022
4	Essential English Grammar	Murphy, Raymond	Cambridge University Press, New Delhi, Third edition, 2011, ISBN: 97893-0521667880-0
5	Living English Structure	Allen, W. S.	Pearson Education, New Delhi, Fifth edition, 2009, ISBN: 9813172849X-94

14. SOFTWARE/LEARNING WEBSITES

- a. <http://www.britishcouncil.in/englishlearn-online>
- b. <http://learnenglish.britishcouncil.org/en/online>

- a. <http://www.talkenglish.com>
- b. languagelearning.com
- c. www.wordswatch.com



Course Name : All Branches of Diploma in Engineering and Technology.
 Course Code : EX-RAN-CHL-CYTH-104-WB-DEPT-NO-01/EN-IT-ME-AUT/ELE/CS/CE/EE/ME/PG-PT/UC-TN-10
 Semester : First
 Subject Title : Basic Science (Physics & Chemistry).
 Subject Code : 22102

1. RATIONALE

Employing 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 brand-based engineering problems. The study of basic principles of sciences and the concepts related to various materials such as metals, alloys, organic acids, polymers, lubricants, materials, composites, alloys, heat, electricity, magnetism, optics, semiconductors and others will help in understanding the technology world where emphasis is on the applications in 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 brand-based engineering problems applying principles of physics and chemistry.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant 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 analysis process in industries.
- Use corrosion preventive measures in industry.
- Use relevant engineering materials in industries.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme	Credits (L+T+P)	Examination Scheme									
		Theory					Practical				
		Open	ESK	PA	COA	ESK	PA	Total			
		Hrs	Max	Min	Max	Min	Max	Min	Max	Min	Max
1	1	1	2	1	2	1	2	2	2	2	2
2	2	2	4	2	4	2	4	4	4	4	4

Notes: 1. The marks for each of the marks 10 marks are to be marked and assessment 1 course is to be Physics and Chemistry. 2. The time requirement of 10 hours is to be completed in the course of 2 weeks to be taken during the semester for the completion of the 10 hours. 3. The assessment of the COs.

Legend: L- Lecture, T- Tutorial, P- Practical, COA- Continuous Open Assessment, ESK- End Semester Examination, PA- Performance Assessment.

5. COURSE MAP (with sample COs, PROs, UOs, ALPOs 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 different areas of learning in terms of the industry/employer identified competency denoted at the centre of the map.

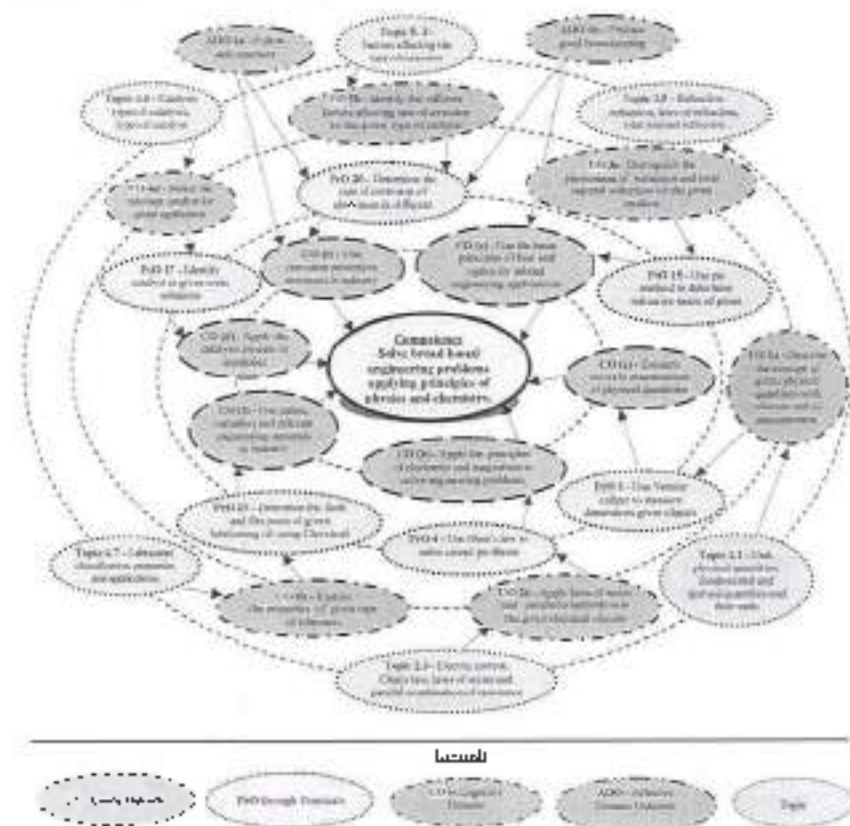


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/EXERCISES

The products in this section are PPrOs (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 (PPrOs)	Unit No.	Approx. Hrs. Required
	Physics		



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Use Vernier caliper (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 (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 magnet points towards the north pole of earth. (ii) South pole of bar magnet points towards the north pole of earth.	I	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 coefficient 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.	V	02*
20	Prepare the corrosion 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	Setting up 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 engine indicator number of given lubricating oil.	V	02
30	Determine the flash and fire point of given lubricating oil using closed and open cup apparatus.	VI	02*
31	Determine the flash point of given lubricating oil using closed cup apparatus.	VI	02*
32	Determine the wet castrol from paint.	VI	02*
Total			64

Note

- A suggested list of PrOs is given in the above table. More 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 'Proficiency Level' of Davis' '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 scheme 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/standards 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 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 Knorr's "Effective Domain Instrument" should gradually increase as planned below:

- "Learning Level" in 1st year
- "Digressing Level" in 2nd year and
- "Characterising Level" in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will assist in uniformly to conduct of ExOs, as well as to measure equipment by activities conducted.

S. No.	Equipment Name with Broad Specifications	Exp. S.No.
1	Vernier Calipers, Range: 0-150 mm, Resolution: 0.1 mm	1
2	Micrometer screw gauge, Range: 0-25 mm, Resolution: 0.01 mm, Accuracy: ± 0.02 mm or better	2
3	Spherometer, range: 10 mm - 10 mm, LC = 0.01 mm	3
4	Digital multimeter, 7½ digit display, 9999 counts, digital multi meter measuring V_A , V_D ; 1000V max; A_A , A_D (10 amp max); Hz, Resistance ($\times 10$ M Ω); Capacitance and Temperature	4, 5, 6, 7, 21, 22, 23
5	Resistance Box, 4 decade ranges from 1 ohm to 1000 ohms, accuracy $\pm 1\%$ - $\pm 5\%$	4, 5, 6, 7
6	Batteries (minimum, 0-12V, 2A)	6, 7, 23, 25
7	Baric apparatus: U-tube manometer, digital barometer	12
8	Table top calorimeter with two size (mechanical) electrical equivalent of heat apparatus in vessels box, digital analog thermometer	12
9	Seebeck's thermal conductivity apparatus: Cylindrical copper, aluminum, steel, glass and wood, steam chamber, digital analog thermometer, arrangement for lining tubes and thermometer	14
10	Perkyn's energy band gap setup: Oven, temperature range up to 100°C, thermometer, microammeter, Cx device	1
11	Ohm meter reading up to 10^{14} ohm, accuracy $\pm 10\%$ to 70% , 50 mV resolution 12 bit	34
12	Electronic balance with capacity range of 0.001 g to 300 gm, pan size 130 mm, 12 count time $\times 5$ sec, power requirement 90-250 V, 10 watt	13, 17, 19, 25, 26, 37
13	Electrical oven, water size 18" x 18" x 18", temperature range 100°C to 250°C, with the capacity of 10 lb.	21
14	Ammeter 1x2 amp	25, 26
15	Redwood viscometer-I	22
16	Cleveland cone penetrometer	24
17	Viscosity and density apparatus	24

8. UNDERPINNING THEORY COMPONENTS

The following topics/sub-topics are to be taught and assessed in order to develop UOs for achieving the EOs 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.	1.1 Unit, physical quantities: fundamental and derived quantities and their units
	1b. Describe with justification the device required to measure the radius of curvature of the given object	1.2 Systems of units: CGS, MKS, FPS and SI
	1c. State with justification the error in the given measurement quantity	1.3 Dimensional, dimensional formula
	1d. Describe the procedure to determine the dimensions of the given physical quantities	1.4 Error 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	2.1 Concept of charge, Coulomb's inverse square law, Electric field, Electric field intensity, potential and potential difference
	2b. Describe the concept of given magnetic intensity and flux with relevant units.	2.2 Magnetic field and magnetic field intensity, magnetic lines of force, magnetic flux
	2c. Explain the heating effect of the given electric current.	2.3 Electric current, Ohm's law, specific resistance, laws of series and parallel combination of resistance, heating effect of 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	2.4 Conductors, insulators and Semiconductors, energy bands, intrinsic and extrinsic semiconductors
	2f. Explain the I-V characteristics and applications of the given p-n junction diodes	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	3.1 Heat, temperature, temperature scales
	3b. Describe the properties of the given good and bad conductors of heat	3.2 Modes of transfer of heat, good and bad conductors of heat, law of thermal conductivity
	3c. Relate the characteristics of the three gas laws	3.3 Boyle's law, Charles law, Gay Lussac's law, perfect gas equation
	3d. Determine the relation between specific heat for the given materials	3.4 Specific heat of gas at constant pressure and volume C_p and C_v , relation of specific heats
	3e. Distinguish the phenomena of total internal reflection for	3.5 Reflection, refraction, laws of refraction, total internal reflection



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	3f. Describe light propagation in the given type of optical fiber	3a. 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 valence, 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 centred cubic, face centred cubic, hexagonal close pack, crystals. 4.4 Catalysis: Types of catalysts, Catalyst: Types of Catalyst: Positive Catalyst, Negative Catalyst, Auto-catalyst, Inhibitor, 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), metal passivity, Types of oxide film, Wet corrosion mechanism (Hydrogen evolution in acidic medium), Concentration cell corrosion-oxygen absorption mechanism in neutral or alkaline medium, Pitting corrosion, Waterline corrosion, Crevice corrosion. 5.2 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. 5.3 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. 3f. Describe the process of electrolysis for the given electrolyte. 3g. Describe the process of electroplating of the given material.	Daniel cell: Limitation and description. 3.3 Faraday's first and second law. 3.4 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 paint. 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 adhesive as 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, ceramic, Thermoplastic. 6.4 Polymer and Monomer: Classification on the basis of Molecular structure, on the basis of functional group in polymer and crosslinking on the basis of thermal behavior and thermodynamics and high melting. 6.5 Types: Polymerization: Reaction, Addition Polymerization, Condensation Polymerization, Synthetic, products and application of Polyethylene, Polystyrene, Polyvinyl Chloride, Nylon, Polystyrene, Phenol formaldehyde, Epoxy Resin. 6.6 Adhesives: Characteristics, Classification and their uses. 6.7 Lubricants: Classification, properties and applications.

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

9. SEGMENTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	C Level	A Level	Total Marks
	Physics					
I	Units and Measurements	06	02	03	01	06
II	Electricity, Magnetism and Semiconductors	14	03	05	06	14

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
III	Heat and Optics	12	01	04	06	11
Chemistry						
IV	Chemical Bonding and Catalysis	08	02	03	04	09
V	Metal Corrosion, prevention and Electrochemistry	2	02	04	05	11
VI	Paints, Varnishes, Insulators, Polymer Adhesives and Lubricants	12	03	05	06	14
Total		44	16	25	29	70

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

Note: This specification will provide 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 for R, U and A in the question paper may vary from above table.

III. 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.

II. 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:

- Massed open online courses (MOOCs) may be used to teach various topics sub-topics.
- 'Flipped' model: A class 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 guide for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for co-curricular activities.
- Guide students 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 teachers in the beginning of the semester. s/he ought to submit it by the end of the semester to develop the industry oriented LOs. Each micro-project should encompass two or more COs which are in fact, an integration of PEOs, LOs 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 law, Charles' Law and Gay Lussac's law using house hold materials.
- Battery and Cells:** Collect waste 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: 8174505661
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: 8174506414
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, 2014, ISBN: 8174506213
5	Fundamentals of	Haliday, David,	John Wiley and sons, Hoboken,



S. No.	Title of Book	Author	Publication
	Physics	Resnick, Robert, and Walker, Jearl	USA, 2014 ISBN : 817650823X
6	Engineering Chemistry	Jain and Jain	Oshapoti Raj and sons, New Delhi, 2013, ISBN : 9782160002
7	Engineering Chemistry	Datta, S. S.	S.Chand. Publications, New Delhi, 2013, ISBN : 8121997638
8	Fundamental of electrochemistry	Bagotsky, V.S.	Wiley International N. J., 2005 ISBN. 9780471760586

14. SOFTWARE/LEARNING WEBSITES

- <http://npce.ac.in/course.php?disciplineid=111>
- <http://npce.ac.in/course.php?disciplineid=104>
- <http://hyperphysics.phy-astr.gsu.edu/hbase/tlph.html>
- www.physicsclassroom.com
- www.physics.org
- www.fearofphysics.com
- www.sciencejywangon.com/physicsscope
- www.science.howstuffworks.com
- <https://phet.colorado.edu>
- www.chemistryteaching.com
- www.visionlearning.com
- www.chem1.com
- www.online.library.wiley.com
- www.rsc.org
- www.chemcollective.org



S. No.	Tutorials	Unit No.	Approx. Hrs. Required
4	Solve solution of Simultaneous Equations using inversion method.	I	2
5	Resolve into partial fraction using linear, non repeated, repeated, and reducible 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 trigonometry 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/concepts should be taught and assessed in order to develop UO- in cognitive domain for achieving the COs to attain the identified competence.

Unit	Unit Outcomes (UOs) (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 systems 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) (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 problem, utilizing inverse trigonometric ratios.	2.1 Engineering ratios of Compound, allied, multiple and sub-multiple angles (without proof). 2.2 Factorization and de-factorization formulae (without proof). 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. Formulae, 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: slope of straight line. 3.2 Angle between two lines. 3.3 Conditions of parallel and perpendicular lines. 3.4 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 Measurement	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 variation 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 Subtopics
	92. Justify the consistency of given sample sets of data.	

Note: The attainment of UOs and competencies under listed Unit Outcomes (UOs) need to be substantiated to achieve the 'Apprentice 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	L Level	A Level	Total Marks
I	Algebra	20	02	08	10	20
II	Programming	18	01	05	12	20
III	Coordinate Geometry	09	02	07	05	38
IV	Versation	08	01	07	04	38
V	Statistics	10	02	05	07	14
Total		64	10	25	35	70

Legend: R=Remember, L=Understand, A=Apply and above attainment's level of taxonomy.

Note: This specification table provides general guidelines to assist student for their learning and to teacher to teach and assess students with respect to attainment of UOs. The actual distribution of marks in different taxonomy levels (at R, L, 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 and solving problems based on real world problems and solve with the use of free online available on the internet.
- Use graphical software: EXCEL, DDTOT and GRAPH for related topics.
- Use MATCAD as Mathematical Tools and solve the problems in Calculus.
- Identify problems based on applications of matrix and use MATLAB to solve these problems.
- Prepare models to explain different concepts.
- Prepare a seminar for 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 course (MOOC) may be used to teach various topics/sub-topics.
- 'Flipped' Learning 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 L/Os/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. She 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 AOs. 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 a home submission. The total duration of the micro-project should not be less than 10 (ten per cent) 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 she 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 series.
- 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, 2002 ISBN: 8174091935
2	Advanced Engineering Mathematics	Krezig, Erwin	Wiley Publications, New Delhi, 2014 ISBN: 978-81-470-4583-3
3	Engineering Mathematics (third edition)	Croft, Anthony	Pearson Education, New Delhi, 2019 ISBN: 978-81-317-2605-1
4	Getting Started with MATLAB	Pratap, Rudra	Oxford University Press, New Delhi, 2014, ISBN: 0169731241
5	Advanced Engineering Mathematics	Das, H.K.	S. Chand & Co., New Delhi, 2008 ISBN: 9788123983445

14. SOFTWARE/LEARNING WEBSITES

- www.scilab.org/ - SCILAB
- www.mathworks.com/products/matlab/ - MATLAB
- www.dp.pl/cm/ - DPLC
- www.all-mathead.com/ - MATCAD
- www.welham.com/mathematica/ - Mathematica
- <https://www.khanacademy.org/math?getid=CNqHuhCj4CFd0J2a6cdHoPg>



- g. www.easy-calculation.com
- h. www.math-in-a-g-1.com



Case code: 23001



S. No.	Practical Outcomes (POs)	Unit No.	Approx. Hrs. required
Computer system and Operating system:			
1	Identify various input/output devices, connections and peripherals of computer system.	1	05

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
2	Manage files and folders: Create, copy, rename, delete, move files and folders	I	1
Word Processing			
3	Create, edit and save documents, apply formatting features on the text, line, paragraph	II	2*
4	Use built-in, numbering, page numbering	II	2
5	Insert and edit images and shapes, sizing, cropping, colour, background, grouping	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	I	1
Spreadsheets			
9	Create, open and edit worksheets 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 in 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

* - Computer practicals to be performed

Note

- A suggestive list of practical COs is given in the above table. more such PrOs can be added to attain the COs and competency.
- However, 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 images (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 work competencies 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 PrOs but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually as the student who is undertaking a series of practical experiences over a period of time. However, the level of achievement of the ADOs according to Kothari's 'Affective Domain Taxonomy' should gradually increase as pointed below.

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

7. MATERIAL/EQUIPMENT/INSTRUMENTS REQUIRED

The major equipment with broad specifications mentioned here will assist in configuring the 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	Table-top printing laser printer.	1,6,12,17
3	Fluor, Switches, Adapters	1,16,17
4	Any operating system	2 to 1*
5	Any Office Software	2 to 1*
6	Any browser	15,17,18

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

UNDERPINNING THEORY COMPONENTS

The following topics/sub-topics are to be taught and assessed in order to develop COs 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	1. Explain the given block diagram of computer system. 2. Classify the given type of software. 3. Explain characteristics of the specified type of network. 4. Describe procedure to manage a file/folder in the given way. 5. 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, solid pen drive) 1.4 Application Software: word processing, spreadsheet, database management systems, control software, accounting software, photo-editing software, video-editing software, graphical manipulation software, System Software components, Drivers, 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. 3. Explain the given page setup features of a document. 3a. Write the specified table formatting feature.	2.1 Word Processings: 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 ind



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		spacing, add bullets and numbers in lists, add borders and shading, document views, Page settings and margins, Spelling and grammatical checker. 2.2 Changing the Layout of a Document: Adjust page margins, Change page orientation, Create headers and footers, Set and change indentations, Insert and delete tabs. 2.3 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. 2.4 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. 2.5 Working with Columned Layouts and Section Breaks: Create 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 features 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 simple data, Save, Copy Worksheet, Delete Worksheet, Close and open Worksheet. 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
		Orientation: Header and Footer, Insert Page Breaks, Set Background. 3.4 Working with Formulas: 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. 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. 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.
Unit- IV Presentation Tool	4a Write the steps to create the specified slide presentation. 4b Write the steps to insert multiple media in the given presentation. 4c Write steps to apply table features in the given presentation. 4d Write steps to manage charts in the given presentation.	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 Columns, fonts and effects, apply custom Colour and font theme, changing the background, Arrange Slide sequence. 4.2 Inserting Media elements: Adding and Modifying Graphical Objects in a Presentation, Insert Images into a Presentation, insert audio clips, video animation, Add Shapes, Add Visual Styles to Text in a Presentation, Font 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. 4.3 Working with Tables: Insert a Table in a Slide, Format Tables, and Insert Tables from Other Office Applications.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		4.4 Working with Charts: Insert Charts in a Slide, Modify a Chart, Export Charts from Other Office Applications.
Unit- V Basics of Internet	5a Explain use of the given setting options in browsers. 5b Explain features in the specified web services. 5c Describe the given characteristics and 5d Explain the specified option used for effective searching in search engine.	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 removing bookmarks, use search engines effectively for searching the content. 5.2 Web Services: e-Mail, Chat, Video Chat, streaming, e-learning, e-shopping, e-Reservation, e Groups, Social Networking.

Note: To attain the UOs and competencies, 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 projects.
- Prepare a sample document with all word processing features, if a teacher shall allow appropriate document type in each student.
- Undertake mini 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.
- Use 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 guide for details).
- With respect to item No.4, teachers need to create in-class opportunities and provisions for co-curricular activities.
- Guide students in undertaking mini-projects.
- Guide students in undertaking various activities in a lab/workshop.
- Demonstrate students thoroughly before they start doing the practice.
- Show video tutorial on films for handling the various 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 a minor in the beginning of the semester. She ought to submit it by the end of the semester to develop the industry oriented UOs. Each micro-project should encompass two or more UOs which are in fact, an integration of FOs, 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 a work diary consisting of individual contribution in the project work and give a seminar presentation of before submitting. The total duration of the micro-project should not be less than 16 minimum students 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 professional so that she contributes to the growth of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty.

- Word documents:** Prepare Title Page, Appendix, Note, Report on subject tested shall design a document to be prepared by the each student.
- Slide Presentations:** Prepare slides with all Precession features such as classroom presentation, presentation about department presentation of report. Subject teacher shall design a presentation to be prepared by the each student.
- Spreadsheets:** Prepare Pay Roll, Fee statement, Student's assessment, monthly mg spreadsheet (Total of six) and give a spreadsheet to be prepared by each student.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Computer Fundamentals	Gael, Anita	Pearson Education, New Delhi, 2014, ISBN: 978-8131731097
2	Computer Basics Application Beginners Guide, Windows 10	Indle, Michael	QIP Publishing, New Delhi Aug 14 2015, ISBN: 978-9397545116
3	Windows 10 for Beginners	Alexia, Felix	Createspace Independent Publishing Platform- 2016, ISBN: 978-1533682721
4	Microsoft Office 2010, User Manual	Johnson, Steve	Pearson Education, New Delhi India, 2010, ISBN: 9788131776641
5	Microsoft Office 2010 for Windows, Visual Quick Start	Schwartz, Steve	Pearson Education, New Delhi India, 2012, ISBN: 978931766613
6	Microsoft Office for Dummies	Leite, Gurdy, Frieschman, Helen, Mary, Leite	Wiley Publishing, New Delhi, 2013 ISBN: 978-9764542260

14. SOFTWARE/LEARNING WEBSITES

- <http://www.microsoft.com/en-in/learn/technet/office/2010.aspx>
- <http://www.internationalopenoffice.org>
- <http://www.openoffice.org/updates/updates.html>



Course Name : Mechanical Engineering – Semester I and II Trade Program Group
 Course Code : MECECE003/004/005/006/007/008/009/010
 Semester : First
 Subject Title : Engineering Graphics
 Subject Code : 220002

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 ability of coming up the actual object or part on the basis of drawings and vice versa. This preliminary course aims at building a foundation for the higher courses related to engineering drawing and other related 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 learner, practical experience and relevant 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 syllabus:

- Draw geometric figures and engineering curves.
- Draw the views of a 3D object using principles of orthographic projection.
- Draw isometric views of given component or four orthographic projections.
- Use drawing codes, conventions and symbols as per IS:SP:4 in engineering drawing.
- Draw free hand sketches of given engineering elements.

4. TEACHING AND EVALUATION SCHEME

Teaching Scheme		Credit (L + P + T)	Examination Scheme										
S. No.	P		Theory					Practical					
			Page No.	ESE	PA	Unit	ESE	PA	Total				
			Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
1	1	1	—	—	—	—	—	15	5	20	10	10	20

*** marks shown are provided on the basis of internal and semester marks ratio of 30 marks each, as per the specification under given in Table 1.

*** For the courses having ONLY practical examination, the P has two components and/or practical marks i.e. the Minimum of practical exam in section is 10% or weightage of 10% (i.e. 10 marks) and corresponding assessment is based on section 2, i.e. a weightage of 20% i.e. 20 marks. This is designed to be double attainment of COs holistically as shown in the below Table.



Legend: L-Lecture, P-Practical, T-Theory, C-Theory, P-Practical, C-Theory, P-Practical, ESE-End Semester Examination, PA-Progressive Assessment in No. drawing paper.

5. COURSE MAP (with sample COs, POs, LOs, 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.

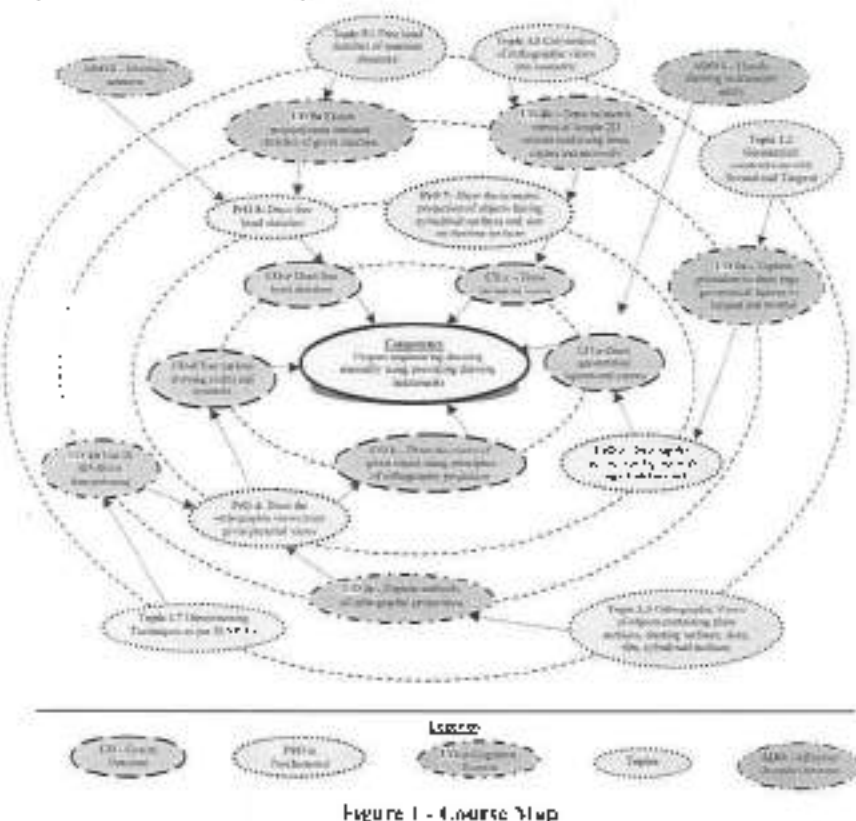


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are POs (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 (POs) (Drawing Outcomes in Psychological Dimension)	Unit No.	Approx. Hrs. Required
1	Sketch Book		

S. No.	Practical Outcomes (POs) (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 etc. by using Set squares/dialter.	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 (POs) (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)	IV	02
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 slant on slanting surface by using isometric scale. (Problem 2)	IV	02
27	Draw a problem on isometric Projection of objects having slant 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 1.4)	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, IV	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, IV	02
Total			64

All practicals are to be performed

Note

- A suggestive list of POs is given in the above table, more such POs can be added to attain the L12 and congruence.
- The 'Process' and 'Product' related skills associated with each PO 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	Consistency in drawing and line work.	10



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

The above POs are composed of the following social skills/competencies, which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences.

- Follow cleanliness and neatness.
- Follow rules and standards.

The ADOs are not specific to any one PO, but are embedded in many POs. 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 specifications mentioned here will usher in uniformity in need list of experiments, as well as aid to procure equipment by various institutions.

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 NSBTE portal to be used as reference standards.	All
6	Drawing equipment's and instruments for class room teaching-large size a. T-square or crafter (Drawing Machine) b. Set squares (45° and 20°-60°) c. Eraser/cutter 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 are to be taught and assessed in order to develop UOs for achieving the POs 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 IS 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 IS: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. Evolve different engineering curves with areas of application 2b. Draw different conic sections based on given condition. 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 Conjugate 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 curves: cycloid, epicycloid and hypocycloid 2.7 Methods to draw Helix And Archimedian 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 domains	Topics and Sub-topics
	4c. Circles and arcs only 4d. Interpret the given orthographic views 4e. Draw isometric views from given orthographic views.	objects having plain, slanting, cylindrical surfaces and slots on slanting surfaces. 4.3 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, or screws, washers, Locking arrangements. (For branches other than mechanical engineering, the teacher should select branch specific elements for free hand sketching).

Note: To assess the UOs and competency, above listed UOs used 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	L Level	A Level	Total Marks
I	Principles of Drawing	04	-	02	04	06
II	Engineering curves and Loc of Points	06	-	02	04	14
III	Orthographic projections	06	-	02	08	10
IV	Isometric projections	08	02	02	07	16
V	Free Hand Sketches of machine elements	08	02	02	08	12
Total		32	4	15	31	50

Legend: R=Remember, L=Understand, A=Apply, and above Bloom's Revised taxonomy

Note: This specification table provides general guidelines to assess 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, L and A) in the question paper may vary from above table.

This specification table also provides a general guideline for teachers to frame internal and semester practical theory exam papers 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. All drawing assignment should be drawn in the sketch book.
 - i. Single stroke vertical letters and numbers

- ii. Type of lines.
- iii. Redraw the figures from end.
- 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 machine elements mentioned in Unit no.4.
- viii. Note: Problems on sheet and in the sketch book should be different.
- h. Students should collect Maps, Production drawings, Building Drawings, Layouts from nearby workshops, industries, engineers' contracts and try to list:
 - i. Types of lines used.
 - ii. Lettering styles used.
 - iii. Dimension styles used.
 - iv. IS code referred.
- i. List the shapes and curves you are observing around you in real life with some of their names and items. For Ex. ellipses, parabolas, hyperbolas, cycloids, spirals, etc.
- j. Take one circular shape. Assume one point on circumference and mark it. Roll this shape on flat and circular surface. Observe the path of the point and try to correlate with the theory taught in the class.
- k. 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.
- l. 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 in each student batch.
- m. 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 encountered 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/job topics.
- b. '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.
- 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 UOs through classroom presentations (see implementation guideline for details).
- d. With respect to item No.6a, teachers need to ensure to create opportunities and provisions for co-curricular activities.
- e. Create student's in undertaking mini-projects.
- f. Guide student's in fixing the sheet and in mounting on drawing board.
- g. Show video-animation films to explain orthographic and isometric projection.
- h. Demonstrate first and third angle method using model.
- i. Use charts and posters of 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 at the beginning of the semester. She ought to submit it by the end of the semester to develop the industry-oriented CDs. Each micro-project should encompass two or more CDs which are in fact, an integrator of PCBs, DDCs and A/Ds. 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 last 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 to make the contribution to the projects of the industry. A suggestive list is given here. 5 min or micro project could be added by the concerned faculty.

- Helical springs:** Each batch will collect 5 open end and closed end 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 isometric models of the same.
- Involute curves:** Each batch will try to develop cardboard/thermofoil 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 the air valve by rolling them on the 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 20 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 bevel gear 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	Director of Public Standards	By Government of India Third Reprint, October 1998, ISBN: 81-7391-091-2

S. No.	Title of Book	Author	Publication
2.	Engineering Drawing	Hazan, N.D.	Charotar Publishing House, Anand, Gujarat 2010, ISBN: 978-93-93358-17-2
3.	Machine Drawing	Hazan, N.D., Panchal V.M.	Charotar Publishing House, Anand, Gujarat 2010, ISBN: 978-93-93358-11-6
4.	Engineering Drawing	Ishee, D.A.	Tata Mc Graw Hill Edu, New Delhi, 2010, ISBN: 978-0-07-061837-1
5.	Engineering Drawing	Dhawan, R.K.	S. Chand and Company, New Delhi, ISBN 81-219-1431-0
6.	Engineering Drawing	Sharma, P.J.	S. Chand and Company, New Delhi, 2008, ISBN: 81-219-2964-4

14. SOFTWARE/LEARNING WEBSITES

- <https://www.youtube.com/watch?v=1D4juy2-WUw>
- https://www.youtube.com/watch?v=dnt6_u7Sgeg
- https://www.youtube.com/watch?v=_MQ5antX1J0M
- https://www.youtube.com/watch?v=2W_XPanCq3Lc
- <https://www.youtube.com/watch?v=fyjk7PlxAcw>
- <http://www.nic.urn.edu/courses/me201/1/handouts/eng%20graphics.pdf>
- <http://www.machinedesignonline.com>

Program Name : Computer & Electronics Program Group

Program Title : CCEMBA WITH ENGINEERING MATHEMATICS

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 in the 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, techniques, the learner about the national and international 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 blueprints. This course also focuses on developing the imagination and translating ideas into sketches and also the ability to draw and understand engineering drawings, projections and dimensioning styles.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competencies 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 as indicated in the above mentioned competency:

- Draw regular geometrical figures.
- Use drawing tools, conventions and symbols as per IS:SP:16 in engineering drawing.
- Draw the views of given object using principles of orthographic projection.
- Draw isometric views of given components 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 (1+T+P)	Examination Scheme									
1	T	P		Theory					Practical				
				Paper No.	LSL	PS	Total	EST	PS	Total			
Max	Min	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max		
2	—	1	—	—	—	—	12	20	32	20	12	12	

(*) Marks should be awarded on the basis of internal and external inspection of 50 marks. For the specification, refer given in Section 1.

(**) For the courses having DNE practical examination, the 1st year compulsory under given scheme i.e. the assessment of practicals based on section 12 has a weightage of 10% of the marks and orthographic projections in section 12 has a weightage of 10% of the marks. This is designed to facilitate inclusion of COs satisfactorily as there is no theory LSL.

Legend: L= Lecture, T= Tutorial, Ye= Year, C= Credit Theory, P= Practical, C= Credits, ESE= End Semester Examination, PA= Progress Assessment, P= Portfolio paper.

5. COURSE MAP with sample COs, POs, UOs, AOs and topics

This course map illustrates an overview of the class and linkages of the topics at various levels of outcomes (objectives) 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.

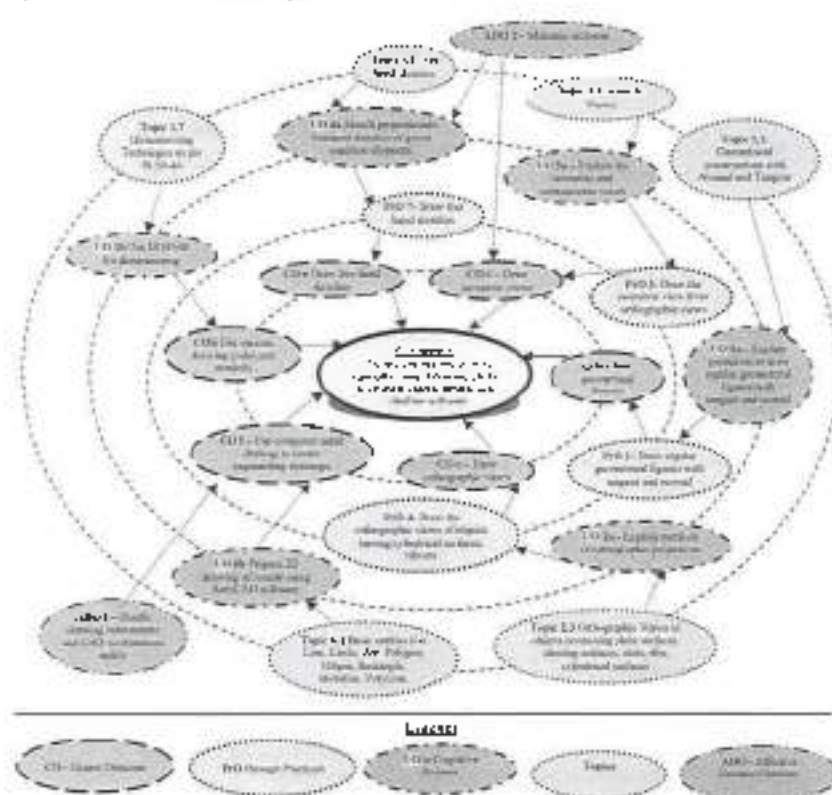


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/EXERCISES

The practicals in this section are POs (i.e. sub-competency) 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 (POs)	Unit No.	Approx. Hrs. Required
1	Sketch Book, Four problems		



S. No.	Practical Outcomes (POs)	Unit No.	Approx. Hrs. Required
1	Draw horizontal, vertical, 30 degree, 45 degree, 60 and 75 degrees lines, different types of lines. Joining lines using T-tee and Set square 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 3)	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 2 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)	IV	02
16	Draw two problems on Isometric view of simple objects having plain and slanting surface by using natural scale. (Problem 2 continued)	IV	02
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 (POs)	Unit No.	Approx. Hrs. Required
	isometrical 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, IV	02
Total			46

S. No.	Practical Outcomes (POs) (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 Circle and rectangle array using AutoCAD (Print out should be a part of progressive assessment). (Problem 3)	V*	02
27	Draw blocks of 2D entities composed 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)	V*	02
29	Draw basic branch specific components in 2D using AutoCAD (Print out should be a part of term work). (Problem 6)	V*	02
30	Draw complex branch specific components in 2D using AutoCAD (Print out should be a part of progressive assessment). (Problem 7)	V*	02
31	Draw complex branch specific components in 2D using AutoCAD (Print out should be a part of progressive assessment). (Problem 8)	V*	02
32	Draw complex branch specific components in 2D using AutoCAD	V*	02



S. No.	Practical Outcomes (POs) (Learning Outcomes in Psychological Domain)	Unit No.	Approx. Hrs. Required
	Print out sample be a part of progressive assessments (Problem 3)		
	Total		18

All practicals are to be performed

Note

- A suggested list of POs is given in the above table, more such POs can be added to attain the CPOs and competency.
- The 'Process' and 'Product' related data associated with each PO 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 on 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 of parameters	05
3	Creating given drawing using relevant Commands	40
4	Dimensioning the given drawing and writing text using Blocks and Insert effects, if any	15
5	Answer to sample questions	10
6	Submission of digital drawing file/print on time	10
	Total	100

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

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

- Fellow cleanliness and neatness.
- Fellow ethics and standards

The ADOs are not specific to any one PO, but are embedded in many POs. 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 11 could be developed by experienced teachers and made used available on the MSDTE 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 (45° and 30°-60°) 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 equipments and instruments for class room teaching-large size: a. T-square or drafter (Drafting Machine) b. Set squares (45° and 30°-60°) c. Protector 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: Plot resolution 1 µ 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 are to be taught and assessed in order to develop CPOs for achieving the CPOs to attain the identified competency:

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – 1 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 (first 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 in detail 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-26 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 plan 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, Qout, 5a. Setting up new drawing: Units, Limits, Grid, Snap 5b. 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 Plotter/plotter.	6.1 Draw basic entities like: Line, Circle, Arc, Polygon, Ellipse, Rectangle, Multiline, Poly, Layer. 6.2 Methods of specifying points: Absolute coordinates, Relative Cartesian and Polar coordinates. 6.3 Modify and edit commands like: trim, delete, copy, mirror, array, block, layers. 6.4 Dimensioning: Linear, Horizontal, Vertical, Aligned, Rotated, Baseline, Continuous, Diameter, Radius, Angular, Dimensions. 6.5 Don't scale variable. 6.6 Editing attributes. 6.7 Text: Single line text, Multiline text. 6.8 Standard sizes in sheets: Setting 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, where **Internal UOs** need to be undertaken to achieve the **Apprentice Level of Bloom's Cognitive Domain Learning**.

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

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	L Level	A Level	Total Marks
I	Basic elements of Drawing	04	–	02	04	06
II	Orthographic projections	36	–	02	04	10
III	Isometric projections	38	02	02	06	10
V	Free hand sketches of engineering elements	14	02	–	14	06
V	Computer aided drafting interface	2–	02	04	–	06
V	Computer aided drafting	06	02	04	06	12
Total		32	08	14	28	50

Legend: P – Remember, L – Understand, A – Apply, and, (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 knowledge levels for Unit I and II in the question paper may vary from above table.



Each specification table given provides a general guideline for students to frame internal and external assessment that is a part of paper which students have to complete 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 assignments should be drawn in the sketch book:
 - Single stroke vertical Letters and Numbers.
 - Type of Lines.
 - Redraw the figures Any three.
 - Engineering Curves: One problem for each type of curve.
 - Orthographic projections: Minimum 5 problems.
 - Isometric Projection Views: Minimum 5 problems.
 - Free hand sketches: All types of engineering elements mentioned in Unit no. 1.
- Students should collect Maps, Production drawings, Building Drawings, Layouts from nearby workshops/industries/builders/contractors and redraw:
 - Types of lines used.
 - Lettering styles used.
 - Dimension styles used.
 - IS code referred.
- Name the shapes and curves you are observing around you in real life with name or place and item. (For example ellipse, parabola, hyperbola, cycloid, spiral, corks, hypocycloid, involute, spiral helix).
- Each student should explain at least one problem for construction and method of drawing it sheet in all batches/levels. Teacher will assign the problem of particular sheet to be explained in each student batch.
- Each student will assess at least one sheet of other students (May be a group of 3-4 students identified by teacher can be taken) and will mark 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)

There 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.
- Unit no. 1 and 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 autonomy.
- About 15-20% of the copies/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 LCOs through classroom presentations and implementation guideline for details.
- While referred to item No.11, teachers need to ensure to create opportunities and provisions for co-curricular activities.
- Once students start understanding engineering graphics.
- Once students start doing the sheet and mini-drawing on drawing sheet.

- 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 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 might 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 FOs, 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 few 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:

- Isometric views: Each student of the batch will try to collect at least one production drawing/construction drawings/trimming drawings from local workshop/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 views: The teacher will assign one set of orthographic projections and ask the student to develop 3D isometric models of the same.
- Computer aided drafting: Each batch will collect 5 components/containers specific to their branch and draw their orthographic views using AutoCAD software.
- Computer aided drafting: Prepare Logo of your institute/school 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	Hazari V. J.	Chamara Publishing House, Anand, Gujarat, 2010: ISBN: 978-81-80156-17-8
3.	Engineering Drawing	Johns, D. A.	1999 McGraw Hill Edu, New Delhi, 2010, ISBN No. 978-0-07-066837-1
5.	Engineering Drawing	Dhawan, R. K.	S. Chand and Company New Delhi, ISBN No. 81-219-143-4-6
6.	Engineering Drawing	Sharma P. J.	S. Chand and Company New Delhi, 2008, ISBN: 81-219-2966-4
7.	Engineering Graphics	Kulkarni, D. M.	PHIX Learning Private Limited-New



S. No.	Title of Book	Author	Publication
	with AutoCAD	Rasingi, A. P., Sarkar, A. K.	Delhi (2010). ISBN: 978-8120337831
8.	Essentials of Engineering Drawing and Graphics using AutoCAD	Jeyarajan, T.	Vikas Publishing House Pvt. Ltd, Noida, 2011. ISBN: 978-8124953005
9.	AutoCAD User Guide	Autodesk	Autodesk Press, USA, 2011
10.	AutoCAD 2016 for Engineers and Designers	Sham Tickoo	Dreamtech Press, Calcutta Publication New Delhi, 2015 ISBN: 978-9351199112

14. SOFTWARE/LEARNING WEBSITES

- a. <https://www.youtube.com/watch?v=TFdjGyD-WCw>
- b. https://www.youtube.com/watch?v=dnp6_n7SgeQ
- c. <https://www.youtube.com/watch?v=-MQScrJ.XI.0M4>
- d. <https://www.youtube.com/watch?v=3WXPanCq9LI>
- e. <https://www.youtube.com/watch?v=fvjK7PtxAuo>
- f. <http://www.cse.unr.edu/courses/cse201/Handouts/engg%20graphics.pdf>
- g. <https://www.machinedesignonline.com>



Program Name : Mechanical Engineering (4th Phase Program Group)

Program Code : 11EAE0401P04010101P0401P0401

Semester : Ist Sem

Course Title : Workshop Practice

Course Code : 22604

1. RATIONALE

Workshop Practice is a basic practical engineering course. The knowledge of basic work skills such as: wood working, fitting, working, plumbing and sheet metal work is essential for the student to perform his/her duties in industries. Students are able to perform various operations on a hand tool equipment and machines in various trades. Working in workshop develops the attitude of group working and safety awareness. This course provides a realistic industrial environment in the educational institute.

2. COMPETENCY

The course should be taught and implemented with the aim of achieving the course outcomes (COs) so that student demonstrates the following competencies needed by the industry:

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

3. COURSE OUTCOMES (COs)

The course practical competencies and relevant 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 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	L	P	T	C	Examination Scheme											
					Theory						Practical					
					Paper I	ESE	PA	Total	PSE	PA	Total	PSE	PA	Total	Min	Max
					100	100	100	100	100	100	100	100	100	100	100	100

Legend: L= Lectures, T= Tutorials, P= Practical, C= Course Project, ESE= End Semester Examination, PA= Progress Assessment.

5. UTM JRF MAP with sample COs, POs, LOs, ADDs and topics

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (Add), 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 in the centre of this map.



Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are POs (ie. 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.	1	1
2	Perform mock drill session in group of minimum 10 students for extinguishing fire - Part I.	1	1

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	Prepare job with following operations: – Part VII 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 oil pit material for given pipeline layout – Part I	III	2*
13	Prepare oil pit material for given pipeline layout – Part II	III	2
14	Prepare box joint using gas welding as per given drawing – Part I	IV	2*
15	Prepare lap joint using gas welding as per given drawing – Part I	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, V	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 jobs 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.	VI	2*
24	Prepare utility jobs 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.	VII	2
25	Prepare utility jobs 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.	VIII	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	VII	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	VIII	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	VII	2
32	Prepare sheet metal utility job using following operations – Part VII a. Cutting and Bending b. Edging c. End Curling d. Lancing e. Soldering f. Riveting	VII	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 minimum of minimum 24 or more practical tasks to be performed out of which the practicals marked as "*" are compulsory, so that the students reaches the 'Proficient level' of their 'Psychomotor Domain Proficiency' 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 POs also comprise of the following social skills/competencies 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 PO, but are embedded in many POs. 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 at Centre - 700mm, Distance between Centers - 1200mm, Spindle Bore - 20mm with Taper, Range of Speeds - 475 to 2820 with suitable Motor Drive, with all accessories	II
4	Circular Saw Machine, Diameter of saw blade 200 mm, Maximum Depth of Cut - 30 mm, Table Size - 350 x 450 mm, Table Tilting - 45°	II
5	Wood working tools- marking and measuring tools, saws, claw hammer, mallet, chisels, planes, squares.	II
6	Carpenter's Vice 200 mm	II
7	Work Benches- size 1800 x 900 x 750 mm	II
8	Bench Drilling machine (up to 17 mm drill capacity) with 1/2 HP Motor 1000 mm Height	II
9	Power Saw machine 350 mm mechanical with 1 HP Motor & all Accessories	II
10	Bench Grinder 200 mm Grinding Disc diameter 200 mm, with 25 mm bore 32 mm, with 1/2 HP/1HP Motor	II
11	Vernier height Gauge 450 mm	II

S. No	Equipment Name with Broad Specifications	Exp. S.No
12	Surface Plate 400 x 500 mm Grade 1	II
13	Angle Plate 45 x 450 mm	II
14	Welding machine 20 KVA, ACOS, welding current 30 A, at 50° Duty, 240 250, 300 mm dia. Accessories and Welding Cable 100 amp, 31 with holder	IV
15	Oxy gen and acetylene gas welding and cutting kit with cylinders and regulators	IV
16	Pipe Bending Machine	V
17	Pipe Vice - 100 mm	V
18	Pipe Cutter 50 mm	V
19	Bench Vice 100 mm	III, IV, V, VI
20	Portable Hammer Drill Machine 0-13 mm dia, 230 V, 2.5Amp, Fixed type, having different sizes of bits	I, 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, & block, angle plate, try square, marking block, steel rule, twist drills, reamers, tap set, die set	III
25	Plumbing tools- pipe cut, pipe bending equipment, pipe wrenches, dies	IV
26	Gas welding hand tools- welding torch, welding tip, pressure regulating, oxygen and acetylene cylinders, spark holder	V
27	Arc welding hand tools- electrode holder, cable connector, cable lug, chipping hammer, earthing clamp, wire brush	V
28	Sheet metal hand tools- snip, shears, sheet usage, straight edge, L square, scriber, divider, trammel, punches, pliers, stakes, snuggers, form set	VI

8. UNDERPINNING THEORY COMPONENTS

The following topics/sub-topics 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	(a) Describe the procedure for extinguishing the given type of fire	1.1 Safety Practices, Causes of accidents, General safety rules, Safety signs and symbols
	(b) Describe the procedure to use the given firefighting equipment	1.2 First Aid
	(c) 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 Fire fighting equipment, fire extinguishers and their types
	(d) 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. Fitting hand tools bench vice.

Fitting	fitting shop machines 21a. Describe the procedure to use the given fitting tools 21b. Describe the operation of the given machineries 21c. Describe the procedure to perform fitting operations 21d. Describe the procedure to maintain tools, equipment and machinery	2.1. Summers, chisels, files, hacksaw, surface plate, parallel 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, Planer, Lathe and maintenance 2.3. Basic process: chipping, filing, 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 process	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 ply wood, block board, burl board, laminated boards, Veneer, fiber Board and their applications 5.2. Wood working hand tools: carpentry cut, measuring and measuring tools, saws, claw hammer, mallet, chisels, plane, square, and their specifications 5.3. Operation of wood working

	operate the given wood working machinery 5d. 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 6f. 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, scriber, divider, try square, punch, pliers, stakes, groovers, limit set and their Specifications 6.2. Operation of machineries in sheet metal shops- sheet cutting and bending, marking their specifications and maintenance 6.3. Basic process- marking, bending, folding, edging, seaming, slaking, riveting

Note: To attain the COs and competency, above listed LOs need to be undertaken to achieve the Application level and above of Bloom's Cognitive Domain Hierarchy

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 consists of job drawing, operations to be performed, 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 specification of following:
 - Various tools and equipments 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 outcomes in this course.

- Various open and on-line 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.



- z. 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 processes.
- g. Show video/animation films to explain functioning of various processes like shaping, tapping, honing, turning, milling, knurling etc.
- h. Prepare maintenance charts various workshop machines.

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 in developed (the industry oriented) COs. Each micro-project should encompass two or more COs which are in fact an integration of DOs, UOs and ADCs. 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 *(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:

- a. Utility job will be assigned by the teacher.
- b. 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, equipment, date and performance record.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publications
1.	Workshop Practice	Hawa, H.S.	McGraw Hill Education, Noida. ISBN: 978-0073571195
2.	A Textbook of Manufacturing Process (Workshop Tech.)	Gupta, J.K.; Khanna, R.S.	S.Chand and Co, New Delhi ISBN: 81-219-7072-8
4.	Introduction to Basic Manufacturing Process & Workshop Technology	Singh, Rajender	New Age International, New Delhi 2014, ISBN: 978-81-224-5077-7

14. SOFTWARE/LEARNING WEBSITES

- a. <http://www.asst.edu.in>
- b. <http://www.abnertools.com/download/Woodworking%20Carpenry%20Tools.pdf>
- c. <http://www.weldingtechnology.org>
- d. <http://www.newagepublshers.com/samplechapter/141466.pdf>
- e. <http://www.youtube.com/watch?v=16UX5LkH1Y>
- f. <http://www.youtube.com/watch?v=Q453kM4hys&feature=related>
- g. <http://www.youtube.com/watch?v=Ks7z09CAs18&feature=related>
- h. <http://www.pchtools.com>
- i. <http://sourcingindiaimport.com/engineering/articles/materials-used-in-automotive>
- j. http://www.youtube.com/watch?v=6_cukrABHJ64



S. No.	Practical Outcomes (POs)	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, Transistor(s), 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 desoldering operations	I	2
8	Connect L.P.S 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	Clear inside PC - Boards and Slots (Part-I)	III	2
13	Clear 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 firing 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 feeding, etc.)	IV	2
22	Install and work with laser printer (various types of configurations, settings on printer, removing and mounting cartridge, troubleshooting paper jam)	IV	2
23	Install and work with scanner with default settings	V	2
24	Change scan settings: scanning documents/images and saving in different formats	V	2
25	Connect Modem, Hub/Switches/routers physically	V	2
26	Prepare and test crossover and straight cable, CAT5, CAT6 Cable using Crimping tools, Splice	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

- A suggested list of POs is given in the above table. But, such POs can be added to, within the POs and compensating. A practical set of at least 24 or more practical need to be performed out of which the practicals marked as * are compulsory, so that the student reaches the 'Proficient Level' of Datta's 'Equivalent Domain Taxonomy', as previously required by the regulator.
- The 'Process' and 'Product' related skills associated with each POs to be achieved according to a suggested way is given below.

S. No.	Performance Indicators	Weightage in %
a.	Use of Appropriate tool to solve the problems	19
b.	Operate equipment skillfully	30
c.	Follow Safety measures	10
d.	Quality of output achieved	20
e.	Answer to sample questions	11
f.	Submit report on time	10
Total		100

The above POs also comprise of the following several skill/competencies, 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/team member
- Maintain tools and equipment
- Follow ethical practices

The ADOs are not specific to any one PO, but are embedded in many POs. Hence, the acquisition of the ADOs takes place gradually on 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

2. MAJOR EQUIPMENT/INSTRUMENTS REQUIRED

The major equipment with broad specifications mentioned here will assist in preference in conduct of experiments as well as aid to procure equipment by auction or otherwise.

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, 17, 18, 19
2	LED/DLP Projector	17



S. No.	Equipment Name with Broad Specifications	Exp. S.No.
3	Modems, Intra-switches, Router	25, 27
4	Wi-Fi set-up with access point and repeater	26
5	Bluetooth based wireless mouse and keyboard or any other device	22
6	Uninterrupted Power supply and earth 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	21, 21, 22
10	Scanner	23, 24
11	Hub, Switches, Routers	25, 27
12	Blank LCD/DVDs	24
13	Photo-copiers, cutter, glue-stick, solder, 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, Relay	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/sub-topics is to be taught and assessed in order to develop LOs for achieving the COs to attain the identified competence.

Unit	Major Learning Outcomes (at cognitive domain)	Topics and Sub-topics
Unit – I Electrical Tools, Cables and Switches	1a. Explain the characteristics of given type of wires, cables, light outlets 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 a interrupted power supply. 1e. Describe the procedure to use the given measuring instrument.	1.1 (List out) 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, mini switch, circuit breaker, MCB, ELCB, Regulators 1.3 Using Photo, 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, Desolder wick. 1.4 Using Uninterrupted power supply, inverter, 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. Passive components: Different types of resistors, inductors, capacitors, potentiometers, Thermistor, Transformer, auto transformer 2.2 Active components: Diode, LED



Unit	Major Learning Outcomes (at 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, BIOS, Hard disk, DVD, Cash 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- DGT, 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 competence, above listed LOs 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

Course Name : All Branches of Diploma in Engineering and Technology

Course Code : DUELENS4QUELENT1EMT1504

Semester : First

Subject Title : Workshop Practice

Subject Code : 12036

1. RATIONALE

Electronic engineering diploma holders are expected to handle various mechanical, electrical and electronics tools in the workshop. The diploma engineer has to supervise soldering, sheet metal work, fitting of electronic components and even to do the workshop. This course will develop skills in handling tools, equipment used in the electronics workshop and perform soldering of components primarily.

2. COMPETENCY

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

- Build test simple electronic circuit on breadboards and PCBs.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant 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 the lighting equipment and other safety related accessories.
- Use fitting and sheet metal tools in the electronics workshop.
- Identify active and passive electronics components.
- Perform soldering and desoldering using soldering tools.
- Build simple jobs in the electronics workshop.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme	L	T	P	Credit (L+T+P)	Examination Scheme											
					Theory						Practical					
					Paper Marks	EST	PA	Total	EST	PA	Total	EST	PA	Total	EST	PA
1	1	1	1	1	100	100	100	100	100	100	100	100	100	100	100	100

(1) For the semester theory (ONE) practical examination, the PT has two components under practical section. The assessment of practical part in semester PT has a weightage of 60% for PT and 40% for theory part. The assessment of practical part in semester PT has a weightage of 40% for PT and 60% for theory part. The assessment of practical part in semester PT has a weightage of 40% for PT and 60% for theory part.

Legend: L= Lecture, T= Tutorial, P= Practical, C= Credit, EST= End Semester Test, PA= Progress Assessment.

5. COURSE MAP (with sample COs, POs, PSs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes across the subsequent section to be attained by the student by the end of the course in addition to learning in terms of the industry employer identified competency depicted at the end of this map.

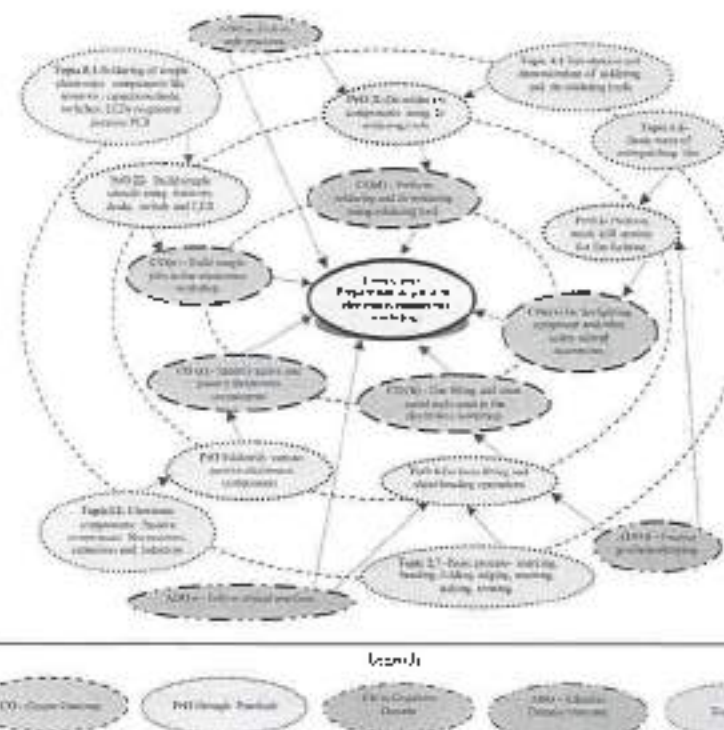


Figure 1 - Course Map

6. SUGGESTED PRACTICAL EXERCISES

The practicals in this section are POs (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 (POs)	Unit No.	Approx. Hrs. Required
1	Use the exact safety symbol from standard safety chart for a given situation.	1*	2
2	Perform mock drill session for firefighting using various classes of fire extinguishers and related accessories.	1	2
3	Use the hand tools and equipment used in fitting shop.	11*	2
4	Use the machine tools and equipment used in fitting shop.	1	2
5	Identify various fitting tools based on given specifications.	1	2
6	Identify various sheet metal tools based on given specifications.	1	2
7	Prepare the given fitting job as per given drawings Part-I.	11*	2
8	Prepare the given fitting job as per given drawings Part-II.	1	2

S. No.	Practical Outcomes (POs)	Unit No.	Approx. Hrs. Required
9	Prepare the given fitting job as per given drawings Part-I	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 electronic 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 by coding 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 triac 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 electronic 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 (POs)	Unit No.	Approx. Hrs. Required
Total			74

Note

i. A suggested list of POs is given in the above table. These POs can be added or deleted to suit the COs and competencies. A minimum list of minimum 24 or more practicals need to be prepared out of which, the practicals marked as * are compulsory so that the student reaches the Proficiency Level of POs. The program domain outcome is generally required by the industry.

ii. The 'Process' and 'Product' related POs associated with each PO is to be discussed according to a suggested sample given below.

S. No.	Performance Indicators	Weightage in %
1	Setting up 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 on time	5
Total		100

The above POs also comprise of the following six, at skill parameters which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory based experiences.

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

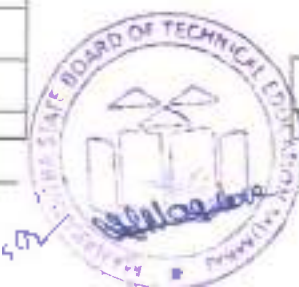
The ADOs are not specific to any one PO, but are embedded in many POs. Hence, the acquisition of the ADOs takes place gradually as the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective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

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

2. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will assist in uniformity in conduct of POs, 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 IS mark 1 & liner B and C type	1



S. No.	Equipment Name with Broad Specifications	Exp. No.
1	Tap	
2	A B.C portable type fire extinguisher with ISI mark	I
3	Bench Drilling machine (up to 13 mm drill tap) with 1/2 HP Motor, 300 mm. height	II
4	Work Benches: 1800mm*1000mm*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 1/2 mm. base 32 mm, with 1/2 HP 1.1 kW Motor	II
7	Vernier height Gauge 450 mm	II
8	Surface Plate 600 x 900 mm (1 face 1)	II
9	Angle Plate 450 x 450 mm	II
10	Bench Vice 125 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: 45°	II
13	CRO: S.M-Ic, Dual trace, Dual beam, Input: 4-5 V supply, Component tester, Function Generator	III
14	Soldering Gun: 40 Watts, Holding stand, Temperature Control, Power cord	III, IV
15	De-soldering Gun: 50 Watts, output voltage 24 V	III, IV V
16	Multimeter 3 and 1/2 digit with component tester	III, IV V
17	Wire Curer	III, IV V
18	Wire Stripper	III, IV V
19	Consumable components: Resistors, capacitors, Diodes, Transistors, ICs, IC Sockets, General Purpose PCBs, L.Ds, Relays, Switches, Connectors, Connecting Wires, Soldering metal, Soldering Flux, De-soldering mesh.	III, IV V

8. UNDERPINNING THEORY COMPONENTS

The following topics/shops are to be taught and assessed in order to develop LCs for achieving the LCs to attain the identified competencies.

Unit	Unit Outcomes (UOs) (to be taught and assessed)	Topics and Sub-topics
Unit – I General Workshop Practice and Fire Fighting	- Describe the procedure for extinguishing the given type of fire. - Describe the procedure to use the given fire fighting equipment. - Locate the safety equipment in workshop. - Describe the ways to maintain good housekeeping in the given situation.	- Safety Practices, Causes of accidents, General safety rules, Safety signs and symbols. - First Aid. - 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. - Workshop Layout. - Issuing and return system of tool, equipment and consumables.



Unit – II Fitting and Sheet Metal Shop	- Explain operation of the given fitting shop machines. - Describe the procedure to use the given fitting tools. - Describe the operation of the given machinery. - Describe the procedure to perform the given fitting operations. - Describe the procedure to maintain the given tools, equipment and machinery. - Explain the given type of welding procedure. - Describe the procedure to use the given metal joining tools.	- 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. - Machinery and their Specifications in fitting shops: Drilling machine, Power saw, grinder. - Basic process: chipping, filing, scraping, grinding, marking, sawing, drilling, tapping, doving, reaming etc. - Sheet metal hand tools and their Specifications: snap, shears, sheet gauge, straight edge, square, scriber, divider, trowel, punches, pliers, stakes, groovers, limit set. - Machinery and their Specifications in sheet metal shops: sheet cutting and bending machine. - Basic process: marking, bending, folding, edging, seaming, slitting, riveting.
Unit- III Identification of Electronic Components	- Explain working of given type of electronics circuit. - Identify given type of active and passive electronics components. - Describe steps to use the given type of multimeter. - Describe the steps to test the given electronics components using the multimeter.	- Source: AC and DC, Batteries. - Electronic components: Passive components like resistor, capacitor and inductor, Active components like diode, transistor, IC. - Switches, relays, LEDs, 7-segment display, step-down transformer, connectors and cables used in electronics circuits. - Data sheet and the catalog of electronics components, multimeter. - 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	- Select the soldering and de-soldering tools for the given job. - Describe procedure for using the given soldering related components. - Explain function of the given type of de-soldering device. - Describe problems of given	- Soldering and de-soldering tools like normal soldering gun, temperature controlled soldering gun, soldering irons, soldering flux, soldering pot, De-soldering gun, De-soldering pump, De-soldering mesh. - Soldering techniques like hand soldering, wave soldering and chip soldering.

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

Note: To attain the COs and competency items listed LOs 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 machines and raw material.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

There 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 guide for details)
- With respect to item No.10 teachers need to ensure to create opportunities and provisions for co-curricular activities



- Guide students in undertaking micro-projects
- Show video/information films to explain functions of fire extinguisher and fire fighting procedure
- Arrange visit to nearby electronics or semiconductor manufacturing industry
- Show video/information films to explain functioning of electronics components and their applications
- 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 number in the beginning of the semester. She might 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, COs and AOs. 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 in the projects of the industry. A suggested 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 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 Guide to Workshop Technology	Raghuvanshi, H.S.	Chandigarh Raysons, New Delhi, 2011 or latest edition, ISBN 9380317168
2	A Textbook of Manufacturing Process (Workshop Technology)	Gupta, K., Khanna, R.S.	S. Chand and Co. New Delhi or latest edition, ISBN 81-219-2092-8
3	Electronic Components Handbook	Jones, Thomas H.	McGraw-Hill Publishing, Boston, Virginia, United States, latest edition, ISBN 9781259672711
4	Principles of Electronics	Mehra, V.K., Mehra, Rajat	S. Chaud and Co. Ram Nagar, New Delhi - 110 055, 2014, ISBN 9788121924504

14. SOFTWARE/LEARNING WEBSITES

- www.ciphi.in/india

- b. <http://www.electronicsart.com>
- c. <http://www.electroschematics.com>
- d. <http://www.asean.com.au>
- e. <http://fireextinguishertraining.com>
- f. www.youtube.com/watch?v=WE-5jleSMY
- g. www.youtube.com/watch?v=1jy5D1PvC8e
- h. http://img1500.com/files/solder.com/FullSolder/0000_5%psd
- i. http://www.kara-nutra-nutrition.com/assets/sites/default/files/References_Bibliography



Program Name : Textile Program Group
 Program Code : DUTCTN
 Semester : I
 Course Type : Workshop Practice
 Course Code : 22002

1. RATIONALE

Skills for operation of various machines and tools in industries are expected to be possessed by the diploma engineers in programmes in textile technology and fashion's clothing. It is also necessary to give preliminary skills in operating related mechanical and electrical equipment to diploma engineers 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 training, 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.
- Principles of block printing and screen printing.
- Perform to test basic mechanical operations and functions related to sewing and embroidery.
- Perform to test basic sewing activities of electrical installers in FCT Textile industry.
- Perform to work skill related to fire fighting in simulated environment.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme		Examination Scheme											
I	II	Practical	Theory	Theory						Practical			
				Paper Mark	EST	CS	Total	Est.	PA	Total	Est.	PA	Total
1	2	3	4	5	6	7	8	9	10	11	12	13	14
—	—	—	—	—	—	—	—	50	20	70	50	50	100

est. For the semester theory (ONLY practical examinations), the PA has a contribution under practical marks for the assessment of practical skill of student for every 10 marks of COs and 20 marks, and under practical examinations given in section II, has a weightage of 40% for 20 marks. Total is designed to include attainment of COs individually as there is no direct 15%.

Legend: Est. Theory : Y – Theory and Lecture Guided Theory Practice, P – Practical, C – Credit, EST – End Semester Examination, PA – Progress Assessment.

5. COURSE MAP (with sample COs, Learning Outcomes and POs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of competencies (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.

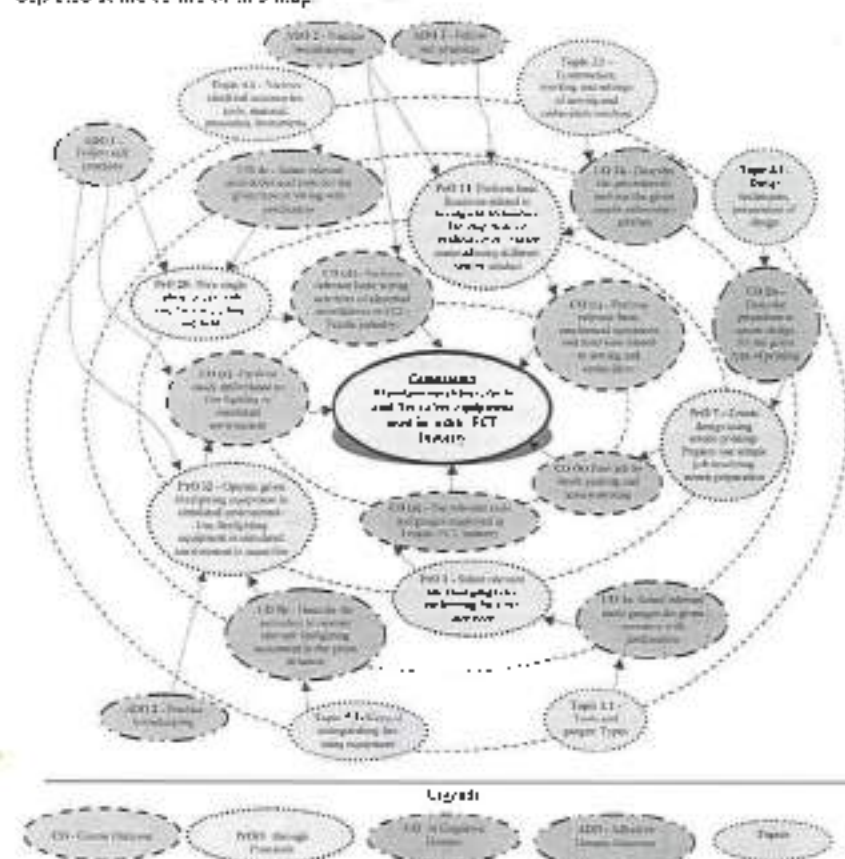


Figure 1: Course Map

6. SUGGESTED PRACTICALS/EXERCISES

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

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



S. No.	Practical Outcomes (POs)	Unit No.	Approx. Hrs. required
1	Maintenance tools, like cut buffing, eccentricity meter, tachometer, stripping machine, carding gauges, pressure gauge, torque spanners, Allen keys, tailors tape, V scale, thermometer - Part I		
2	Select relevant tools and gauges for performing one simple activities involving applications of working of different maintenance tools like cut buffing, eccentricity meter, tachometer, stripping machine, carding gauges, pressure gauge, torque spanners, Allen keys, tailors tape, V 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 cut buffing, eccentricity meter, tachometer, stripping machine, carding gauges, pressure gauge, torque spanners, Allen keys, tailors tape, V 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 cut buffing, eccentricity meter, tachometer, stripping machine, carding gauges, pressure gauge, torque spanners, Allen keys, tailors tape, V 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 cut buffing, eccentricity meter, tachometer, stripping machine, carding gauges, pressure gauge, torque spanners, Allen keys, tailors tape, V 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 cut buffing, eccentricity meter, tachometer, stripping machine, carding gauges, pressure gauge, torque spanners, Allen keys, tailors tape, V 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 feet.	III	02
13	Perform basic functions related to sewing and embroidery: Segregate different fibres, 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 (POs)	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	IV	02*
20	Perform basic mechanical operations related to machines and accessories. Prepare a chain drive machine	IV	02
21	Perform basic mechanical operations related to machines and accessories. Assemble fit simple parts, spare parts, accessories mechanisms of simple F&T related machine in workshop	IV	02
22	Perform basic mechanical operations related to machines and accessories. Assemble fit simple parts, spare parts, accessories mechanisms of simple F&T related machine in workshop	IV	02
23	Perform basic mechanical operations related to machines and accessories. Segregation of different types of Material handling equipment in F&T 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 SA 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 MCCB 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 F&T/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 cause fire. (Group activity)	V	02
Total			64

Note

- 4.4 Suggestive list of POs is given in the above table. After each PO, it can be added to given the COs and competencies. List of max. of maximum 24 or more points need to be performed out of which the students mentioned in 4.3 are compulsory to fulfil the degree holder the program level of Degree. Programme Faculty/Institute as provided required to be include.
- 4.5 The process and Product related data and status with each PO it to be discussed according to a suggested sample given below.

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Set up 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 POs also comprise of the following social skills/competencies which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experience.

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

The ADOs are not specific to any one PO, but are embedded in many POs. Hence, the acquisition of the ADOs takes place gradually as the student works/she undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Northwood's Affective "Domain Taxonomy" should gradually increase as planned below.

- Value Level in 1st year
- Improving Level in 2nd year
- Charactering Level in 3rd year

7. MAJOR EQUIPMENT/INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will assist in uniformity in production POs, as well as to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Exp. No.
1	Different automobile tools such as oil bottling, eccentricity meter, tachometer, stripping machine, landing gauges, pressure gauge, torque spanners, Allen keys, tailors tape, scale, thermometer etc.	1 to 5
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 switching 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/sub-topics are to be taught and assessed in order to develop JCK for achieving the COs or attain the identified competence.

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: Print up 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) (for 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 resources 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, 5.5 practice of good housekeeping in workplace 5.6 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 at minimum the Application Level and above of Bloom's Cognitive Domain Category.

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 expedite the attainment of the various outcomes in this course:

- Prepare presentation displaying various tools and accessories and their specifications.

- Prepare charts on types of Lax and related line using graphing tools for display at institute.
- Prepare presentation on different types of blues, used in printing.
- Arranging Competence exhibitions for creating jobs in identification 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.

- Make open online course (MOOCs) may be used to teach various topics/sub-topics.
- LE in item Aa-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 important 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 5a(iii), teachers need to ensure to create opportunities and provision for co-curricular activities.
- Guide students in undertaking micro-projects.
- Arrange visit to nearby industry/workshop/Boutique and preparing reports on 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 at the beginning of the semester. She is 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 1 to 6 and A to C. The micro-project can be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of and visual contribution to the project work and give a seminar presentation at the end submission. The total duration of the micro-project should not be less than 15 (fifteen) 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 she contributes to the progress 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, slapping machine, curing gauges and pressure gauges and list as alluded in the text book.
- 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: women's wear, 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.

1. Wiring of electrical installation: Prepare a catalogue of different types of electrical accessories and machines used in electrical industry, such as switches, lights, fuses, MCBs, MCCBs, motor starters, multimeter and energy meters.
2. 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	Reghuvaran D.S.	Dhanraj Rao Sons, New Delhi, 2011. ISBN: 999017103
2	Electrical Wiring - Estimating and Costing	Uppal, S. I.	Kharana Publishers, New Delhi, ISBN: 9788174397403
3	Elements of Workshop Technology	Choudhary, Hajra S.K.; Choudhary, Hajra, A.S., Kalyanpur	Media Promoters and Publishers Mumbai, 2009. ISBN: 8185099146
4	A Textbook of Manufacturing Process (Workshop Tech.)	Gupta, J.K., Khanna R.S.	S. Chand and Co. New Delhi, 2016-17. ISBN: 9788121920925
5	Electrical Workshop: Safety, Commissioning, Maintenance and Testing of Electrical Equipment	Singh, B.P.	I.K. International Publishing House Pvt. Ltd. New Delhi, 2012. ISBN: 9789381141205
6	The Complete Technology Book on Waste Processing With Effluent Treatment	NIE Board	NIE Board, ISBN: 8176390594

14. SOFTWARE/LEARNING WEBSITES

1. <http://www.resource.org/pub/in/bis5/bis57021989.pdf>
2. www.sawingpointonline.com
3. Machine manufacturers websites





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 : Second

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	Applied Mathematics	AMS	22201	3	1	-	4	3	70	28	30*	00	100	40	--	--	--	--	--	--	140	
2	Applied Science	Physics Chemistry	ASM	22202	2	-	4	8	90 Min	70**	28	15*	00	100	40	25§	10	25	10	50	20	200
	2				-	15*					00	25§	10			25	10	50	20			
3	Applied Mechanics	AME	22203	3	1	2	6	4	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	BSI	22205	3	-	4	7	3	70	28	30*	00	100	40	50*	20	50	20	100	10	240	
6	Civil Engineering Workshop and Practice	CEW	22208	-	-	4	4	--	--	--	--	--	--	--	50*	20	50*	20	100	40	100	
7	Business Communication Using Computers	BCC	22209	-	-	2	2	--	--	--	--	--	--	--	35§	14	35	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.



Program Name : Civil Engineering Program Group
 Program Code : CCEC-R3-2
 Semester : Second
 Course Title : Applied Mathematics
 Course Code : 222107

1. RATIONALE

This course is an extension of Basic Mathematics of first semester namely Applied Mathematics which is designed for its application in engineering and technology using the techniques of calculus, differentiation, integration, differential equations and in particular numerical integration. Derivatives are useful to find slope of the curve, maximum and a minimum of the function, rate of curvature, but, at the same time, helps in finding the area. Differential equations are used in finding the curve and its related applications for various engineering models. Numerical integration is used to find the area of the function's equation when integration cannot be evaluated easily with putting in the definite limits. 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 attain the following industry identified competencies through various teaching learning experiences:

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

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant 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 competencies:

- Calculate the gradient, tangent, normal, radius of curvature by differentiation.
- Solve the given problems of maximization using suitable methods.
- Apply the concept of integration to find area and volume.
- Solve the differential equations of first order and first degree using suitable methods.
- Apply the concept of numerical integration to integrate the area.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme				Examination Scheme											
C	T	P	Credit L+T+P	Theory						Practical					
				Paper Rev.	ESE		PA		Total	ESE		PA		Total	
					Max	Min	Max	Min		Max	Min	Max	Min	Max	Min
5	1	—	4	7	75	25	50	25	100	40	—	—	—	40	—

(*) Under the theory, PA, Practical Work is to be done for every project assignment to integrate the use of COs and the remaining 20 marks of the average of 2 years to be taken during the semester for the assessment of the regular assessment. The required term is mentioned in the COs.

Legend: L+T+P = Theory, T = Theory, P = Practical, C = Credit
 ESE = End Semester Examination, PA = Progress Assessment

5. COURSE MAP with sample COs, Learning Outcomes and LOs and topics

This course map displays the coverage of the COs and the stages of the topics at various levels of attainment. Details in subsequent sections to be attained by the student by the end of the duration of learning in terms of the industry employer identified competencies depicted at the centre of this map.

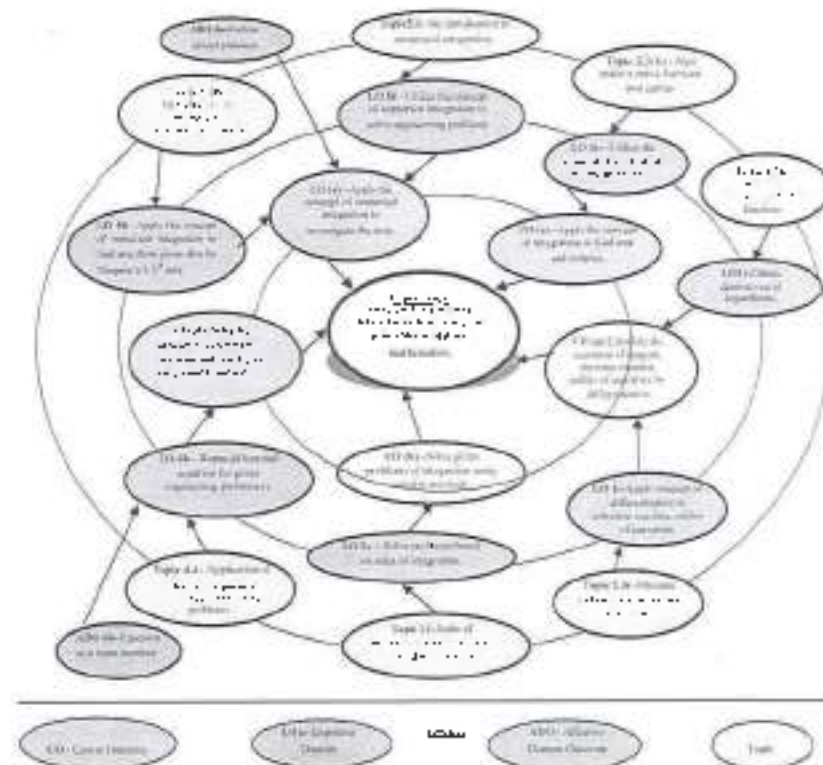


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The materials in this section are LOs or cross-components of the COs to be developed and assessed by the student to facilitate 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	I
2	Solve problems based on derivatives of function function and parametric function	I	I
3	Solve problems to find derivative of log-function and exponential function	I	I
4	Solve problems based on finding equation of tangent and normal	I	I
5	Sub-problems based on finding maximum, minima of function and radius of curvature at a given point	I	I
6	Solve the problems based on standard formula of integration	I	I
7	Solve problems based on methods of integration: substitution, partial fractions	II	I
8	Solve problems based on integration by parts	II	I
9	Solve practice problems based on properties of definite integration	II	I
10	Solve practice problems based on finding area under curve, area between two curves and volume of revolution	III	I
11	Solve the problems based on formation, order and degree of differential equations	V	I
12	Develop a model using variable separable method to related engineering problem	V	I
13	Develop a model using the concept of linear differential equations to related engineering problem	V	I
14	Solve problems based on Trapezoidal rule	V	I
15	Solve problems based on Simpson's 1/3 rule, Simpson's 3/8 rule	V	I
16	Make use of concept of numerical integration to solve related civil engineering problems	V	I
Total			18

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/sub-topics should be taught and assessed in order to develop UUs in cognitive domain for achieving the CLOs to attain the identified competency.

Unit	Major Cognitive Domain Learning Outcomes	Topics and Sub-topics
Unit-I Differential Calculus	a) Solve the given simple problems based on functions. b) 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
	a) Obtain the derivatives of logarithmic, exponential functions. b) Apply the concept of differentiation to find equations of tangent and normal. c) 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) Derivatives 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 problems based on rules of integration. 2b) Obtain the given simple integrals using substitution method. 2c) Integrate given simple functions using the integration by parts. 2d) Calculate the given simple integral by partial fractions.	2. Simple Integrative: 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) Make use of 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 Definite integration: a) Area under the curve. b) Area between two curves. c) Volume of revolution.
Unit-IV First Order First Degree Differential Equations	4.1 Find the order and degree of given differential equations. 4.2 Form simple differential equations for given simple engineering problems. 4.3 Solve given differential equations using the method of variable separation. 4.4 Solve given engineering problems	4.1 Concept of differential equation 4.2 Order, degree and formation of differential equation. 4.3 Solution of differential equation: a) Variable separation. b) Linear differential equation. 4.4 Applications of differential equation and related engineering problems.



Unit	Major Cognitive Domain Learning Outcomes	Topics and Sub-topics
	based on linear differential equations.	
Unit-V Numerical Integration	7a. Apply the concept of numerical integration to find area from given data by Trapezoidal rule. 7b. Apply the concept of numerical integration to find area from given data by Simpson's $1/3^{rd}$ rule. 7c. Apply the concept of numerical integration to find area from given data by Simpson's $3/8^{th}$ rule. 7d. Utilize the concept of numerical integration to solve related engineering problems.	5. Area under simple line and area under integration. a. Trapezoidal rule. b. Simpson's $1/3^{rd}$ rule. c. Simpson's $3/8^{th}$ rule.

Note: To attain the COs and competence, above listed Learning Outcomes (LOs) need to be addressed to achieve the 'Apprehend' level of Bloom's Cognitive Domain Learning.

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	04	12	24
II	Integral calculus	12	05	04	08	18
III	Applications of Double's Integration	08	02	02	04	08
IV	First Order-First Degree Differential Equations	06	02	02	04	08
V	Numerical integration	06	00	03	03	06
Total		46	12	25	28	65

Legend: 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 enable us to teach and assess student work related to attainment of LOs. The actual distribution of marks in different questions 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 situations and solve with the use of the formula available on the internet.
- Use graphical software like EXCEL, MS-PPT and GRAPH for related topics.
- Use Mathcad as Mathematical tools and solve the problem of choice.
- Identify problems based on applications of differential equations and solve these problems.

- Prepare models to explain different concepts of applied mathematics.
- Prepare a simulation activity to estimate input 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.

- Positive open online courses (MOOCs) may be used to teach various topics and topics.
- Utilize the various 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 simple in description in nature is to be given to the students for self-directed learning and assess the development of the COs/LOs through classroom presentations and implementation guidelines for details.
- With respect to open assessment, teachers need to ensure to create opportunities and provision for assessment activities.
- Guide students in undertaking micro-projects.

11. SUGGESTED MICRO PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to a unit in the beginning of the semester. The student 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 line with integration of practice's, cognitive domain and affective domain COs. 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 she contributes in 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, wheel 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 the concept of integration.
- Prepare models using the concept of differential equations for mixing problem.
- Prepare models using the concept of differential equations for radioactive 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	Crowal, B.S	Khanna publications, New Delhi, 2012 ISBN- 8174991955
2	A Text Book of Engineering Mathematics	Datta, D.	New Age International Publications, New Delhi, 2006. ISBN- 978-81-224-1689-3
3	Advanced Engineering Mathematics	Stoer, Ervin	Wiley Publications, New Delhi, 2016 ISBN-978-81-265-5422-2
4	Advanced Engineering Mathematics	Jas. H.K	S. Chand Publications, New Delhi, 2008. ISBN- 9788121913444
5	Engineering Mathematics Volume I (4 th edition)	Singh, S.S	PHI Learning, New Delhi, 2014 ISBN-978-81-203-3616-2.
6	Comprehensive Basic Mathematics, Volume 2	Verma, G.R.	New Age International Publications, New Delhi, 2005 ISBN:978-81-224-1684-6
7	Getting Started with MATLAB-7	Pratap, Rudra	Oxford University Press, New Delhi, 2009 ISBN- 0199731291
8	Engineering Mathematics (3 rd edition)	Erwin. Antonius	Pearson Education, New Delhi, 2010 ISBN- 978-81-317-2605-1

13. SOFTWARE LEARNING WEBSITES

- www.solidworks.com - SOLID Lab
- www.mathworks.com/products/matlab/ - MATLAB
- Spreadsheet applications
- www.dplot.com/ - DPlot
- www.1mthcad.com/ - MathCAD
- www.math.union.edu/mathematica/ - Mathematica
- <http://flossie.in/>
- <http://www.khanacademy.org/math?gid=CCNqHusBfvs4CFJOJawandaHoP-g>
- www.easycalculation.com
- www.math-magic.com



Program Name : Mechanical and Civil Engineering Programs Group
 Program Code : ME/CIVIL/ENGINEERING
 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 electricity, magnetism, surface tension, motion, thermodynamics, 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 principles and methods which will be economical and eco-friendly.

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 using principles of advanced physics and chemistry.

3. COURSE OUTCOMES (COs)

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

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

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme	L	T	P	Credit (L+T+P)	Examination Scheme											
					Theory						Practical					
					Upper Max.	ESE	PA	Expt	ESE	PA	Expt	Upper Max.	ESE	PA	Expt	Total
1	1	1	1	3	20	10	10	10	10	10	10	20	10	10	10	50
2	1	1	1	3	20	10	10	10	10	10	10	20	10	10	10	50

Expt Under the theory P.T. Out of 10 marks. 10 marks are for the conceptual assessment. 15 marks are for the practical & theory. The balance integration of COs are the remaining 25 marks. The average of 2 tests is to be taken during the semester for the assessment of the cognitive domain. COs required for the assessment of the COs.

Legend: L= Lecture, T= Tutorial, P= Practical, C= Credit
 ESE= End Semester Examination, PA= Progress Assessment

Note: Chemical & Chemistry and Physics will be assessed in alternate years for each session.

5. COURSE MAP with sample COs, POs, AQs and Jokers

This course map illustrates an overview of the flow and bridge 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 P.T.Os (Practical Outcomes) of the COs to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (P.Os)	Unit No.	APPROX. Hrs. Required
1	Use Searle's method to determine the Young's modulus of given	1	5.0

S. No.	Practical Outcomes (POs)	Unit No.	Approx. Hrs. Required
1	None		
2	Apply Archimedes' principle to determine the buoyant force in 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 down and force along inclined plane, acting on a roller due to gravity and its relationship with the angle of inclination	I	02
5	Find the range of the projectile from the initial 'launch' speed and angle	II	02* </td
6	a) Find the dependence of the stopping potential on the frequency of light source in photoelectric effect experiment. b) Find the dependence of the stopping potential on the intensity of light source in photoelectric effect experiment.	II	02
7	Determine the I-V characteristic of photoelectric cell and LDR	III	02* </td
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* </td
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* </td
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 gravimetric analysis	VI	02* </td
15	Determine the calorific value of given solid fuel using Bomb calorimeter	VI	02* </td
16	Determine the percentage of Sulphur in given coal sample by ultraviolet analysis (colorimetric analysis)	VI	02
Total			02

Note:

- A suggested list of POs is given in the above table. More such POs can be added to attain the desired competence. A detailed list of minimum list of major practical need to be performed out of which the following is marked as * are compulsory so that the student attains the 'Proficiency Level' of *Course & Department Domain Taxonomy* as generally required by the industry.
- The 'Process' and 'Product' related skills associated with each PO is to be assessed according to a suggested sample given below.

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	25
2	Setting and operation	25



S. No.	Performance Indicators	Weightage in %
1	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 on time	10
Total		100

The above POs also comprise of the following set of skills/attitudes, which are Affected 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 PO, but are embedded in many POs. Hence, the acquisition of the ADO takes place gradually in the student when s/he completes a series of practical experiences over a period of time. Moreover, the level of achievement at the ADOs according to Knutholt'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 appear in uniformity in conduct of experiments, as well as aid in procure equipment by administrations.

S. No.	Equipment Name with Broad Specifications	Exp. No.
1	Scale (suggested) with slotted mass (0.5 kg each)	1
2	Liquid container	2
3	Solid body (cylinder) size and material	3,4
4	Stoke's apparatus (glass tube, viscous liquid, spherical balls of varying sizes)	5
5	Stop watch	2,5
6	Plastic trolley	4
7	Roller	4
8	Photoelectric detector	6
9	Photoelectric effect apparatus	6
10	Experimental setup for characteristics of photoelectric cell	7
11	Experimental setup for characteristics of LDR	7
12	Laser Source (HeNe, diode laser)	8
13	Electronic balance with the scale range of 100 g and 100g pan and 100nm response time 2-5 sec., power requirement 90-250 V, 10 watt.	9
14	Electric oven (inner size 18" x 8" x 15" temperature range 10 to 250 °C with the capacity of 40 lb)	14, 15
15	Bomb calorimeter	15

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		4.11 Refractory materials: Types, properties
Unit-V Water Treatment	5a. Describe the given tests/analyses related to hard water and their effects. 5b. Describe the given process for softening of the given water sample. 5c. Draw by hand sketches the purification of the given type of water. 5d. Describe the given type of waste water treatment.	5.1 Hardness: Classification 5.2 Hard water in boilers and prevention, Hardness removal: chemical method: precipitation and softening: zeolites and sludge. 5.3 Water softening: lime-soda process: hot lime soda and cold lime soda process, zeolite process, ion exchange process: calcium exchange and anion exchanger. 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 Fuel and Combustion	6a. Describe salient properties of the given type of fuel. 6b. Explain the given type of analysis of the given type of fuel. 6c. Calculate the calorific value of the given solid fuel using Bomb calorimeter. 6d. Describe composition, properties of given gaseous fuel with their applications. 6e. Calculate the mass and volume of air required for complete combustion of the given fuel.	6.1 Fuel: Calorific value and ignition temperature: classification. 6.2 Solid fuels: Coal: Classification and composition, proximate analysis, Ultimate analysis: Bomb calorimeter: Carbonization of coke by Otto Hoffmann's oven. 6.3 Liquid fuels: Fractional distillation of crude petroleum, boiling range, composition: properties: Knocking, cracking, octane number and cetane number. 6.4 Gaseous fuels: Biogas, LPG and CNG: Combustion equation of gaseous fuels, mass and volume of air required for complete combustion.

Note: (a) among the COs and competencies, above listed UOs need to be undertaken to achieve the: *Apprenticeship Level* and *grades of Bloom's Cognitive Domain* Examinations.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Hours Marks			
			R Level	T Level	A Level	Total Marks
	Physics					
I	Properties of matter and NDT	14	03	05	06	14
II	Types of Motion	04	02	02	06	16
III	Photoelectricity, X-Ray and LASER	09	03	02	04	11
	Chemistry					



Unit No.	Unit Title	Teaching Hours	Distribution of Hours Marks			
			R Level	T Level	A Level	Total Marks
IV	Metals, alloys, cement, refractories, refractories	12	03	04	05	12
V	Water treatment	04	02	03	06	11
VI	Fuels and combustion	10	03	04	03	12
	Total	61	15	22	31	70

Legend: R=Remember, T=Understand, A=Apply and above letters A=Assess, Evaluate, Create.

Note: (a) one should follow the given general guidelines to assist student to show learning and to teachers to mark and assess students with respect to attainment of COs. The general distribution of marks in different categories, levels (R, T, A) and in the question paper can vary from year to year.

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 competencies in this course.

- Seminar on any relevant topic.
- Library safety research engineering material used in different industries.
- Prepare power point presentation on application 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 learn various important topics.
- 21 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.
- At least 15-20% of the topics and topics which are 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 in undertaking mini-projects.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to another in the beginning of the semester. Since might be submitted 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 POs, UOs and AOs. 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 later semesters it should be individually undertaken to build up the skill and confidence in every

student to become problem solver so that she contributes to the progress of the industry. A suggested list is given here. Similar and equivalent could be added by the concerned faculty.

- Elasticity:** Prepare working model to demonstrate the stress – strain behavior of different wires of different thickness and material.
- Viscosity:** Collect 2 to 5 liquids and prepare a working model to differentiate liquids on the basis of viscosity and demonstrate their applications.
- Motion:** Prepare model of ball rolling down on inclined plane to demonstrate the conservation of energy and motion of an object on inclined plane.
- Photo Sensors:** Prepare simple photo sensor using LDR.
- Properties of Laser:** Use Key chain laser to differentiate laser with ordinary light.
- Water analysis:** Collect water samples from different water sources and find the characteristics like resistivity, conductivity, dissolved solids, suspended particles.
- Water treatment:** Collect 2 to 5 water samples to find the dosage of bleaching powder required for its sterilization.
- Water analysis:** Prepare model to find the soap lathering capacity of bore water on addition of soda ash.
- Fuels:** Prepare chart showing different types of liquid fuels showing their caloric values and uses.
- Cement:** Collect different samples of cement and find their initial and final setting time.
- Refractory materials:** Prepare chart showing properties of refractory materials.
- Metal properties:** Prepare chart showing different industrial application of metal and relate each required property to properties using material.
- Alloy steel:** Find the effect of alloying elements like Mn, Cr, Ni, W, V, Cu 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 II - Class XI	Narinder, L.V., Jishi, A. W., Mathur, Anuradha, et al	National Council of Education Research and Training, New Delhi, 2010, ISBN: 8174505383
2	Physics Textbook Part I and part II - Class XII	Narinder, L.V., Jishi, A. W., Ghatak A. K. et al	National Council of Education Research and Training, New Delhi, 2013, ISBN: 8174505314
3	Engineering Physics	Dhawan, D. K., London Pearson	Oxford Publishing, New Delhi, ISBN 9199452814
4	Principles of Engineering Physics - I	Md. Nazim Khan and Simanchale Panigrahi	Cambridge university press, New Delhi, 2016, ISBN: 9781316655647
5	Engineering Physics	Palan priya, P. K.	SCITECH Publications, Chennai ISBN: 9785183311012
6	Principles of Physics	Walker, J., Halliday, D., Resnick, R.	Wiley Publications, New Delhi, 10 th edition ISBN: 9788126552566
7	Textbook of Engineering Physics	Avadhani, M. N., Kulkarni, P. G.	S. Chand and Co., New Delhi, 2015 ISBN: 9788121608177
8	Engineering Chemistry	Agarwal, Sankar	Cambridge university press, New Delhi, 2015 ISBN: 9781107429417

S. No.	Title of Book	Author	Publication
9	Engineering Chemistry	Datta, S. S., Umare S.S.	S. Chand and Co., Publishing, New Delhi, 2011, ISBN: 8121597558
10	Engineering Chemistry	Jain & Jain	Changai Rai and sons, New Delhi 2014, ISBN: 9352161002
11	Engineering Chemistry	Varma, S.	Wiley India Pvt. Ltd, New Delhi 2013, ISBN: 9788126553547
12	Chemistry for Engineers	Agarwal, Rajesh	Wiley India Pvt. Ltd, New Delhi, 2014, ISBN: 9788126550784

14. SOFTWARE/LEARNING WEBSITES

- <http://nptel.ac.in/course.php?discipline=115>
- <http://nptel.ac.in/course.php?discipline=114>
- <http://physics.phys.tor.gsu.edu/hbase/hph.html>
- www.phys.tor.gsu.edu/~tor
- www.fearofphysics.com
- www.science.wyagan.com/physics.htm
- www.scholarhowto.com/works
- <https://phet.colorado.edu/>
- www.chemistryteaching.com
- www.chemlearning.com
- www.chem1.com
- www.onlinelibrary.wiley.com
- www.rsc.org
- www.chemcollective.org
- www.wpi.org
- www.cm-az.org



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

Program Code : AECCEC/MEFG/MEPT/ENG

Semester : Second

Course Title : Applied Mechanics

Course Code : 22205

1. RATIONALE

In day-to-day, various types of structures created for different purposes and functions. While designing the structures, analysis of forces and stresses is an important and previous to step. Correct analysis is possible only when one knows the type and effects of forces acting on the structures. This course provides the scope for understanding, functioning, advantages or disadvantages 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 aid in analysing different structural systems.

2. COMPETENCY

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

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

3. COURSE OBJECTIVES

The theory, practical experiences and reasoning 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 mechanisms for given purposes.
- Determine the static functions of different engineering systems.
- Check the stability of various force systems.
- Apply the principles of motion 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	Cred. (L+T+P)	Examination Scheme									
		Theory					Practical				
		Paper Max.	LSE Max/Min	PA Max/Min	Total Max/Min	ESE Max/Min	PA Max/Min	Total Max/Min	ESE Max/Min	PA Max/Min	Total
1	1	1	1	1	1	1	1	1	1	1	1

(Note: Under the theory PA, Out of 20 marks, 10 marks are for unpractised assessment of practical application of COs and the remaining 10 marks is the average of 2 tests to be taken during the semester for the attainment of the engineer domain COs required for the attainment of the COs)

Legend: L= Lecture, T= Tutorial, LSE= Level of Learning Experience, P= Practical, CO= Course, ESE= End Semester Examination, PA= Progressive Assessment.

5. COURSE MAP with sample COs, TrOs, LOs, AOs and Topical

This contains all situations in overview of the flow and linkages of the topics at various levels of outcomes detail in subsequent sections to be achieved by the student by the end of the semester in all domains of learning in terms of the industry employer identified competencies depicted in the centre of this map.

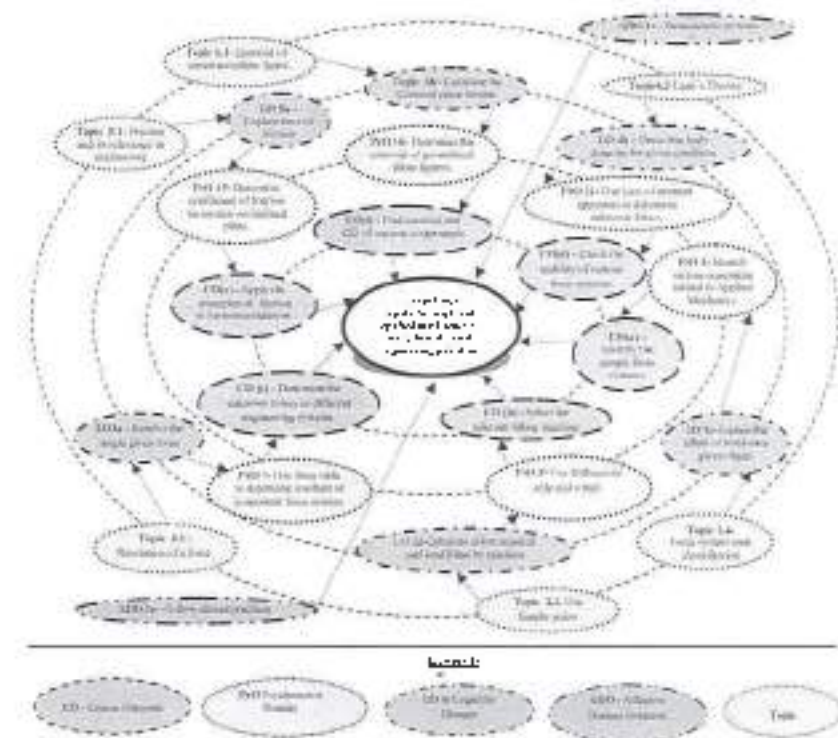


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

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

S. No.	Practical Outcomes (P-COs)	Est. No.	Approx. Hrs. required
1	Identify various equipment related to Applied Mechanics.	10	01
2	Find the centroid and centre of gravity.	11	02

S. No.	Practical Outcomes (POs)	Unit No.	Apprais. Hrs. required
1	Use Single screw jack	II	01
2	Use worm and worm wheel	II	02
3	Use single or double purchase winch	II	02
4	Use Weston's Differential in worm gear <u>geared pulley block</u>	II	02
5	Use force table to determine resultant of concurrent force system applying Law of Polygon of forces. (Part-I)	III	02*
6	Use force table to determine resultant of concurrent force system applying Law of Polygon of forces. (Part-II)	III	02*
7	Graphically determine resultant of concurrent force system	III	02
8	Graphically determine resultant of parallel force system	III	02
9	Use Law of moment apparatus to determine unknown forces	IV	02*
10	Apply Lami's Theorem to determine unknown force	IV	02
11	Determine support reactions for simple supported beam	IV	02
12	Determine coefficient of friction for motion on horizontal plane	V	02*
13	Determine coefficient of friction for motion on inclined plane	V	02
14	Determine centroid of geometrical plane figures	VI	02
Total			32

Note

- A suggested list of POs is given in the above table. More such POs can be added to attain the C.O and competency. A minimum maximum 12 or more practical need to be performed out of which the practicals marked as * are compulsory so that the student reaches the 'Proficiency Level' of Level 1 'Psychomotor Domain Taxonomy' as specified required by the industry.
- The 'Process' and 'Product' related skills associated with each PO 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 POs also comprise of the following social desiderata 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's team member
- Maintain tools and equipment
- Follow ethical practices



The ADOs are pre specified to any one PO. They are embedded in many POs. 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:

- 'Knowing Level' in 1st year
- 'Organizing Level' in 2nd year
- 'Characterizing Level' in 3rd year

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specifications mentioned here will assist in the formulation of 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 50 cm diameter and axles are made of 25 mm and 10 mm reducing diameter)	1
2	Single screw jack (Table mounted metal body, screws 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, loose drum effort wheel, with necessary started weights, hanger and threads)	4
4	Single Purchase GCB winch (Table mounted heavy cast iron body. The effort wheel is of CI 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 GCB winch (having assembly same as above but with double set of gearing arrangement)	6
6	Weston's Differential pulley block (consisting of two pulleys, one bigger and other smaller)	7
7	Weston's Differential worm geared pulley block (Consists of a metallic (preferably steel) cogged wheel of about 20 cm diameter with a protruded ball drum of 10 cm dia to support the weights of 10 kg, 20 kg, 25 weights and a 50 kg weights)	8
8	Universal Force Table (Consists of a circular 40 cm dia. Aluminium plate graduated in 360 degrees) with all accessories	9, 10
9	Law of moments apparatus (consisting of a stainless steel graduated beam 12.5 cm square in section, 1m long, pivoted at centre)	11
10	Beam Reaction apparatus (The apparatus is with two circular disc type 10 kg)	12
11	Friction apparatus for motion along horizontal and inclined plane (base in which a sector with graduations are 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, 20 gm, 50 gm, 100 gm weights)	13
12	Models of geometrical figures	14

8. UNDERPINNING THEORY COMPONENTS

The following topics/examples should be taught and assessed in order to develop UCs in cognitive domain for achieving the CUs in attain the defined competency.

Unit	Unit Outcomes (UOs) in cognitive domain	Topics and Sub-topics
Unit – I Mechanics and force systems	1a. Explain concepts of the given terms. 1b. Use the relations of units of various quantities in the given situation. 1c. Explain effect of a force on the given object. 1d. Identify the force system for the given situation.	1.1 Sign, sense and reference. 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 its flow's rotation, characteristics and effects of a force. Principles 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 % of the given simple lifting machine. 2d. Calculate effort required and load lifted by the given simple lifting machine. Interpret the graphs after drawing them with the given data. 2e. 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 machines. 2.2 Ideal machine, friction in machine, mechanical advantage and efficiency, reversible and non-reversible machines, condition for reversibility. 2.3 Velocity ratios in simple axle and wheel, Differential axle and wheel, Worm and gear wheel, Single purchase and double purchase crab winch, Simple screw jack, Weston's differential pulley block, geared pulley block. 2.4 Graphs of Load versus Effort, Load versus Effort lost in friction, Load versus MA, Load versus Efficiency.
Unit – III Resolution and composition	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 – Resolution, 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 Graphical statics, polygons, representation

Unit	Unit Outcomes (UOs) in cognitive domain	Topics and Sub-topics
	law of triangle and law of parallelogram.	of three, Space diagram, force diagram, polar diagram and Lami's polygon, Graphical method of determination of resultant for concurrent and parallel co-planar force systems.
Unit – IV Equilibrium	4a. Draw the free body diagram for the given condition. 4b. Determine reaction forces 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 Equilibrium 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 (point load, beam (vertical and inclined point load), U.D 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 U.D 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 given 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, coefficient of friction, angle of friction, angle of repose, relation between coefficient 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 and/or. 5.4 E.R.R 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 figures. 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 of the various forms, 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 objectives listed COs need to be undertaken to achieve the Appt action 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	C Level	A Level	Total Marks
I	Mechanics and Force System	04	02	02	02	06
II	Simple Lifting Machines	05	02	04	06	12
III	Resolution and Composition	04	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		49	12	18	40	70

Legend: R-Remember, C-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 COs. The approximate distribution of marks in different taxonomy levels of R, C, 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 of 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 where a 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)

There 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.
- Use of 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 complex 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, case implementation and/or for debate.
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for co-curricular activities.
- Give students 25% in undertaking mini-projects.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to Engineer in the beginning of the semester. She/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 may in fact an integration of PdCs, UOs and AOs. 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 those machines with the machines being studied and prepare models of simple lifting machines using joints of MECHANISMS and MECHANICS.
- Types of supports:** 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 beams.
- 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	Publisher
1	Applied Mechanics	Khanna, R.S.	S Chand & Co. New Delhi 2014 ISBN: 9788121916437
2	Engineering Mechanics	Ramamurtham, S.	S Chand & Co. New Delhi 2005 ISBN: 9788187433514
3	Formulations and Applications of Applied Mechanics	Ram, H. D., Chouhan, A. K.	Cambridge University Press, Thomson Press India Ltd., New Delhi, 2015 ISBN: 9781107466236
4	Engineering Mechanics-Statics Vol. I	Meriam, J. J. Kraige, L.G.	Wiley Publication, New Delhi ISBN: 978-81-265-4396

14. SOFTWARE/LEARNING WEBSITES

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



Program Name	: Civil Engineering Program Group
Program Code	: C E C R C S
Semester	: Second
Course Title	: Construction Materials
Course Code	: 22204

L. K. KUMAR AND E.

Concrete is a new material is the key element in the construction project. A diploma civil engineer, also called technologist, has to competently deal with selection of materials for various engineering project of constructions such as residential, commercial buildings, roads, metro railways, bridges, dams, tunnels, and flyovers. The development of any new technology generates the necessity of new engineering materials. It is a challenging job for the civil engineer to select relevant material which is durable, economical and eco-friendly. New materials are introduced every day in the market. Modern techniques are developed to handle and use materials for economic and safer designs of engineering structures. At diploma level students are expected to study about these aspects so as to develop their understanding, maintenance orientated abilities in order to enable their knowledge in construction industry.

2. COMPETENCY

The goal of this course is to help the student to attain the following industry standards competencies through various teaching/learning experiences:

- Select relevant bulletin material to fulfill construction requirements

3. CORRELATION COEFFICIENTS

the theory, and all experiences and relevant self signals are used with this aim in order to be taught and influenced so that the student acquires the following *industry oriented* CQ, associated with the above mentioned consistency:

- Identify relevant construction materials.
- Identify relevant nature, construction, or process.
- Select relevant initial elements, construction, or process.
- Select relevant specific type or construction materials.
- Select relevant functional objects or elements.
- Identify objects and construction materials.

T. Y. CHUNG, UNDERSTANDING KJROB SCHEMATIC

Test form S ₁ , S ₂ , etc.			Credibility C ₁ , T ₁ P	Examination scheme											
I	P	Theory						Practical							
		Paper			Essay			Task			Total				
hrs.	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
1	10	5	1	15	5	10	15	5	10	10	25	10	5	10	

The following are the data of 25 weeks' forecasts and for which actual is given and the errors are calculated as given by the model in the average of 5 years, with the following error, e_t , $t = 26$, deviation of the expected demand D_t required for the estimation of the D_t .



Legend: L = Lower; T = Target/Treatment/Limiting Upper Oxygen; P = Pressure; K₁ = 0.0001
EOL = End Substrate Consumption; PA = Product or Accumulate.

5. COURSE MAP with sample COs (5%), LOs, AUOs and content

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes details. In subsequent sessions to be furnished by the student by the end of the course, in all domains of learning in terms of the industry, biology, chemical and environmental, is depicted in the centre of this map.

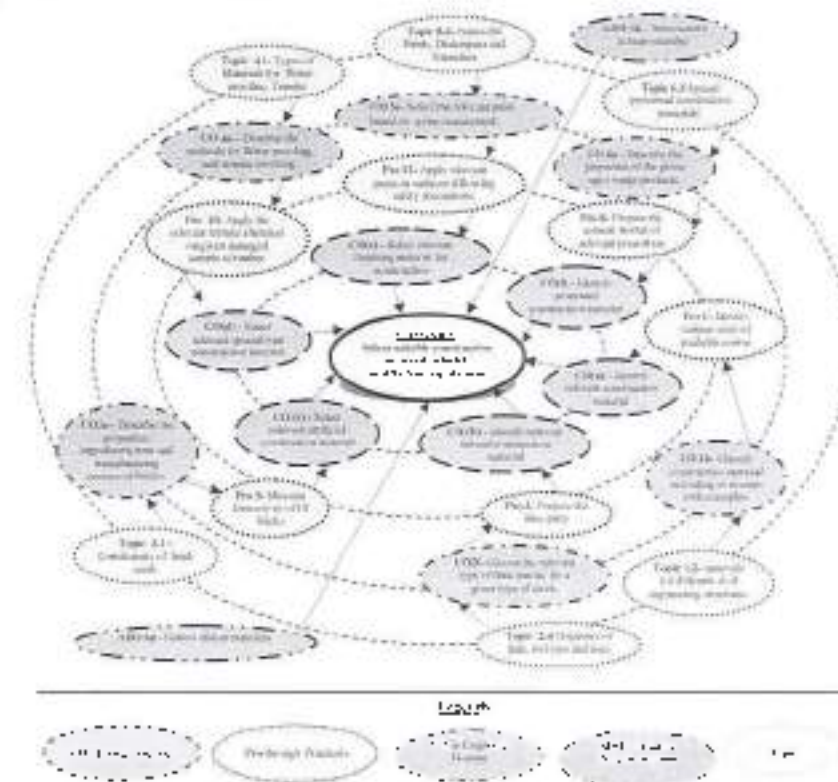


Figure 1 - Concept Map

A. SUCCESSFUL PRACTICALS: EXERCISES

The primary focus is secure, reliable components of the U.S. to be developed and assessed in the student for the attainment of the curriculum.

S. No.	Practical Outcomes (PrO's)	Unit No.	Approx. Hrs. required
1	Identify the various sizes of available cell suspension media suitable of blood in laboratory and prepare serum (80, day 2, 110)	1	02

S. No.	Practical Outcomes (POs)	Unit No.	Approx. Hrs. required
1	Identify the available construction materials in the laboratory on the basis of their sources.	I	02
2	Identify the grain distribution pattern in given sample of teak wood in the laboratory and draw the various patterns (along and perpendicular to the grains).	II	02*
4	Prepare the lime putty by mixing lime (kg) with water in appropriate proportion and prepare report on the setting of lime.	III	02
4	Identify various layers and types of soil in given section pit by visiting at least 3 construction sites in different locations of city and prepare report consisting photographs and samples. Part I	II	02
6	Identify various layers and types of soil in foundation pits by visiting at least 3 construction sites in different locations of city and prepare report consisting photographs and samples. Part I	II	02
7	Select first class, second class and third class bricks from the stock of bricks and prepare report on the basis of its properties.	III	02*
8	Measure dimensions of 10 bricks and find average dimensions and weight. Perform field tests - dropping, striking and scratching by nail and correlate the results obtained.	III	02*
9	Measure dimensions of 10 bricks and find average dimensions and weight. Perform field tests - dropping, striking and scratching by nail and correlate the results obtained.	III	02
10	Identify different types of flooring tiles such as vitrified tiles, ceramic tiles, glazed tiles, mosaic tiles, anti-slip tiles, chippered tiles, paving blocks and prepare report about the specifications. Part I	III	02*
11	Identify different types of flooring tiles such as vitrified tiles, ceramic tiles, glazed tiles, mosaic tiles, anti-slip tiles, chippered tiles, paving blocks and prepare report about the specifications. Part I	III	02
12	Apply the test and identify chemical on given damaged sample of timber. Part I	IV	02*
13	Apply the test and identify chemical on given damaged sample of timber. Part I	IV	02
14	Prepare the finished piece of glass of given dimension from broken and damaged pieces of glass and asbestos using standard cutting and finishing tools with safe practices. Part I	IV	02
15	Prepare the finished piece of glass of given dimension from broken and damaged pieces of glass and asbestos using standard cutting and finishing tools with safe practices. Part II	IV	02
16	Apply two or more coats of selected paint on the prepared base of a given wall surface for the area of 1m x 1m using suitable brush rollers adopting safe practices. Part I	V	02*
17	Apply two or more coats of selected paint on the prepared base of a given wall surface for the area of 1m x 1m using suitable brush rollers adopting safe practices. Part II	V	02

S. No.	Practical Outcomes (POs)	Unit No.	Approx. Hrs. required
18	Apply two or more coats of selected paint on the prepared base of a given wall surface for the area of 1m x 1m using suitable brush rollers adopting safe practices. Part I	V	02
19	Apply two or more coats of selected paint on the prepared base of a given wall surface for the area of 1m x 1m using suitable brush rollers adopting safe practices. Part II	V	02
20	Prepare the cement mortar of proportion 1:3 on 1:6 using artificial sand as a special processed construction material.	VI	02*
21	Prepare mortar using cement and Fly ash in Granite marble polishing waste of the proportion 1:5 or 1:2.	VI	02
Total			12

Note

- The suggested list of POs is given in the above table. More than 1 PO can be added to cover the 1st and 2nd competency. A pattern out of minimum 2 POs were provided. The university need to do performance out of which the percentage should be 70% or more. It is that the student reaches the *Proficient level* of *Domain Performance* (Domain Performance) at present required to be include.
- Hence, the *Process* and *Product* related skills associated with given POs in the laboratory, including performance to be included and including 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	Observations and Recording	10
5	Interpretation of result and conclusion	20
6	Answer to sample questions	10
7	Submission of report on time	10
Total		100

The above POs also comprise of the following sub-points/indicators which are Achieve or Common 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 PO, but are embedded in many POs. 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 pointed below.



- Evaluating 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 must meet with the following in conformity in conduct of experiments, as well as in order to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Exp. No.
1	Weighing Balance	2 to 5
2	Paints tray	2 to 5
3	Steel Tape	5 to 6
4	Saw of different types i.e. Rip saw having 4 to 6 mm pitch, cross cut saw with thin's pitch 3 to 4 mm, panel saw.	7
5	Painting brushes of different size for oil, acrylic painting and rollers of different size for smooth finishing work.	11
6	Manual Glass tinter with diamond tip at end.	13
7	Trowel/Deck, Buttering, Finishing, Floating, ranging in size up to about 11 inches (279.46 mm) long and from 191.6 mm to 203.2 mm wide (i.e. 7 to 8 inches wide).	1, 3, 7 & 12
8	Portable Hammer, Spade, Pans (Clay, Chisel, trowel)	1, 3, 4 & 8, 12
9	Square, trisquare level and straightedge 28.5" mm to 38.10 mm and the middle portion of the top edge from 132.40 mm to 254 mm wide	3, 5, 12
10	Grinders, Portland Cement	8
11	Blocks of standard size 230 mm x 115 mm x 75 mm.	4, 5
12	High speed concrete machine polishing wheel.	12
13	Paints (OBD, acrylic, plastic emulsion)	11
14	Given pieces of Glass	3



8. UNDERPINNING THEORY COMPONENTS

The following topics/sub-topics should be taught and assessed in order to develop LOs or 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 Construction Materials	1a. Describe the civil engineering applications in the given field of civil engineering. 1b. Classify the given construction material according to sources with examples. 1c. Describe the criteria to select the construction materials for the given situation. 1d. Suggest the construction material in the given situation with justification.	1.1 Scope of construction materials in Building Construction, Transportation Engineering, Infrastructure Engineering, Irrigation Engineering (Application only). 1.2 Selection of materials for different civil engineering structures on the basis of strength, durability, local availability and economy. 1.3 Broad classification of material, sources of materials i.e. Natural, Artificial, special finishing and recycled.
Unit – II Natural Construction Materials	2a. Describe the properties and structure of the given natural construction materials. 2b. Explain the given type of defects in timber. 2c. Explain the procedure of preservation of timber in the given situation. 2d. Select the natural construction material for the given situation with justification. 2e. Choose the relevant type of lime similar for the given type of construction work with justification.	2.1 Requirements of good building stone, general characteristics of good quarrying and dressing methods and tools for stone. 2.2 Structure of timber, general properties of good timber, seasoning, preservation and defects in timber and uses, use of timbers in construction. 2.3 Ashlar, hewn and are used in construction, properties of them. 2.4 Properties of lime, its types and uses. 2.5 Types of soil and its suitable for construction. 2.6 Properties of sand and uses. 2.7 Classification of coarse aggregate according to sizes and its uses.
Unit – III Artificial Construction Materials	3a. Describe the properties, ingredients, use and manufacturing process of the given type of brick. 3b. Classify the given artificial construction materials. Classify different artificial construction material. 3c. Select relevant type of artificial	3.1 Constituents of Brick earth: Conventional / Traditional Bricks, Modular and Standard Bricks. Characteristics of good brick. Classification of burnt clay bricks and their sub-types, special bricks. Common field test for Bricks, Manufacturing process of burnt clay brick.

Unit	Unit Outcomes (UOs) (to attain the outcome)	Topics and Sub-topics
	material for the given type of construction work with justification. 3c. Select the type of precast concrete products for the given civil structure with justification. 3e. Select relevant type of ferrous metal for the given type of construction work with justification. 3f. Select relevant type of non-ferrous metal for the given type of construction work with justification.	3.2 Flooring tiles – Types, uses. 3.3 Manufacturing process of Cement and wet-dry flow chart, types of cement and its uses. 3.4 Precast concrete blocks- Insulating concrete blocks, Insulated, and their uses. 3.5 Plywood, particle board, Veneer, laminated board and their uses. 3.6 Types of glass- soda lime glass, lead glass and laminated glass and their uses. 3.7 Ferrous and non-ferrous metals and their uses.
Unit- IV Special Construction Materials	4a. Describe the method used for waterproofing, thermal and sound insulation in the given situation. 4b. Select the relevant material required for the given operations with justification. 4c. Describe the fibres required for the given construction material. 4d. Select features of the given fiber which can be used in construction material with justification. 4e. Describe the features of the given type of geopolymer cement.	4.1 Types of material and suitability in construction works of following materials: Water proofing, Thermal proofing, Thermal and sound insulating materials. 4.2 Fibres – Types – Jute, Glass, Plastic, Aramid, Kevlar and their uses. 4.3 Geopolymer cement – Geo-cement, properties, uses and applications.
Unit- V Finishing Materials	5a. Choose the relevant proportion identified in mixtures for the given type of construction work with justification. 5b. Select the relevant type of PGP board for the given type of work with justification. 5c. Describe the properties of the given type of paint. 5d. Select the relevant type of putty to be used for the given situation with justification. 5e. Choose the relevant type of finishing material for the given situation with justification.	5.1 Lime Mortar, Cement Mortar, Special Mortars and their uses as plastering material. 5.2 Gypsums and uses of POP (Plaster of Paris), PGP (plaster board), uses and uses. 5.3 Paints and Putties, Emulsions and Varnishes with their uses and situations where used.
Unit- VI Processed	6. Describe the properties of the given industrial or agro waste.	6.1 Industrial waste materials- Fly ash, Blast furnace slag, Slag and



Unit	Unit Outcomes (UOs) (to attain the outcome)	Topics and Sub-topics
Construction Materials	products used for the given type of work. 6b. Describe the inherent properties of the given industrial construction material. 6c. Describe the inherent properties of the given agro construction material. 6d. Select the relevant processed construction material for the given situation with justification.	6.1 Industrial waste materials and their uses. 6.2 Agro waste materials - Rice husk, Pigeon, cotton linter, and their uses. 6.3 Spec. in processed construction materials - Geopolymer, Ferrocement, Artificial marble, Aerated sand and their uses.

Note: To attain the UOs and competencies, course listed I. Desired to be undertaken in a, here the department level and above of Degree & Certificate Program (Appropriate).

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			B Level	C Level	A Level	Total Marks
I	Overview of Construction Materials	14	04	04	06	14
II	Natural Construction Materials	12	06	06	04	16
III	Artificial Construction Materials	14	06	06	04	16
IV	Special Construction Materials	36	06	04	04	14
V	Finishing Materials	36	02	04	04	10
VI	Processed Construction Materials	36	02	04	04	10
Total		48	18	32	20	70

Legend: A - Penetration, C - adhesion, D - impact, E - abrasion, F - flex, G - thermal expansion.

Note: This specification table provides general guidelines for question paper design. The number of questions in each unit may vary as per the requirement of the course. The number of questions in each unit may vary as per the requirement of the course.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student activities which can be undertaken to enhance the importance of the various outcomes in this course.

- Conduct a market survey of different construction materials and compare the following points:
 - Structure
 - Properties
 - Applications
- Prepare journals consisting of sketches of construction materials.
- Conduct a market survey from local dealers for procurement of civil engineering material.
- Inspect the various activities related to Construction material at sites of different civil structures.
- Teacher guided self-learning strategies.

- Course library internet based mini-projects.
- Undertake survey of available or institute library regarding construction material used for different purposes and situations.
- Develop Power point presentation or animation for demonstrating laying and using the construction materials.
- Summarise any relevant topic related to construction materials.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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

- Maximise open online courses (MOOCs) may be used to teach various topics sub-topics.
- Utilise *Flipped Classroom* means only the traditional lecture method, not 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 LCOs through classroom presentations (see implementation guideline for detail).
- With respect to given NCERT teachers need to ensure to provide opportunities and provisions for *co-curricular activities*.
- Guide students in understanding and responses.
- Provide concrete materials related for practical exercises.
- Arrange visit to nearby industries and workshops for understanding various construction materials.
- Use video animation films to explain various practices like Manufacturing of construction materials, concrete mixing and base preparation for painting, over-laying, lat-painting work, false ceiling.
- Use different instructional strategies in classroom teaching.
- Demonstrate different samples of various construction materials like Stone aggregate and different sizes, fine sand, natural or synthetic, normal concrete products, Water proofing material, Tensile proofing material, Thermal insulating material, plaster of Paris, paints, d-stumps and cement.
- Display various technical brochures of recent building materials.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is given to the students by a student assigned to him/her in the beginning of the semester. He/She ought to submit by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in real life integration of POs, LOs and AOOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain a detailed work diary consisting of individual contribution in the project work and give a seminar presentation at the end of the semester. The total duration of the micro-project should not be less than 16 (sixteen) student engagement hours during the course.

In the first few semesters, the micro-project could be given-based. However, in higher semesters, it should be individually undergone to build up the skill and confidence in every student to become problem solver so that they contribute to the projects of the industry. A suggestion is given here, some micro-projects could be added by the concerned faculty.

- Collect the market rates for following construction materials from various dealers, prepare of local market for different brands.

- Bricks
- Stone - aggregate (20 mm, 40 mm and 80 mm)
- Less sand
- Flooring tiles
- Ordinary Portland Cement
- Putty
- Colours Paint
- Plaster of Paris
- Plastic paints
- Recent types of paint.
- Download the IS 456 and IS 800 and attach the printout for following materials.
 - Steel section (I-section and IS 4)
 - Mortar of proportion 1:3 and 1:4
 - Cement concrete mix of 1:1.4, 1:3 and 1:4.8
- Collect the technical brochures of following construction materials.
 - Ordinary Portland Cement
 - Vitreous flooring tiles
 - Particle boards used for room partition
 - Paints
- Undertake a market survey for the cost and technical specification of different brands of following construction Materials and prepare comparison chart.
 - Cement
 - Bricks
 - Glass
 - Paints

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publisher
1	Construction Materials	Ghose, D. N.	Lata Mangeshkar Hall, New Delhi-2014 ISBN: 9788171311133
2	Building Materials	Varghese, J. C.	PH Learning, New Delhi, 2014 ISBN: 8120335483
3	Engineering Materials	Bargwala, S. C.	Charotar publisher, Gandhinagar, 2013, ISBN: 9789385130177
4	Civil Engineering Materials	Somayaji, Shan	Person Education, New Delhi-2013 ISBN: 9788131756316
5	Engineering Materials	Rajput, R. K.	S. Chand and Co., New Delhi-2015 ISBN: 8121919500
6	Engineering Materials	Sharma	PH Learning, New Delhi-2015 ISBN: 8120324838
7	Building Materials	Duggal, S. K.	New International, New Delhi, 2014 ISBN: 8131741434

14. SOFTWARE/LEARNING WEBSITES

- <https://www.gipsa.in/whats-new/whats-new/>
- <http://apis-cdr.com.cn/about/blog/20200801-new-generation-high-tech-material/>
- <http://www.abnnews.com/concrete/10827-geopolymer-concrete-a-new-eco-friendly-material-in-construction.html>



Program Name : Civil Engineering Program Group
 Program Code : CEA/CUES
 Semester : Second
 Course Title : Basic Surveying
 Course Code : 22205

1. RATIONALE

Development and planning process for any civil engineering project needs survey of that site to be carried out and various types of survey maps are to be prepared. These maps and drawings are used for taking various decisions regarding the planning, designing, estimation, execution and construction process. The diploma pass out technician should therefore know the various methods and instruments required for surveying. They should also have the skill and attention to handle and operate the needed survey instruments. This course is therefore one of the core courses required for civil, mining, environmental and transportation engineers. Students are advised to master the desired skills which are expected from them for survey related works.

2. COMPETENCY

The aim of this course is to help the student to plan the following cluster of skill competency through various learning experiences:

- Undertake civil engineering surveys.

3. COURSE OUTCOMES (COs)

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

- Identify the type of survey required for given situation.
- Compute area of open field using chain, tape and magnetic T.
- Conduct traversing in the field using chain, tape and compass.
- Use leveling instruments to determine reduced level of ground points.
- Draw, interpret and interpret a plan of an open collecting field data.
- Calculate the planimeter to calculate the areas.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (0-100)	Examination Scheme									
L	T	P		Theory					Practical				
				Paper	ESE			Total	ESE		P&S		Total
					Max	Min	Max		Min	Max	Min	Max	
1	1	1	1	3	75	25	100	100	40	30	70	40	100

1st Paper (Theory): P.T. Out of 30 marks, 10 marks are for internal project assessment to be done integral to COs and not contributing 10 marks in the average of 100% to be given during the semester for the assessment of the competency domain COs required for the attainment of the COs.

Legends: L= Lecture, T= Tutorial, Practical, Project, P= Practical, C= Credit, ESE= End Semester Examination, PA= End Semester Assessment

5. COURSE MAP: A sample COs, Learning Outcomes (LOs) and topics

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (LOs) in subsequent sections to be attained by the student by the end of

the course in all dimensions of learning in terms of the industry employer identified competencies denoted by the circles of this map.

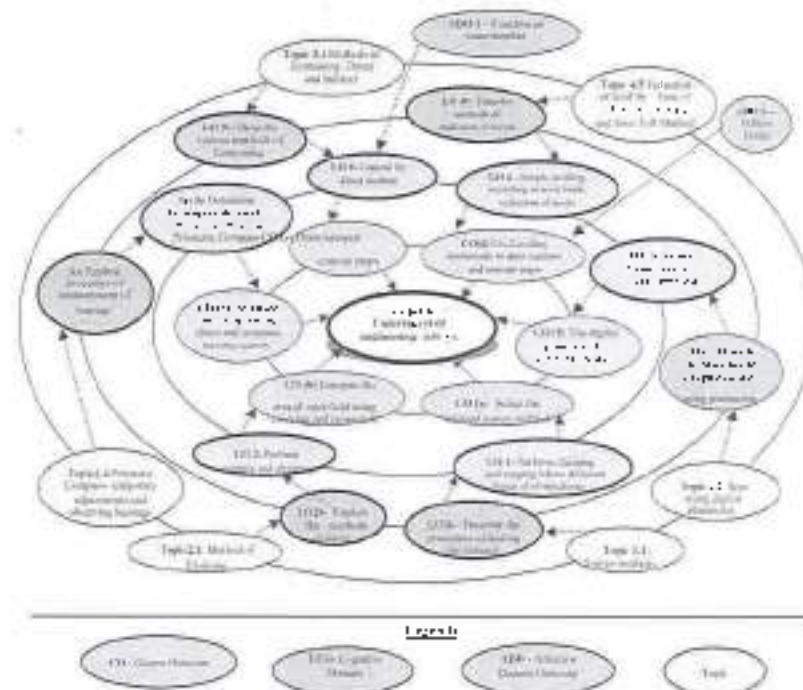


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals were essentials in the student's achievement of the COs, the main components of the COs, to be developed and assessed in the student to lead to the attainment of the competency.

S. No.	Practical Exercises (Learning Outcomes in Professional Domain)	Unit No.	Approx. Hrs. Required
1	Study & use of Metric Chain, Tapes, Ranging rods, Arrows.	1	02
2	Measure distance between two survey stations using chain, tape and ranging rods in when two stations are inter-visible. Part I	1	02



S. No.	Practical Exercises (Learning Outcomes – A) (Psychomotor Theory – A)	Unit No.	Approx. Hrs. Required
1	Under take simple ranging up and measure the distance between two stations. Part I	II	05*
4	Under take simple ranging up and measure the distance between two stations. Part I	II	02
5	Determine areas of open field using chain and cross staff survey. Part I	II	02*
6	Determine area of open field using chain and cross staff survey. Part II	I	02
7	Determine area of open field using chain and cross staff survey. Part III	I	02
8	Measure Fore Bearing and Back Bearing of survey lines of open traverse using Prismatic Compass. Part I	II	02*
9	Measure Fore Bearing and Back Bearing of survey lines of open traverse using Prismatic Compass. Part I	II	02
10	Measure Fore Bearing and Back Bearing of survey lines of open traverse using Prismatic Compass. Part III	III	02
11	Measure Fore Bearing and back bearing of a closed traverse of four sides and correct the bearings and included angles for the local attraction. Part I	III	02*
12	Measure Fore Bearing and back bearing of a closed traverse of four sides and correct the bearings and included angles for the local attraction. Part II	III	02
13	Measure Fore Bearing and back bearing of a closed traverse of four sides and correct the bearings and included angles for the local attraction. Part III	III	02
14	Measure Fore Bearing and back bearing of a closed traverse of four sides and correct the bearings and included angles for the local attraction. Part IV	III	02
15	Under take Survey Project with chain and compass for closed traverse for four sides and correct a building. (Compulsory)	III	1* Part Day
16	Plot the traverse on A1 size imperial drawing sheet for data collected in Survey Project mentioned at practical No. 15. Part I	II	02
17	Plot the traverse on A1 size imperial drawing sheet for data collected in Survey Project mentioned at practical No. 15. Part II	II	02
18	Under take simple leveling using dumpy level. Auto level and leveling staff. Part I	IV	02*
19	Under take simple leveling using dumpy level. Auto level and leveling staff. Part I	IV	02
20	Under take differential leveling and determine Reduced Levels by Height of instrument method and Rise and fall method using dumpy level. Auto Level and leveling staff. Part I	IV	02*
21	Under take differential leveling and determine Reduced Levels by Height of instrument method and Rise and fall method using dumpy level. Auto Level and leveling staff. Part II	IV	02
22	Under take differential leveling and determine Reduced Levels by Height of instrument method and Rise and fall method using	IV	02



S. No.	Practical Exercises (Learning Outcomes – A) (Psychomotor Theory – A)	Unit No.	Approx. Hrs. Required
	Under take simple ranging up and measure the distance between two stations. Part I		
23	Under take differential leveling with double check using dumpy level. Auto level and leveling staff. Part I	IV	02
24	Under take differential leveling with double check using dumpy level. Auto level and leveling staff. Part II	IV	02
25	Under take Survey Project for plotting contour map using block contouring method for a block of 150m x 150m with grid of 10m x 10m. (Compulsory)	IV	1* Part Day
26	Plot the contours on A1 size imperial drawing sheet for data collected in Survey Project mentioned at practical No. 25. Part I	V	02*
27	Plot the contours on A1 size imperial drawing sheet for data collected in Survey Project mentioned at practical No. 25. Part II	V	02
28	Conduct block contouring for the area of 40m x 40m to draw its contour plan. Part I	V	02
29	Conduct block contouring for the area of 40m x 40m to draw its contour plan. Part II	V	02
30	Under take Survey Project for plotting contour map using block contouring method for a block of 150m x 150m with grid of 10m x 10m. (Compulsory)	V	1* Part Day
31	Plot the contours on A1 size imperial drawing sheet for data collected in Survey Project mentioned at practical No. 30. Part I	V	02
32	Plot the contours on A1 size imperial drawing sheet for data collected in Survey Project mentioned at practical No. 30. Part II	V	02
33	Plot the contours on A1 size imperial drawing sheet for data collected in Survey Project mentioned at practical No. 30. Part II	V	02
34	Measure area of irregular figure using planimeter. Part I	V	02*
35	Measure area of irregular figure using planimeter. Part II	V	02
	Total		82

Note

- * Suggested list of practicals is given in the above table. More than practicals can be added to attain the COs and competencies. A practical time of maximum 24 or more minutes is suggested. The practicals should be performed and of which the practicals marked as * are compulsory. It may be taken as per the discretion of the Institute.
- Measure the distance and direction of the survey line with each side of the traverse, including right angle, are to be recorded in a survey book suggested format given below.

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental setup	10
2	Setting and pointing	20
3	Safety measures	10
4	Observations and Recording	20
5	Interpretation of result and conclusion	20

The following competencies should be taught and assessed in order to develop LEOs in cognitive domain for achieving the CLOs to attain the identified competency.

Sr. No.	Performance Indicators	Weightage in %
6	Answer to sample questions	10
7	Sub-totals of report on CLO	10
Total		100

Additionally, the following additional domain CLOs (special skills/attitudes) are given in regard to components of the competencies which can be best developed through the above mentioned laboratory based exercises.

- Follow safety practices.
- Follow good bookkeeping.
- Demonstrate working as a leader & team member.
- Maintain tools and equipment.
- Follow proper practices.

The development in the attitude related LEOs of (Radio-diffy: Affective Domain: Teamwork), the achievement level may reach

- "Assessing Level" in 1st year
- "Organizing Level" in 2nd year
- "Characterizing Level" in 3rd year.

7. MAJOR EQUIPMENT/INSTRUMENTS REQUIRED

The major equipment with brand specifications mentioned here will assist in understanding the equipment to be used, as well as aid in procuring equipment for all institutions.

Sr. No.	Equipment Name with Brand Specifications	Exp. No.
1	Metric Chain made from galvanized mild steel wires 18mm in dia. brass buckles with swivel joints, brass rollers provided at every 5m length of chain 22mre 50m. Materials: taps, Steel tape, Insvar, Fiber glass tape satisfying IS 1266 (Part 1 and Part 2) 1987 specifications.	Exp. 6, 11, 13 and 14
2	Peas of length 400mm and its area of 20 mm x 20 mm. Arrows 400 mm long and made up of good quality hardened and tempered steel wire of 1mm or diameter.	Exp. 6, 11, 13 and 14
3	Neatly the Ranging rods of 2 m length, circular or octagonal cross section of 30 mm diameter, 1 meter three of 150 mm long. Painted in black, white and red in area of 200 mm each.	Exp. 6, 11, 13 and 14
4	Optical square conforming to IS 7999 - 1973 specifications and open cross staff consisting of 4 metal arms with vertical pins for sighting through.	Exp. 6, 11, 13 and 14
5	Stadia compass conforming to IS 1957-1961 with stand, made in Gun metal material having diameter of 80-110 mm and the least count of 30 minutes.	Exp. 6 and 13
6	Simple level and automatic level conforming to IS 9612 - 1980 with standard and internal rotating telescope of standard make.	Exp. 6, 11, 13 and 14
7	Leveling staffs 2 m and 4 m of telescopic type conforming to IS 1196 - 1980 or folding type conforming to IS 1774 (Part 1) 1980 (least error)	Exp. 6, 11, 13 and 14
8	Stadia alidade of standard make with Nod batteries and AC battery.	Exp. 6

Unit	Major Learning Outcomes in cognitive domain	Topics and Sub-topics
Unit- I Overview and Classification of Survey	1a. Classify given type of survey based on purpose, instruments used and nature of field and place. 1b. Explain the given basic principles of surveying. 1c. Describe given type of state. 1d. Select the type of survey for given situation. 1e. Select the type of scale for given situation.	1. Survey: Purpose and Use, Principles or Types. 1.1 Types of survey (Primary and Secondary classification: Plane, Geodetic, Celestial, Hydrographic, Photogrammetric, Aerial, Layout survey, Control and topographic survey, Profile survey, Reconnaissance survey. 1.3 Scales: Engineer's scale, RF and Diagram scale 2.
Unit- II Chain and cross staff Survey	2a. Describe the procedure of finding the distance between two given inter-visible and non inter-visible survey stations. 2b. Explain the methods of ranging and measuring the length of the given survey line with examples. 2c. Explain the corrections in measurement of distance with chain in given situation. 2d. Compute the area of given field using principle of triangulation. 2e. Compute area of given open field by using chain and cross staff. 2f. Select type of chaining for given situation.	2. Chain survey: Instruments, Methods of Ranging, Approx. Ranging and Open cross staff, Optical square (10 questions to be asked in exams) 2.2 Chain survey: Station adjustment: Checks: Line, Tie line, offset, 1 st station, obstacles in chaining: Types of errors: Proper handling of Obstacles. 2.3 Ranging: Direct and Indirect Ranging (10 questions to be asked in exams) 2.4 Errors in length: Instrumental error, personal error, error due to natural cause, random error. 2.5 Principle of triangulation 2.6 Methods: Station of survey station and running measurements of building 2.7 Conventional signs, Recording of measurements in a field book. 2.8 Area Calculations: Geometrical problems
Unit- III Chain and Compass traverse Survey	3a. Carry out the traversing in given situation by using compass and chain. 3b. Convert given whole circle bearing to reduced bearing and vice versa to find included angle with examples. 3c. Explain construction and functions of given parts of the given type of compass. 3d. Determine correct bearings from the given observed	3.1 Compass: Traversing: open, closed. 3.2 Technical Terms: Geographical, True, Magnetic and Arbitrary Meridians and Bearings: Meridian and Bearing, Whole Circle Bearing System, Azimuth and Reduced, Quadrantal Bearing system and examples on conversion of given bearing to another bearing: from one form to another: Fore Bearing and Back Bearing, Calculation of internal and external angles from bearings of a station, Dip of Magnetic needle, Magnetic Declination: Numerical problems

8. FUNDAMENTAL THEORY COMPONENTS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
	bearings. 3e. Explain the methods used in plane table survey in the given situation. 3f. Adjust the closing error of the traverse for the given data.	3.3 Components of Prisms, Clinometer and their functions; Sketch Method of using Prismatic Compass; Temporary adjustments and observing bearings. 3.4 Local attraction, Methods of correction of observed bearings-Correction at station and correction to included angles. 3.5 Methods of plotting a traverse and closing error; Graphical adjustment of closing error.
Unit- IV Leveling	4a. Explain the given terms related to leveling. 4b. Describe construction and use of the given leveling instrument. 4c. Explain the given temporary adjustments of a typical dumpy level. 4d. Describe methods of reduction of levels by height of collimation method and fall method in the given situation. 4e. Select type of leveling for the given work with examples and justification. 4f. Compute the missing readings from the given observed readings.	4.1 Terminologies: Level surfaces, level line, Horizontal and vertical surfaces, Datum, Bench Marks, G.P.s, Permanent, Arbitrary and Temporary, Reduced Level, Rise, Fall, Line of collimation, Section, Back sight, fore sight, intermediate sight, Change point, Height of instrument. 4.2 Types of Levels: Dumpy, Tilting, Automatic, Digital level, Components of Dumpy Level, its fundamental lines, Temporary adjustments of Level. 4.3 Types of Leveling: Staff, Self-reading staff and Target staff. 4.4 Reduction of level by: Line of collimation method and Rise, Fall Method. 4.5 Methods: To find the R.L. by H.L. method/Numerical problems. 4.6 To find R.L. by Rise and Fall method with necessary checks (Numerical problems). 4.7 Leveling Types: Simple, Differential, Fly, Profile and Reciprocal Leveling. 4.8 Computation of missing readings, Errors in Leveling, (Numerical problems). 4.9 Comparison of different levels.
Unit- V Contouring	5a. Describe the importance of contour map for the given type of topography. 5b. Explain characteristics of contours for the given terrain. 5c. Explain methods of plotting contours in the given situation. 5d. Explain factors affecting the selection of the given contour interval. 5e. Prepare contour map from the given B.M.s of grid points with examples.	5.1 Contour, contour interval, horizontal equivalent. 5.2 Contour maps: Characteristics and uses of 5.3 Methods of Contouring: Direct and indirect. 5.4 Methods of interpolation of contours: approximate, arithmetic and graphical. 5.5 Toposheets: Study.



Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit- VI Measurement of Area and Volume	6a. Explain the theory and use of digital planimeter, etc. in the given situation. 6b. Describe the procedure for measuring the given area using digital planimeter. 6c. Compute the area from the given contour map. 6d. Compute the volume of reservoir from the given contour map.	6.1 Digital planimeter: Components and uses. 6.2 Measurement of area using digital planimeter: No problems to be asked for exam. 6.3 Measurement of volume of reservoir from contour map. No problems to be asked for exam.

Note: From them the COs and competencies are related to learning Outcomes 2. Outcomes 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	L Level	A Level	Total Marks
	Overview and Classification of Survey	2	2	4	-	06
I	Chain and cross-staff Survey	20	2	-	6	08
II	Chain and Compass traverse Survey	12	4	4	8	16
III	Leveling	16	6	6	12	24
IV	Contouring	20	2	4	4	10
V	Measurement of Area and Volume	20	2	4	-	16
	Total	48	18	22	30	70

Legend: R – Remember, L – Understanding, A – Apply and create (Bloom's Revised taxonomy).

Note: This specification table provides general guidelines to set a subject for theory, practical and to teachers to teach and assess students with respect to attainment of COs. The actual distribution of marks at different learning levels of R, L, and A will be in the question paper itself and from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory activity following are the suggested student-based/construction activities which can be undertaken to accelerate the attainment of the various outcomes.

- Construct a plain scale 1 cm = 1 m to read up to a meter and represent 2.5 m on the scale.
- Draw a neat labeled sketch of a 20m chain and show its salient features.
- Explain the method each to measure the distance between points on either side of obstacles in case of following: River, Lake, Building.
- Explain different obstacles encountered in chain survey.
- Explain the relation between the whole circle bearing and reduced bearing with the help of neat sketches and convert the given set of five WC to RH and vice versa.
- Measure the bearing of sun at noon with compass and then magnetic bearing of any line and find the true bearing of that line.

- g. Find the deflection angles at each vertex of a given traverse with interior angles.
- h. Find the bearing of remaining angles when the bearing of any one line of a traverse and deflection angles at respective stations are given.
- i. Determine the true north aspects from a given contour map of reservoir.
- j. Interpret the given contour maps drawn in the situation.
- k. Draw and represent a contour map for the following: Ridge with mountain, Hill pass, Valley, Road lake, Gentle slope, Very Steep Slope, Plain Surface.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES of unit

The student employs strategies with 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 via app.
- b. *Flipped Classroom* is an instructional model in which traditional lecture material, but different types of teaching methods are used that are to be employed to develop the students.
- c. About 15-20% of the topics/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 (can implement a guideline for details).
- d. With respect to team work, teachers need to ensure to create opportunities and provide means for *collaborative activities*.
- e. Guide students in undertaking micro-projects.
- f. Arrange visit to recently newly started site for understanding various surveying techniques.
- g. Show a video/animation film to explain various programs like leveling, levelling, traversing and contouring.
- h. Prepare brainstorming sheets for various questions/questionnaire in survey laboratory.

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. The report to submit it by the end of the semester in developing the industry-oriented COs. Each micro-project should encompass two or more COs which are in line, an integration of practical, cognitive domain, and affective domain. For the micro-project could be industry application based, internet-based, work-oriented, laboratory-based or field-based. Each student will have to maintain a work diary consisting of individual contribution in the project work and give a seminar presentation at the final term exam. 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 needs of the industry. A suggestions list is given here. Similar micro-projects could be added by the concerned faculty.

- a. Collect the necessary set of surveying instruments available in the market with specifications.
- b. Carry out comparative study of following surveying instruments of different make and provide a comparative study of the instrument.
- c. Utilize the given map with reference to standard page.
- d. Collect the map of the town and collect the word base and detail map using digital plotter.
- e. Determine the R.L.s of the existing structures like bridge, dam, etc. and height.

- f. Conduct theodolite tests for proximate compass, dumpy level, auto level, spirit level, etc.
- g. Perform reciprocal survey for alignment of road.
- h. Collect and interpret contour maps of different terrains available in the various authorities.
- i. Estimate and measure given length using Diagonal scale from a given map.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Surveying and Levelling Volume 1	Sanjiv Kumar, S. V.	Pre Vidyarthi Granth Prakashan Press, ISBN: 978-81-838-2711-7
2	Surveying and Levelling	Bask, S. N.	Vishwa Hill Education, New Delhi ISBN: 93-329-6111-5
3	Surveying	Saikar, V. D., Das B. M., Das, R. M.	PH Learning, New Delhi ISBN: 978-81-903-3987-9
4	Fundamentals of Surveying and Levelling	Subramanian, R.	Universal Academy Press, New Delhi ISBN: 93-9045471-8
5	Survey I	Duggal, S. K.	McGraw Hill Education, New Delhi, ISBN: 978-00-701-5121-6
6	Textbook of Surveying	Rao, V. Venkatesh Akrta, Visalakshmi	PH Learning, New Delhi ISBN: 978-81-203-4731-8
7	Surveying I	Parthasarathy, B. C., Ram, Ashok Kumar, Jain, Arun Kumar	Laxmi Publications, New Delhi ISBN: 81-71-00853-4
8	Surveying and Levelling, Volume 1	Ghosh, S. S.	J. K. International, New Delhi ISBN: 978-81-979-9421-9
9	Textbook of Surveying	Venkatesan, C.	University Press New Delhi ISBN: 978-81-737-1021-6

14. SOFTWARE/LEARNING WEBSITES

- a. www.cadsoft.com.au
- b. www.cadsoft.com.au
- c. www.cadsoft.com.au
- d. www.cadsoft.com.au
- e. www.cadsoft.com.au
- f. www.cadsoft.com.au
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Program Name : Civil Engineering Program Group
 Program Code : CEECT001S
 Semester : Second
 Course Title : Civil Engineering Workshop and Practice
 Course Code : 220008

1. RATIONALE

Construction and building practices is a basic engineering course. The knowledge of basic civil engineering operations like masonry, plastering, concrete, finishing works is essential for technicians 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 will be able to supervise construction activities and use quality control techniques and materials and equipment with safety to self, co-workers and the constructed community at the building. Working in field develops the attitude of team working and safety awareness. This course provides the minimum exposure to field work.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various training/learning experiences.

- Perform basic civil engineering jobs using relevant tools.

3. COURSE OUTCOMES (COs)

The course, practical experiences and relevant skill is 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 course work.

- Identify the various civil engineering materials.
- Perform masonry job (masonry).
- Perform plastering job (plastering).
- Identify finishing jobs related to building construction.
- Identify the various components of typical civil structures like road, railway bridge.

4. TEACHING AND EXAMINATIONS SCHEME

Teaching Scheme	L	T	P	Credit (L+T+P)	Examination Scheme									
					Theory					Practical				
					Pages	EST	PT	Total	EST	PT	Total	EST	PT	Total
					Max	Min	Max	Min	Max	Min	Max	Max	Min	Max
—	—	—	—	4	—	—	—	—	—	—	—	—	—	—

[Note: For the practical only courses, the PA has two components under practical marks i.e. the *classroom end of practicals* (given in section 4) has a weightage of 60% (i.e. 24 marks) and the *project assessment* (given in section 4d) has a weightage of 40% (i.e. 16 marks). For a course designed to achieve attainment of COs noticheing, as there is no theory ESE.

Legend: L= Lecture, T= Tutorial, P= Practical, P= Project, C= Credit, PA= Part A, PB= Part B, PC= Part C, PD= Part D, PE= Part E, PF= Part F, PG= Part G, PH= Part H, PI= Part I, PJ= Part J, PK= Part K, PL= Part L, PM= Part M, PN= Part N, PO= Part O, PP= Part P, PQ= Part Q, PR= Part R, PS= Part S, PT= Part T, PU= Part U, PV= Part V, PW= Part W, PX= Part X, PY= Part Y, PZ= Part Z.

5. COURSE MAP (with sample COs, POs, CS, ADUs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (define) subsequent sections to be attained by the student by the end of the course and the domains of learning in terms of the industry or project identified competency depicted at the center of the map.

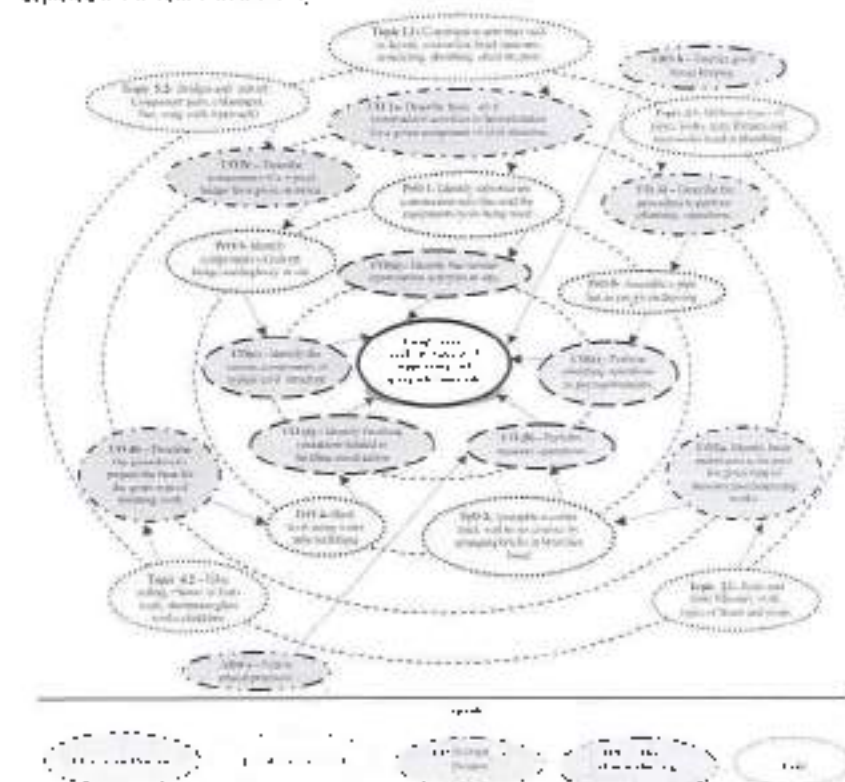


Figure 1- Course Map

6. SUGGESTED PRACTICAL LEARNING OUTCOMES TO COURSE

The practicals in this section are POs and sub-components of the COs to be developed and possessed by the student for the attainment of the competency.

S. No.	Practical Outcomes (POs)	Unit No.	Approx. Hrs. required
1	Identify the substructure construction activities and the equipment tools being used at site during the visit. Part A	1	02
2	Identify the substructure construction activities and the equipment tools being used at site during the visit. Part B	1	02

S. No.	Practical Outcomes (POs)	Unit No.	Approx. Hrs. required
1	Identify the superstructure construction activities and the equipments/tools being used at site during the visit (Part I)	I, II	02
1	Identify the superstructure construction activities and the equipments/tools being used at site during the visit (Part I)	I, II	02
2	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 existing wall (Group of 10 students)	II	02*
3	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 existing wall (Group of 10 students) (Part I)	I	02
4	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 existing wall (Group of 10 students) (Part 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 existing wall (Group of 10 students) (Part I)	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 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 existing wall (Group of 10 students) (Part I)	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 existing wall (Group of 10 students) (Part I)	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 existing wall (Group of 10 students) (Part I)	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 I)	III, IV	02
12	Identify the superstructure construction activities and the equipments/tools being used at site during the visit (Part I)	III, IV	02
13	Identify the superstructure construction activities and the equipments/tools being used at site during the visit (Part I)	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)	I, IV	02*
15	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)	I, IV	02
16	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)	I, IV	02
17	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
18	Visualize 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 assemble 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 assemble this pipe line (Part I)	II	02*

S. No.	Practical Outcomes (POs)	Unit No.	Approx. Hrs. required
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 assemble this pipe line (Part I)	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 assemble this pipe line (Part I)	II	02
22	Test the quantity of cement on site (Laboratory) (Part I)	IV	02*
23	Test the quantity of cement on site (Laboratory) (Part I)	IV	02
24	Test the quantity of cement on site (Laboratory) (Part I)	IV	02
25	Identify types of reinforcement bar and its traps at site during the field visit for the reinforcement for beams, column and slab (Part I)	IV	02
26	Identify types of reinforcement bar and its traps at site during the field visit for the reinforcement for beams, column and slab (Part I)	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 I)	IV	02
29	Carry out field test on bricks at site (Part I)	IV	02
30	Identify the various components of the bridge at site	V	02*
31	Identify the various components of the bridge at site	V	02
32	Identify the various components of the bridge at site	V	02
Total			64

Note:

1. A suggested list of POs is given in the above table. More such POs can be added to attain the COs and competencies. A student who is minimum 21 or more years of age is deemed to be performed out of which the practicals marked by * are compulsory. It is that the student reaches the 'Proficiency level of the 21 competencies domain framework' as generally expected by the industry.

2. Hence, the 'Practicals and Projects related skills associated with each part of the laboratory involving field work are to be observed 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	Submitting a report in time	10
Total		100

The above POs also comprise of the following special skills/attitudes, which are Attitude domain Outcomes (ADOs) that are best developed through the laboratory field based experiences:



Unit	Unit Outcomes (UOs) in cognitive domain	Topics and Sub-topics
	have for the given type of finishing painting work 4c. Assess the necessity of minimum section for the given type of work with justification 4e. Estimate what, what, when and how for the given type of wall & door frames wooden structure	Tools required, brush, roller and spray painting preparation of surface for timber and steel members for painting
Unit-5 Construction of Road, Culverts, Bridges	5a. Identify roles and materials for the given type of road construction with justification 5b. Describe the types and components of road in 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, so construct and give type of bridge culvert	5.1 Types of road, components of road, drainage way, shoulder, center line, gradient 5.2 Design of Culvert, components parts, Abutment, Pier, Wing wall, Approach

Note: The students' UOs must complete by course listed in the used to be implemented to achieve the specified course level of understanding of Basic's of Engineering Technology.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN - Non application

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning activities are the suggested student-related *on-experience* 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, planning materials and finishing coats
- Organize a visit to Construction sites of different types wall is simple residential buildings, malls, multi-storied buildings, observe the course/topic based practices in the field
- Teacher guided self learning activities
- Give self directed project based mini-projects
- Develop Power point presentation or animation for activities seen during field visit

11. SUGGESTED PRACTICAL INSTRUCTIONAL STRATEGIES (if any)

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

- Use open online content (MOOCs) can be used to teach various topics such topics
- Flipped Classroom* - It does not mean that the traditional lecture method and a flipped type of teaching methods and media has to be employed to develop the outcomes.

- About 15-20% of the topics/sub-topics which is relatively simple or short piece of writing is to be given to the students for *self-directed learning* and assess the development of the UOs through classroom presentation, case implementation, guideline to details
- With respect to Unit-5, teachers need to ensure to create opportunities and provisions for *on-experience activities*
- Guide students in undertaking mini-projects
- Arrange visit to nearby construction sites for understanding various construction stages and construction activities
- Show video animation films to explain various processes, use, evaluation, foundation or jobs, planning, laying water supply and sewer pipelines
- Assign construction tasks to chart for various civil engineering stages

12. SUGGESTED MICRO-PROJECTS

Only one mini-project is planned to be undertaken by a student assigned to him or her at the beginning of the semester. He might submit it by the end of the semester to develop the industry required UOs. Each mini-project is guided by project plan, UOs which are included, integration of PLOs, UOs and APOs. The micro-project could be using application based, machine-based, workshop-based, animation-based or field based. Each student will have to maintain clear records, highlighting a individual contribution in each project work and give a seminar presentation of it before submission. The total duration of the mini-project should not be less than 15 (fifteen) 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 suitable self-evaluation to become problem solver so that s/he contributes in the projects of the industry. A suggestive list is given here. Similar mini-projects could be added by the lecturing faculty.

- Bill Preparation** - Give a set of 5 model plan, prepare bill of materials for given type of wall
- Material and concrete** - Each student will collect the information regarding the bill provisions for the construction materials like cement, bricks, reinforcement and formwork
- Finishing Work** - Collect the information from local market regarding the types, thickness, specification, cost of various brands and price of plumbing, reduced section along with its specifications, line in its code, finish, standard, price
- Plumbing** - Download the specifications on plumbing work such as benches, valves, fountains, pipe, wrench and pipe accessories
- Masonry and concrete** - Undertake a market survey of cement, aggregate and sand of various specifications from local dealers (give a list of five students)
- Plumbing** - Collect the technical information for various plumbing accessories such as elbows, pipes, bend, union, couplings of various diameters and write a Price report and a bill of materials
- Masonry and concrete reinforcement**
 - Collect five samples of bricks from different suppliers and test them in field to measure its quality and write a report with reference to its environment and protection of environment
 - Prepare a mind - current inventory of various properties of UOs and apply project in a place and test 20 in a 5 days and observe the data, test and plan it
 - Prepare a document a variety of equipment of UOs, 1.5, 2.5, 3.5 and 4.5 and prepare a catalog book of it to determine its strength, UOs and its parts



- iv. Masonry and cementing –Collect the list of various brands of flooring tiles with their BS specifications and make a report of it.
- f. *Masonry and cementing* (Group of five students) – Undertake the local survey for various scattering material along with its specifications.
- g. *Masonry and cementing* (Group of five students) – Assemble and describe the scattering material for a house of given cross-section, using appropriate materials decided by concerned teacher.
- h. *Finishing Work* (Individual activities) – 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	Hill, J.W.	Gower Press, London, 1989, ISBN: 9780566093288
4	Basic Plumbing With Illustrations	Massey Howard G.	Craftsman Book Co, California, ISBN: 9780934061997
5	Modern Plumbing	Daker, E.Keith Blunker	Goodheart-Willcox Co, ISBN: 978-1596707502
6	Structural Schedule of rates, (DSR)	PWD	PWD, Government of Maharashtra, Mumbai
7	A To Z Of Practical Building Construction & its Management	Mantri Sandeep	Sarya Prakashan, New Delhi: 2015, ISBN: 9788175892951

14. SOFTWARE/LEARNING WEBSITES

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



Program Name: All Branches of Diploma in Engineering and Technology

Program Code: CE/CR/CS/CH/PS/CM/CO/ID/OW/DE/EN/EE/ET/ES/EA/ME/EE

DEPARTMENT OF COMMUNICATION ENGINEERING

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 writing a business 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	L	T	P	Weightage (%)	Examination Scheme									
					Theory					Practical				
					Paper I (10%)	ESE (10%)	PA (10%)	Yr End (10%)	ESA (10%)	PA (10%)	Yr End (10%)	ESA (10%)	PA (10%)	Yr End (10%)
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

As this only practical course, the PA of this course has two components under practical marks viz. the assessment of practical has a weightage of 60% under marks and an in-situ practical assessment has a weightage of 40% (under business). Thus it is designed to facilitate attainment of COs holistically as there is no theory ESE.

Legend: L = Lecture, T = Tutorial, P = Practical, ESE = End Semester Examination, PA = Practical Assessment.

5. COURSE MAP (with sample COs, POs, PSOs and topics)

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

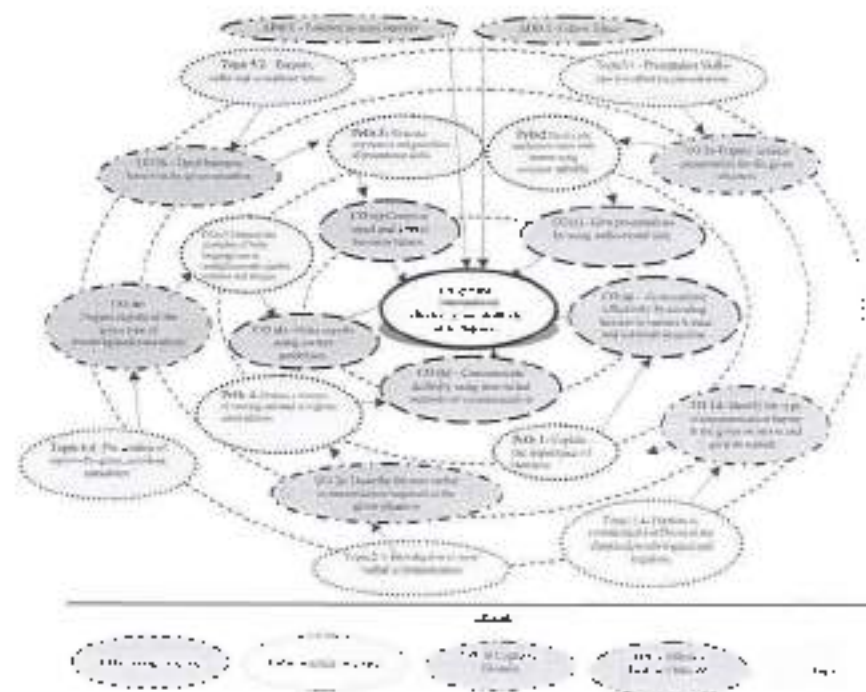


Figure 1 - Course Map

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

The practicals of this section are POs, PSOs, sub-components of the COs to be developed and assessed in the student for the attainment of the competency.

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

S. No.	Practical Outcomes (POs)	Unit No.	Approx. Hrs. required
2	Design job application letter with resume using computer.	V	2*
3	Mention three examples of body language use in workplace with suitable pictures and images.	II	2*
4	Prepare a minutes of meeting and read it to given email address.	VI	2
5	Write the importance and guidelines of presentation skills.	II	2*
6	Draft a detailed Progress Report.	IV	2*
7	Organize a debate on types of communication.	I & II	2
8	Summarize an industry report using techniques of summarizing.	IV	2
9	Draft a complaint letter on a set topic.	V	2
10	Design Powerpoint presentation on any technical topic.	II	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 up 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

1. A suggestive list of practical LOs is given in the above table. More such practical LOs can be added to attain the COs and skills listed. A judicious mix of minimum 12 or more practical LOs/activities need to be performed, out of which the processes marked as * are compulsory, so that the student reaches the Proficiency level of knowledge. Professional Document Formatting is generally required in the industry. The size of batch for the proposed should not exceed more than 24 students jointly for the maximum attainment of COs and POs.

2. Hence, the Process and Product related skills associated with each LO of the laboratory/workshop/practical work are to be covered according to a suggested sample given below.

7. MAJOR EQUIPMENTS/INSTRUMENTS REQUIRED

The major equipment with brief specification mentioned here will adhere in conformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Brief Specifications	Exp. S.No.
1	PC Processor	All
2	Smart Board with networking	All
3	Language Lab with headset	All
4	Printer	Wherever Applicable



8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop COs 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	a. Describe the importance of the business communication in the given situation. b. Identify the missing element in the given communication process. c. Identify the type of communication in the given situation. d. Identify the type of communication barrier in the given situation and its remedy.	e. 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, mental, social, 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), cosmetics. 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 reports.

Unit	Unit Outcomes (UOs) (in cognitive domain)		Topics and Sub-topics
	Writing Skills for the given topic	Speaking Skills computer presentations	
Unit-IV Office Drafting	4a. Draft the given notice using the relevant format. 4b. Draft the given memo/ordinance 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/situations.	4f. Read the agenda of the given meeting. 4g. Read the report of the given event. 4h. Initiate telephone calls for the 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 advertisement by writing your CV/Resume. 5b. Draft business letters in the given situations. 5c. Draft sample letters for the given situations. 5d. Compose E-mails with relevant for the given situation.		5.1. Business correspondence. 5.2. Enquire, order and sample letters. 5.3. E-mails, notices. 5.4. Difference – Curriculum Vitae, Bio-data and Resume. 5.5. Job application and resume writing.

Note: To meet the UOs and competencies, above listed Learning Outcomes (LOs), there is no limitation regarding the Assessment Level of Bloom's Cognitive Domain. Various theory/practical topics should be covered during practical lab/assignment activities.

9. SUGGESTED SPECIFICATION TABLE FOR INTERNAL END SEMESTER EXAMINATION

Unit No.	Unit Title	Distribution of practical marks			
		R Level	L Level	A Level	Total Marks
1	Introduction to Business Communication	01	02	01	04
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, L-Understand, A-Apply and analyse (Bloom's Revised taxonomy).

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

10. SUGGESTED GUIDELINES FOR ASSESSMENT TOOL TO CONDUCT INTERNAL END SEMESTER EXAMINATION.

Weightage (20 Marks)	Weightage (15 Marks)	Total
A	B	
Assessment based on POs, practicals conducted during semester. Based on computer and written skills. (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 POs Topics mentioned in syllabus (Minimum five questions each own 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 group interaction.
- Listen to Business news on TV and radio.
- Watch videos of effective presentation on television and learn 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.



11. *10 to 15 per cent* does not mean only the traditional lecture method, but different modes of teaching methods and means that are to be employed to develop the outcomes.
12. *View 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 Appendix 1 for details).
13. With respect to *every* MO, teachers need to ensure to create opportunities and provide the following *classroom* activities:
 - a. Arrange various group/individual activities using smart and flipchart.
 - 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 class projects in groups as well as individually.

12. SUGGESTED TITLES OF MICRO-PROJECTS

Only one *micro-project* is proposed to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. She 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 such as in fact, an integration of COs, HCs 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 a detailed 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 laboratory 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 she 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 company form Business advertisement.
- 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 newspaper/magazines and other sources.

13. SUGGESTED LEARNING RESOURCES

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

S. No.	Title of Book	Author	Publication
2	Communication Skills	Sanjay Kumar and Pooja Lata	Oxford University Press
3	Personality Development and Soft Skills	Ram K. Verma	Oxford University Press

14. SOFTWARE/LEARNING WEBSITES

- a. <https://www.khanacademy/a/crash-course-online>
- b. <http://www.englishforbusiness.net/organization>
- c. <http://www.talkingskills.com>
- d. <http://www.englishforbusiness.com>
- e. <http://www.englishforbusiness.com>
- f. <http://www.englishforbusiness.com>
- g. <http://www.englishforbusiness.com>
- h. <http://www.englishforbusiness.com>
- i. <http://www.englishforbusiness.com>
- j. <http://www.englishforbusiness.com>





Maharashtra State Board of Technical Education, Mumbai
Teaching And Examination Scheme For Post S.S.C. Diploma Courses

Program Name : Diploma in Electrical Engineering

Program Code : EE/EP/EU

With Effect From Academic Year: 2017 - 18

Duration of Program : 6 Semesters

Duration : 16 Weeks

Semester : Second

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	Applied Mathematics		AME	22210	4	2	-	6	3	70	28	30*	00	100	40	--	--	--	--	--	--	100
2	Applied Science	Physics	ASE	22211	2	-	2	6	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	Fundamentals of Electrical Engineering		FEE	22212	4	2	2	8	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150
4	Elements of Electronics		EOE	22213	3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150
5	Basic Mechanical Engineering		BME	22214	3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150
6	Business Communication Using Computers		BCC	22009	-	-	2	2	--	--	--	--	--	--	--	35@	14	15	06	50	20	50
Total					18	4	10	32	--	350	--	150	--	500	--	160	--	140	--	300	--	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 (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.



Program Name	: Electrical Engineering Program Group & Electronics Engineering Program Group
Program Code	: DEEEELMEISVI
Semester	: Second
Course Title	: Applied Mathematics
Course Code	: 22210

1. RATIONALE

The core technological studies can be understood with the help of precalculus or applied mathematics. This course is an extension of Basic Mathematics of first semester which is designed for its applications of engineering and technology using the techniques of calculus, differential equations, 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 finding the displacement and in finding the area under the curve. Integration is important in differential equations used in finding the curve and its related applications for various engineering models like LCR circuit. This course further develops the skills and understanding of mathematical concepts when needed in 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 brand-based problems using the principles of applied mathematics.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant skill sets 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, normal, radius of curvature in 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 method.
- Use Laplace transform to solve first order first degree differential equations.

4. TEACHING AND EXAMINATION SCHEME

L	T	P	Credit (L+T+P)	Examination Scheme											
				Theory						Practical					
				Expt Nos	Expt Max	Expt Min	QA Max	QA Min	Total Max	Total Min	Expt Max	Expt Min	QA Max	QA Min	Total Max
—	—	—	—	2	7	28	24	0	100	24	—	—	—	—	—

(*) 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 14 marks to be taken during the semester for the assessment of COs required for the achievement of the COs.
Legend: L-Theory, T-Internal-Theory Exam, P-Practical, C-Collaborative, ESE-End Semester Examination, PA-Projective Assessment.

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

This course map illustrates an overview of the flow and linkage 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 the way of learning in terms of the industry employer identified competencies depicted at the centre of the map.



Figure 1: Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The exercises 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.	Materials	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 algebraic function and parametric function.	I	2
3	Solve problems to find derivatives of logarithmic and exponential functions.	I	2
4	Solve problems based on finding equations of tangent and normal.	I	2
5	Sub-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.	I	2
7	Solve problems based on methods of integration: substitution, partial fractions.	I	2
8	Solve problems based on integration by parts.	I	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 revolution.	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 in 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 material required are for guidance only. The remaining material figure are for revision and practice.

7. MAJOR EQUIPMENT/INSTRUMENTS REQUIRED

- Not applicable -

8. UNDERPINNING THEORY COMPONENTS

The following topics/sub-topics is to be taught and assessed in order to develop UOs for achieving the COs to attain the identified CQ competencies.

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 2. Derivatives a) Rules of derivatives such as sum,	1.1 Functions and Limits 2.1 Concept of function and simple examples 2.2 Concept of limits with examples 2.3 Derivatives a) Rules of derivatives such as sum,

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit-I Differential Calculus	1a. Apply the concept of differentiation to find equation of tangent and normal. 1b. Apply the concept of differentiation to calculate maxima and minima and radius of curvature of given problem.	1.1 Derivatives of functions 1.2 Derivatives of composite functions (Chain Rule), implicit and parametric functions. 1.3 Derivatives of inverse logarithmic, and exponential functions. 1.4 Applications of derivatives: a. Second order derivatives with examples. b. Equations of tangent and normal. c. Maxima and minima. d. Radius of curvature.
Unit-II Integral Calculus	2a. Solve the given problems based on rules of integration. 2b. Obtain the given simple integrals 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 integrals. 3b. Apply the concept of definite integration to find the area under the given curve. 3c. Obtain 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 problems. 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, limits and first shifting property. d. Laplace transform of derivatives and solution of first order first degree differential equations.

Note: To assess the COs and competences above listed UOs used in an underlined form in the Application Level and above of Bloom's Cognitive Domain Framework.

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	06	14
III	Applications of Definite Integration	10	02	02	06	08
IV	First Order First Degree Differential Equations	08	02	02	04	08
V	Complex numbers and Laplace transform	12	02	06	07	14
Total		64	12	23	35	70

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

Note: This specification table provides general guidelines to assess 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 cognitive levels (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 materials available on the internet.
- Use graphical software as EXCEL, DERBY, and GRAPH for related topics.
- Use Wolfram 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 trigonometry.
- Prepare a seminar on any relevant topic based on applications of Laplace transform in 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.

- Mass e-open online courses (MOOCs) may be used to teach various topics/sub-topics.
- Flipped classroom 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.
- Assign 15-20% of the topics/sub-topics which is relatively simpler or descriptive in nature 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. She 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 AOs. 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 steering of a vehicle.
- Prepare models using the concept of radius of curvature in 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 solving problems.
- Prepare models using the concept of differential equations for refrigeration cycles.
- Prepare models using the concept of differential equations for population growth.
- Prepare models using the concept of differential equations for thermodynamics.
- Prepare models using the concept of Laplace transform to solve linear differential equations.



Program Name : Electrical Engineering Program Group
 Program Code : EL/EP/UE/UE95
 Semester : Second
 Course Title : Applied Science (Physics & Chemistry)
 Course Code : 22211

1. RATIONALE

Electrical engineers (also called technologists) have to deal with various materials and machines. The study of concepts and principles of science like capacitance and current electricity, effect of magnets, induction and alternating current, photo-sensors and L.A.S.E.R, water treatment and analysis, electrochemistry and batteries, metals, alloys, magnets and others will help them in identifying along the engineering courses where emphasis is laid on the applications. This course is developed in the way by which fundamental information will help the budding engineers to apply the concepts and principles of advanced science in various engineering applications to solve broad based problems.

2. COMPETENCY

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

- Apply principles of advanced physics and chemistry to solve broad based engineering problems.

3. COURSE OUTCOMES (COs)

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

- Use relevant components in electrical circuits.
- Use equipment/instruments based on radioactive and ultrasonic principles.
- Use equipment/instruments based on photoelectric effect, X-Ray and LASER.
- Select relevant water treatment process for various applications.
- Use relevant electrolyte in batteries for different applications.
- Use relevant metal alloys and engineering materials in various applications.

4. TEACHING AND EXAMINATION SCHEME

Reaching Strategy	L	T	P	Course Code: EL/EP/UE/UE95	Examination Scheme											
					Theory						Practical					
					Paper (hrs)	Exst. (Mins)	Exst. (Mins)	PA (Mins)	Exst. (Mins)	Total (Mins)	Exst. (Mins)	PA (Mins)	Exst. (Mins)	PA (Mins)	Exst. (Mins)	Total (Mins)
1	1	1	1	1	3	15	15	15	15	60	15	15	15	15	15	60
2	1	1	1	1	3	15	15	15	15	60	15	15	15	15	15	60

(PA) Under the theory, P.A. Out of 10 marks. 10 marks are for major project assessment of mainly on basic physics and chemistry, to be taken integration of COs and the remaining 10 marks is the average of 2 tests to be taken during the semester for the attainment of the competency and 10 marks for the attainment of the COs.

Legend: L-Lecture, T- Tutorial, Teacher Guided Theory Session, P-Practical, COs-Course Outcomes, Exst- End Year the Examination, PA-Pragmatic Assessment

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

5. COURSE MAP (each sample COs, POs, EOAs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (data 1 or 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.

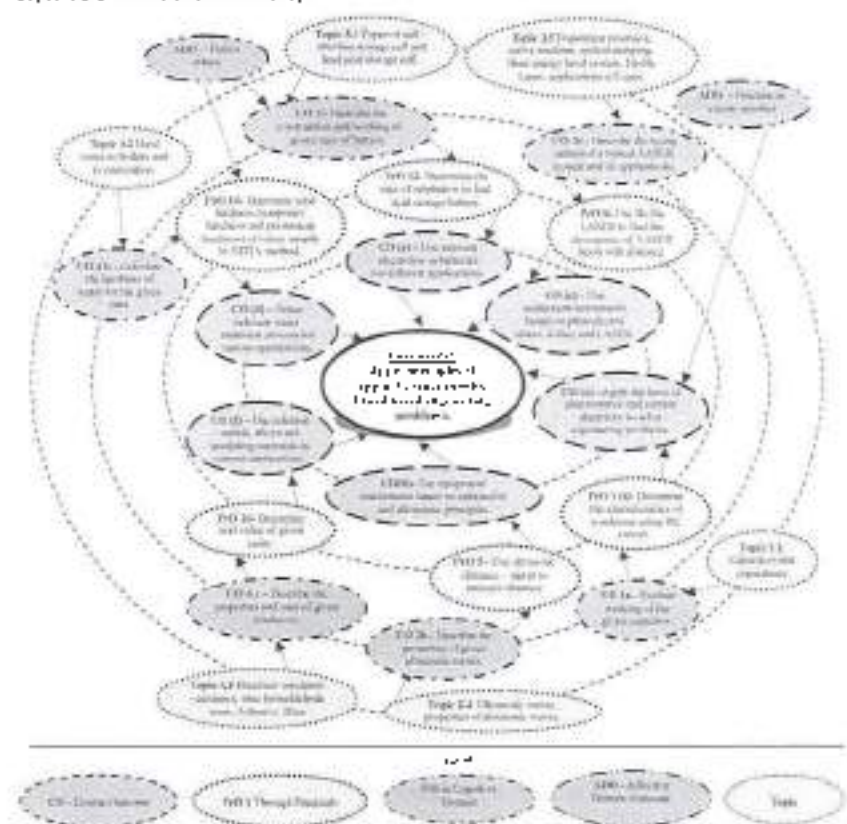


Figure 1 - Course Map

6. SUGGESTED PRACTICALS / EXERCISES

The practicals in this section are POs (Program Outcomes) of the COs. To be developed and assessed to the student for the attainment of the competency.



S. No.	Practical Outcomes (POs)	Unit No.	Approx. Hrs. Required
Physics			
1	i) Use condensers to increase and decrease the equivalent capacity of the circuit. ii) Determine the characteristics of a condenser from R.v. circuit.	I	02
2	i) Use meter bridge to determine the equivalent resistance of the conductors in series and parallel. ii) Use meter bridge to estimate specific resistance of a given wire.	I	02
3	i) Use potentiometer to compare emf of two cells. ii) Use potentiometer to find internal resistance of a cell.	I	02
4	Use resonance tube to determine velocity of sound.	II	02
5	Use ultrasonic distance meter to measure distances.	II	02
6	i) Use photo electric cell to see the dependence of photoelectric current on intensity of light. ii) Use photo electric cell to see the dependence of photoelectric current on plate potential.	III	02
7	Use LDR to see the dependence of resistance of LDR on intensity of light.	III	02
8	Use He-Ne LASER to find the divergence of LASER beam with distance.	III	02
Chemistry			
9	Determine alkalinity of water sample.	IV	02
10	Determine total hardness (temporary hardness and permanent hardness) of water sample by EDTA method.	IV	02*
11	Determine specific conductance and equivalent conductance of given salt sample solution.	V	02
12	Determine equivalence point of acetic acid and ammonium hydroxide using conductivity meter.	V	02*
13	Determine chloride contents in a given water sample by Mohr's method.	V	02
14	Prepare the Thickol rubber.	V	02
15	Separate two miscible liquids like acetone and water using distillation technique.	V	02
16	Determine ΔG value of given reaction.	VI	02*
		Total	32

Note

* A suggestion list of POs is given in the above table where each POs can be added to attain the POs and competencies. A suggestion of maximum 12 practicals need to be performed out of which the practicals marked as "*" are compulsory so that the student reaches the prescribed level of Outcome. Experiments Domain Learning is generally required in the end of.

ii) The Process and Product related skills associated with each POs is to be assessed according to a suggested sample given below.

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20



S. No.	Performance Indicators	Weightage in %
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 on time	10
Total		100

The above POs also comprise of the following 'soft skills' categories 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/team member.
- Follow ethical practices.

The ADOs are not specific to any one POs, but are embedded in many POs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undergoes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Kothari'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 basic specification mentioned here will usher a uniformity in conduct of experiments as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Basic Specifications	Exp. S. No.
1	Digital multimeter: 3½ digit display, 9999 counts digital multimeter measures V_{AC} , V_{DC} (100V max), R_{AC} , R_{DC} (10amp max) for Resistance (100 Ω to 100k Ω), capacitance and Temperature.	1, 2, 3, 6, 7
2	Slotted meter screw gauge: Range: 0-25mm, Resolution: 0.01mm, Accuracy: ± 0.02 mm or better.	2
3	Resistance Box: 4 decade ranges from ohm to $\infty \Omega$, accuracy $\pm 1\%$ to $\pm 5\%$	1, 2, 3, 6, 7
4	Battery (Duracell): 6-12 V, 1A	1, 2, 3, 6, 7
5	Wheatstone bridge, Galvanometer and Jockey	2
6	Potentiometer	2
7	1 m, gull's distance meter	5
8	Resonance tube, tuning fork	4
9	Diode cell and Voltmeter cell	2
10	LASER kit	8
11	Conductivity meter, conductance range: 10 μ S/cm to 200 mS/cm, Cell constant = digital, 0.1 to 2.00, Temp. range: 0 to 100°C	11, 12
12	Electronic balance, with the scale factor of 0.001gm to 500gm pan size	3, 4

S. No.	Equipment Name with Broad Specifications	Exp. S. No.
10	100 mHz, response time 2-5 sec., power requirement 90-250V, 10 watt	
12	Simple distillation unit	15

8. UNDERPINNING THEORY COMPONENTS

9. The following topics/sub-topics are to be taught and assessed in order to develop UOs for 8th level, the UOs to attain the identified competencies.

Unit	Unit Outcomes (UOs) in cognitive domain	Topics and Sub-topics
Physics		
Unit-I Electricity and Capacitance	1a. Explain working of the given capacitor. 1b. Calculate the equivalent capacitance and energy stored in the given combination of capacitors. 1c. Calculate the voltage in various arrangement of the given electric circuit. 1d. Calculate the value of the given resistance using the principle of Wheatstone's bridge. 1e. Calculate the emf of the given cell using potentiometer.	1.1 Capacitors and capacitance. 1.2 Parallel plate capacitor, effect of dielectric on capacitance. 1.2 Combination of capacitors, energy stored in a capacitor. 1.4 Cells, emf of cell, internal resistance of cell, Kirchhoff's laws, Wheatstone's bridge. 1.5 Potential gradient, potentiometer.
Unit-II Radioactivity and Ultrasonic Waves	2a. Describe the phenomenon of radioactivity for the given system. 2b. Calculate half-life period of given radioactive substance. 2c. Calculate the value of the period, frequency and velocity of the given type of wave. 2d. Describe the properties of given ultrasonic waves. 2e. Describe the properties of the given Piezoelectric material. 2f. Explain the production of ultrasonic waves using the given equipment. 2g. Describe the Doppler effect for the given application.	2.1 Radioactivity of α and β particles and their properties. 2.2 Radioactive decay law, half-life period. 2.3 Sound waves, amplitude, frequency, time - period, wavelength and velocity of wave, relation between velocity, frequency and time - period of wave. 2.4 Ultrasonic waves, properties of ultrasonic waves. 2.5 Piezo-electric effect, Piezo materials: Natural (Quartz, Synthetic: Gelatin, orthophosphate). 2.6 Generation of ultrasonic waves using Piezo-electric effect. 2.7 Applications of ultrasonic waves. 2.8 Doppler Effect and its applications.
Unit-III Photo electronics.	3a. Explain concept of photoelectric effect for the given materials. 3b. Explain the working of the given	3.1 Planck's hypothesis, properties of photons, photoelectric effect, threshold frequency, threshold

Unit	Unit Outcomes (UOs) in cognitive domain	Topics and Sub-topics
X-Rays and LASERS	4a. Explain the production of X-Rays from given material with its properties and applications. 4b. Differentiate between LASER and given colour of light. 4c. Describe the working of a typical LASER system and its applications.	4.1 wavelength, stopping potential, Work function, characteristics of propagating light, Einstein's photoelectric equation. 4.2 Photoelectric cell and LDR: principle, working and applications. 4.3 Production of X-rays by Moseley's law, production, properties and applications of X-rays. 4.4 Laser, properties of laser, characteristics: spontaneous and stimulated emission. 4.5 Population Inversion and excitation, optical pumping, three energy level system: He-Ne Laser, applications of Laser.
Chemistry		
Unit-IV Water Treatment and analysis	4a. Describe the hardness in given water source. 4b. Calculate the hardness of water for the given data. 4c. Describe the effects of hard water in the given boilers. 4d. Explain the given type of water softening process. 4e. Describe the purification of municipal water for the given process. 4f. Describe the reverse osmosis process for the given type of water. 4g. Describe the given process of desalination of water.	4.1 Hardness, types of hardness, soap solution method, EDTA method. 4.2 Effect of hard water on boilers and prevention: Boiler corrosion, scale, emulsion, priming and foaming, scales and sludges. 4.3 Water softening: lime soda process, ion exchange process, zeolite process, ion exchange process, cation exchange and anion exchange. 4.4 Municipal water treatment: Sedimentation, coagulation, filtration and sterilization. 4.5 Waste water, characteristics, BOD and COD, Sewage treatment, recycling of waste water. 4.6 Desalination process by reverse osmosis.
Unit-V Electrochemistry and Batteries	5a. Differentiate the electrical conductance in given metals and electrolytes. 5b. Identify factors affecting conductivities of the given solution. 5c. Describe the construction of given	5.1 Electrolytic conductance in metals and electrolytes, specific conductance, equivalent conductance, cell constant. 5.2 Conductance: Nature of solute, nature of solvent, temperature, concentration, reduction



Unit	Unit Outcomes (UOs) or Competency Outcomes	Topics and Sub-topics
	electrodes. 5a. Describe the principle for measuring the strength of given acid and base. 5b. Calculate specific and equivalent conductance of given electrolyte. 5c. Describe construction and working of given type of battery.	5.1 Electrodes: Hydrogen electrode, calomel electrode and glass electrode. 5.2 Conductometric titration. 5.3 Batteries: Dry cell, Leclanche battery, and Acid storage cell and Ni-Cd battery, Hydroxyl cell, Lithium ion battery.
Unit-VI Metals, Alloys and Insulators	6a. Discuss the properties of the given metal. 6b. Select the most convenient material for given application. 6c. Discuss the properties and uses of the given alloy. 6d. Select the best insulator for given system. 6e. Describe given techniques of material operation.	6.1 Properties of metals like copper, Aluminium, tungsten, platinum, nickel. 6.2 Thermocouple alloy: Composition and characteristics of nickel alloy, platinum rhodium, copper rhodium, chrome-nickel alloy. 6.3 Electrical insulators: Classification, Solid: ceramic, mica, asbestos, mel, formaldehyde resin and glass, Liquid: oil, oil, Gaseous: air, gases, hydrogen and nitrogen gas. 6.4 Types of rubber: Natural and, synthetic, processing of natural rubber, Synthetic rubber: Properties and applications of Buna-N, Thiokol, Neoprene. 6.5 Process industries: unit operations: Evaporation, condensation, Distillation, Energy balance and mass balance for above processes. 6.6 Nanomaterials: Applications of Fullerene, Graphene.

Note: In attaining the UOs and competency outcomes listed UOs need to be undertaken to achieve the application level as indicated in Bloom's Cognitive Domain Taxonomy.

10. SUGGESTED SPECIFICATION TABLE FOR OPEN-BOOK PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			B Level	C Level	A Level	Total Marks
Physics						
I	Capacitors and conduct electricity	8	02	05	03	10
II	Radio waves and ultrasonic waves	12	03	04	05	12
III	Fibre optics, X-rays and LASER	12	03	02	05	10
Chemistry						
IV	Water treatment and analysis	12	02	02	06	10

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			B Level	C Level	A Level	Total Marks
V	Electrochemistry and Batteries	12	03	05	04	12
VI	Metals, Alloys, Insulators	12	02	02	06	10
Total		64	15	22	33	70

Legend: B=Remember, C=Understand, A=Apply and above notation is followed accordingly.

Note: The specification table given in the general guide has to assist students for their preparing and to teachers to teach and assess students with respect to attainment of UOs. The actual marks in different questions varied as per the level and as in the question paper set out from above table.

11. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related activities to do which can be undertaken to increase the attainment of the learning outcomes in this course.

- Seminar on any relevant topic.
- Library survey regarding Engineering related word and Recent industries.
- Prepare power point presentation in mini case for showing applications of lasers.

12. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are simple strategies which the teacher can use to accelerate the attainment of the various learning outcomes of this course.

- Most of open online courses (MOOCs) may be used to learn various topics in Physics.
- Unit-III and No. 4 does not mean only the traditional lecture method, but all different types of teaching methods and media that are to be employed to develop the outcomes.
- About 14-20% of the topics/Approaches which is relatively simple or descriptive in nature is to be given to the students for self-directed learning and assess the development of the UOs through classroom presentations (see implementation guidelines for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for co-curricular activities.
- Guide student in undertaking mini-projects.

13. SUGGESTED MICRO-PROJECTS

Only one mini-project is planned to be undertaken by a student assigned to another in the beginning of the semester. The project to submit by the end of the semester to develop the industry-oriented UOs. Each mini-project should encompass two or three UOs which are in fact, an integration of UOs, UOs and ADGs. 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 contributions in the project work and give a seminar presentation on a formal submission. The total duration of the micro-project should not be less than 15 (fifteen) student engagement hours over 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 he/she contributed to the projects of the industry. A suggestion is to go on here, some of the projects could be added by the concerned faculty.

- Capacitors: Prepare the most list of various types of capacitors.



- Current electricity:** Make one circuit with bulb, LED connected in parallel or series.
- Photoresistor:** Prepare working model of simple photoresistor using LED.
- LASER:** Prepare the new information on the industrial application of LASER.
- Water analysis:** Collect water samples from different water sources and determine the conductivity, dissolved solid suspended particles in the sample.
Water treatment: Collect 5 to 8 water samples from borewell and determine the change of alkalinity, hardness, pH, TDS, etc.
- Water analysis:** Determine the soap forming capacity of five water on milliequivalent of soap.
- Energy sources:** Prepare chart showing different types of energy sources with their uses.
- Electrolytic Cells:** Collect fruit and vegetable and prepare working model of cell.
- Electric Insulators:** Collect the samples of different insulators and list their industrial applications.
- Thermocouples:** Prepare chart showing different types of thermocouples with their applications used in electronic and electrical industry.

- b. <http://nord.ac.in/course.php?discip=ind>
- c. <http://hyperphysics.phy-astr.gsu.edu/hbase/hpl.html>
- d. www.physicshighschool.com
- e. www.physics.org
- f. www.fearofphysics.com
- g. www.kit-zeppelion.com/physicszone/
- h. www.chemistryteaching.com
- i. www.ccsimlab.rup.com
- j. www.gchem1.com
- k. www.mindspark.co.uk/gam
- l. www.vcs.org
- m. www.chemcollective.org
- n. www.wpi.org
- o. www.cmi.ac.in/

14. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Physics Textbook Part I - Class XI	Karlikar, J. V.; Joshi, A. W., Matham, Arundhati et al	National Council of Education Research and Training, New Delhi, 2015, ISBN- 8174375843
2	Physics Textbook Part II - Class XI	Karlikar, J. V.; Joshi, A. W., Matham, Arundhati et al	National Council of Education Research and Training, New Delhi, 2015, ISBN- 8174375860
3	Physics Textbook Part I - Class XII	Karlikar, J. V.; Joshi, A. W., et al	National Council of Education Research and Training, New Delhi, 2013, ISBN- 8174376314
4	Physics Textbook Part I - Class XII	Karlikar, J. V.; Joshi, A. W., et al	National Council of Education Research and Training, New Delhi, 2013, ISBN- 8174376317
5	Engineering Chemistry	Agarwal, Nisha	Cambridge university press, New Delhi, 2015, ISBN- 9781107476410
6	Engineering Chemistry	Datta, S. S.	3 rd Edition Publication, New Delhi, 2013, ISBN- 8121972678
7	Engineering Chemistry	John & John	Engineering Publications, New Delhi, 2013, ISBN- 9552-60902
8	Engineering Chemistry	De Vazirani, S.	Wiley India Pvt Ltd, New Delhi, 2013, ISBN- 9788126575242
9	Chemistry for Engineers	Aggarwal, Rakesh	Wiley India Pvt Ltd, New Delhi, 2014, ISBN- 9788126575784

14. SOFTWARE/LEARNING WEBSITES

- $$\therefore \text{http://ncicb.nci.nih.gov/xml/owl/EVS/Thesaurus.owl#C112}$$



Program Name : Electrical Engineering Program Group
 Program Code : EE_LPEE
 Semester : Second
 Course Title : Fundamentals of Electrical Engineering
 Course Code : 22212

1. RATIONALE

Technicians in electrical engineering are expected to handle electrical circuits, instruments, devices and equipment's. Besides this, operations about power system, protection scheme and economics are to be studied and developed by the students. The basic aim of this course is that, the student must learn the basic concepts, rules and laws of electrical engineering, currents and practice is thereof. The basic concepts of electrical engineering in this course will be very useful for understanding of other higher level subjects in further study.

2. COMPETENCY

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

- Use basic principles of electrical engineering in different applications.

3. COURSE OUTCOMES (COs)

The theory practical experience and relevant skill set 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.

- Determine various parameters used in electric circuit.
- Use of basic laws in electrical engineering.
- Make use of capacitor in different conditions.
- Use principles of magnetism.
- Use principles of electromagnetic.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Total L+T+P	Examination Scheme												
L	T	P		Paper theory	Theory						Skill					
					ESE		PA		TSP		ESE		PA		TSP	
Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
1	1	2	3	1	10	20	10	20	10	20	10	20	10	20	10	

Note: For the theory, P.T. Exam is to be held. The marks are given as per the percentage distribution in the scheme mentioned in the end of the examination. The marks in the average of 2 years to be taken during the evaluation for the assessment of the candidate. Minimum 10% required for the recognition of No. COs.

Legend: Lettering: T= Tutorial/ Lecture/ Seminar/ Theory, P= Practical, C= Credit, ESE= End Semester Examination, PA= Progression Assessment.

5. COURSE MAP (with learning Out, POs, COs, ADOs and topics)

This course map illustrates a framework of the flow and linkage of the topics at course levels at various categories. A subsequent section to be attained by the student by the end of the

course in all domains of learning in terms of the industry employer identified categories depicted at the centre of this map.



Figure 1 - Course Map

6. SUGGESTED PRACTICALS/EXERCISES

The practicals in this section are POs and sub-components of the COs to be developed and tested in the student for the attainment of the competency.

S. No.	Practical Outcomes (POs)	Unit No.	Approx. Hrs. Required
1	Trace over electrical engineering laboratory a. Draw basic electrical circuit diagrams. b. Prepare chart of electrical safety and demonstrate the operation of the extinguishing equipment. c. Demonstrate and use safety tests such as phase, voltage divider, insulation tester, tester.	I	05
2	Measure of EMF of a cell source and to calculate its internal resistance by connecting it to an external load. Part I		05
3	Measure of EMF of a cell source and to calculate its internal resistance by connecting it to an external load. Part II		05
4	Determine the equivalent resistance of a given network.	II	05



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Determine the equivalent resistance of Parallel connection	I	02
2	Use Kirchhoff's current law and Kirchhoff's voltage law to determine currents and voltages in electric circuits. Part I	II	03
3	Use Kirchhoff's current law and Kirchhoff's voltage law to determine currents and voltages in electric circuits. Part II	II	02
4	In the series connected circuits determine the equivalent capacitance.	III	02*
5	In the parallel connected circuits determine the equivalent capacitance.	III	02
10	Determine the time constant of RC circuit analytically and graphically including plotting the charging and discharging curves of a capacitor (C), through resistor (R). Part I	III	02
11	Determine the time constant of RC circuit analytically and graphically including plotting the charging and discharging curves of a capacitor (C), through resistor (R). Part II	III	02
12	For the given magnetic material find the B-H curve and hysteresis loop. Part I	IV	02*
13	For the given magnetic material find the B-H curve and hysteresis loop. Part II	IV	02
14	For the given magnetic material find the B-H curve and hysteresis loop. Part III	IV	02
6	Use Faraday's first law of electromagnetic induction to analyse the behaviour of statically induced e.m.f and dynamically induced e.m.f in the given circuit. Part I	V	02*
10	Use Faraday's first law of electromagnetic induction to analyse the behaviour of statically induced e.m.f and dynamically induced e.m.f in the given circuit. Part II	V	02
	Total		32

Note

- Suggested list of PrOs is given in the above table. More such PrOs can be added to meet the CO based competency. A judicious list of maximum 12 or more practical tests to be performed out of which the percentage marked as * are compulsory, so that the student attains the 'Proficiency Level of Data / Experimentation Domain Test/competency' as generally required by the industry.
- The 'Practical' and 'Practical related data' associated with each PrOs 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	Observations and Recording	10
5	Interpretation of result and Conclusion	20
6	Answer to sample questions	10
7	Submission of report on time	0
	Total	100

The above PrOs also comprise of the following essential 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 PrOs 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 Krauthorst's 'Affective Domain Taxonomy' should gradually increase as is listed below:

- Valuing Level - 1st year.
- Appreciating Level - 2nd year.
- Characterizing Level - 3rd year.

7. MAJOR EQUIPMENT/INSTRUMENTS REQUIRED

The major equipment with broad specifications mentioned below is to be procured by the conduct of experiments, as well as aid to procure equipment by the administrators.

S. No.	Equipment Name with Broad Specifications	Exp. No.
1	D.C. Ammeter (range 0-5 V, 7 pin type analog PMMC type as per relevant IIS standard)	1
2	D.C. Voltmeter (range 0-100 mV/V, 7 pin type analog PMMC type as per relevant IIS standard)	1
3	D.C. Voltmeter (range 0-50 V, 7 pin type analog PMMC type as per relevant IIS standard)	11
4	Resistor (0.25W/0.5W/1W) 100 ohm wire wound resistor or epoxy resin or glass film using to be with two fixed and one sliding contact	11
5	Rheostat (0-25 Ohm/0.5W) 100 ohm wire wound rheostat or epoxy resin or glass film using to be with two fixed and one sliding contact	11
6	Rheostat (0-25 Ohm/0.5W) 100 ohm wire wound rheostat or epoxy resin or glass film using to be with two fixed and one sliding contact	11
7	Rheostat (0-25 Ohm/0.5W) 100 ohm wire wound rheostat or epoxy resin or glass film using to be with two fixed and one sliding contact	11
8	D.C. Supply, 0-25 V dc supply with built-in rectifier to convert a.c. to D.C.	1
9	Oil filled capacitor, 100 pF, 100 V oil filled capacitor with rated voltage up to 500V	1
10	Electrolytic type capacitor, 100 pF, 100 V electrolytic capacitor with rated voltage up to 500V	1
11	Galvanometer, 150 mV/0.5 mV/1 PMMC type analog portable galvanometer	1

UNDERPINNING THEORY COMPONENTS

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



Unit	Unit Outcomes (UOs) in cognitive domain	Topics and Sub-topics
Unit - I Basic Electrical Parameters	1a. Distinguish the features of the given electric parameters. 1b. Explain the given terms. 1c. Describe the given effect of the electric current with a relevant application. 1d. Calculate work, power and energy for given circuit.	1.1 Direct Current (DC), Alternating Current (AC), Voltage Source and Current Source: Ideal and Practical. 1.2 Electric Current, Electric Potential, Potential Difference (P.D), Electro-Motive Force (EMF). 1.3 Electrical Units, Power and Energy. 1.4 Resistance, Resistivity, Conductivity, Effect of Temperature on Resistance. 1.5 Types of Resistors and their Application. 1.6 Heating Effect, Magnetic Effect, Chemical Effect of Electric Current.
Unit - II D.C. Circuits	2a. Apply Ohm's law to calculate internal resistance of a given circuit. 2b. Distinguish the given two parameters. 2c. Calculate equivalent resistance for given circuit. 2d. Apply Kirchhoff's laws to determine current and voltage in a given circuit.	2.1 Ohm's Law, Internal resistance of source, internal voltage drop, Terminal Voltage. 2.2 Resistance in Series, Resistance in Parallel. 2.3 Active, Passive, Linear and Non-linear Circuit, Unilateral Circuit and Bilateral Circuit, Passive and Active Network, Node, Branch, Loop, Mesh. 2.4 Kirchhoff's Current Law, Kirchhoff's Voltage Law.
Unit- III Capacitors	3a. Describe the construction of the given types of capacitor. 3b. Describe the working of the capacitor in given circuit. 3c. Calculate equivalent capacitance in given circuit. 3d. Plot charging and discharging curves for a given capacitor.	3.1 Capacitor, Types, Polar Capacitor. 3.2 Various combinations of capacitor. 3.3 Energy Stored in Capacitor. 3.4 Charging and Discharging of Capacitor. 3.5 Dielectric strength and Dielectric strength. 3.6 Types of Capacitor and Application.
Unit- IV Magnetic Circuits	4a. Distinguish the given terms related to a magnetic circuit. 4b. Calculate various parameters of a given magnetic circuit. 4c. Plot B-H curve and hysteresis loop for a given magnetic material. 4d. Compare the performance of the given series and parallel magnetic circuit.	4.1 Magnetic Effect of Force, Flux, Flux density, magnetic Flux materials. 4.2 Magnetomotive-Force (MMF), Ampere Turns (AT), Reluctance, Permeance, permeability. 4.3 Electric and Magnetic circuit: Series Magnetic and Parallel Magnetic circuit. 4.4 Magnetization Curve (B-H) Curve. 4.5 Magnetic Hysteresis: Hysteresis Loop Application.

Unit	Unit Outcomes (UOs) in cognitive domain	Topics and Sub-topics
Unit- V Electromagnetic Induction	5a. Describe the use of Faraday's laws of electromagnetic induction in the given application. 5b. Distinguish between the given types of EMFs. 5c. Apply Faraday's laws to calculate induced EMF in given circuit. 5d. Calculate self inductance and energy stored in magnetic field in given circuit.	5.1 Development of Induced EMF and Current: Faraday's Law of Electromagnetic induction. 5.2 Static and dynamic emf, Lenz's Law, Fleming's Right hand rule. 5.3 Self Inductance, Coefficient of self-inductance (L), Mutual inductance, Coefficient of Mutual inductance, Coefficient of coupling. 5.4 Inductance in series. 5.5 Types of inductor, their applications and Energy Stored in Magnetic Field.

Note: To attain the UOs and competencies 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	L Level	A Level	Total Marks
I	Basic Electrical Parameters	11	12	06	04	12
II	D.C. Circuits	11	12	03	07	12
III	Capacitors	11	12	03	07	12
IV	Magnetic Circuits	13	12	04	08	14
V	Electromagnetic Induction	11	14	06	11	20
Total			61	22	36	70

Legend: R- Remember, L- Understand, U- Apply and above the given's learned knowledge. Any Two question table provides general guideline to a question paper for the following and to maintain a fair and accurate question table respect to attainment of UOs. The actual distribution of marks at different terminal levels for R, L and A in the question paper may vary from the sample.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related assignments as to how they can be undertaken to accelerate the attainment of the various outcomes. Activities are:

- Illustrate situations where in electrical energy is required.
- Prepare model of the form of electromagnetic.
- Prepare power point presentation related to basic life electrical engineering.
- Prepare a chart of electric circuit elements and relevant industrial applications.
- Prepare question bank referring the MSBTE question paper.

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 course (MOOCs) may be used to teach various topics sub-topics.



- b. *Unit 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. *Item 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 CCs 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 group 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. It is to be submitted by the end of the semester to develop the industry oriented CCs. Each micro-project should encompass two or more CCs which are in fact an integration of Pres. CCs and ADCKs. The micro-project could be industry application based, internet-based, work experience, 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. **Types of Electrical equipment:** Prepare chart showing real-life examples indicating various types of electrical equipment.
- b. **Resistance:** Collect photographs of resistances and prepare models of simple series circuit and parallel circuit.
- c. **Capacitance:** Collect photographs of capacitors and prepare models of simple series circuit and parallel circuit.
- d. **Inductance:** Collect photographs of inductance and prepare models of simple series circuit and parallel circuit.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	ATLAS Book of Electrical Technology Vol. 1	Herman B. I. Therman, A. S.	S. Chand and Co. New Delhi, 2014 ISBN: 9788121924495
2	Basic Electrical Engg.	Muthu, V. R.	Tata McGraw-Hill, New Delhi ISBN: 978-0-07-096572-5
3	Electrical Technology	Hughes, Edward	Pearson Education, New Delhi ISBN-13: 978-0-58241514-6
4	Fundamentals of Electrical Engineering	Savarna, S. D. Lal	Cambridge University Press, New Delhi ISBN: 9781107464317
5	Basic Electrical and Electronics Engineering	Jegathesan, V.	Wiley India, New Delhi, 2014 ISBN: 9788126525513



14. SOFTWARE/LEARNING WEBSITES

- a. www.youtube.com
- b. www.gutenberg.org
- c. www.wikipedia.com
- d. www.electricaltechnology.org
- e. www.fundamentals.com
- f. www.electrical4u.com

Program Name : Electrical Engineering Program Group
 Program Code : EE-EP-1
 Semester : Second
 Course Title : Elements of Electronics
 Course Code : 22213

1. RATIONALE

Electronic engineers have to deal with the various electronic components while maintaining various electrical systems. The study of their operating principles and handling of various electronic devices will help them in troubleshooting electronics equipment used in electrical system. This course is developed in such a way that students will be able to apply the knowledge to solve broad electronic engineering application problems in electrical engineering field.

2. COMPETENCY

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

- Use electronic components and circuits in electrical equipment.

3. COURSE OUTCOMES (COs)

The following practical experiences and relevant 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 resistors and diode in different electronic circuits.
- Use diode in rectifiers and filters.
- Use BJT and FET in electronic circuits.
- Use DC regulated power supply.
- Use transistor as an oscillator.
- Use of logic gates in electronic circuits.

4. TEACHING AND EVALUATION SCHEME

Teaching Scheme			C L T P	Evaluation Scheme												
L	T	P		Paper	Theory						Practical					
					ESE		PS		Total		ESE		PS		Total	
Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
20	10	20	10	20	10	40	20	10	30	10	70	30	70	30	70	30

Note: L-Lecture, T-Tutorial, P-Practical, C-Computer, ESE-End Semester Examination, PS-Progressive Test Scheme.

Legend: L-Lecture, T-Tutorial, P-Practical, C-Computer, ESE-End Semester Examination, PS-Progressive Test Scheme.

5. COURSE MAP (with sample COs, POs, LOs, ABs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of its various 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 in the course map.



Figure 1 - Course Map

6. SUGGESTED PRACTICALS - EXERCISES

The practicals / exercises are POs that sub-components of the COs to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (POs)	Unit No.	Approx. Hrs. required
1	Test the performance of PN junction diode.	1	10
2	Test the performance of Zener diode.	1	10
3	Test the performance of photo diode by varying the light intensity as well as distance.	1	10
4	Build half-wave rectifier on breadboard.	1	10

8. UNDERPINNING THEORY COMPONENTS

The following types/sub-topics is to be taught and assessed in order to develop CLOs by achieving the COs to attain the identified competency.

Unit	Unit Outcomes (UOs) (Cognitive Domain)	Topics and Sub-topics
Unit – I Semiconductor Diode	1a. Describe the construction and working principle of the given diode. 1b. Describe characteristics and applications of the given diode. 1c. Describe application of the given opto-coupler. 1d. Compare performance parameters of the given devices.	1.1. Construction, symbol, working principle, specifications, applications forward and reverse biasing and V-I characteristics of following semiconductor diodes: PN junction diode, Zener diode. 1.2. Special diodes: LED, Photodiode, LASER diode and Power diode.
Unit – II Rectifiers and Filters	2a. Describe working of the given rectifier. 2b. Compare the performance of the given rectifiers. 2c. Describe the working of the given type of filter circuit. 2d. Calculate ripple factor, PIV and efficiency of the given type of rectifier. 2e. Justify the selection of component for the given application.	2.1 Types of Rectifiers: Half Wave, Full Wave Rectifier Bridge and center tap type 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 FIV of diode, TUF and efficiency of rectifier. 2.3 Types of Filters: Shunt capacitor, Series inductor, LC and π filter.
Unit – III Transistor	3a. Differentiate the working of the given type of transistor. 3b. Compare the performance of the given transistor configurations.	3.1. Different types of transistors: PNP, NPN. 3.2 Transistor configurations: CB, CE, CC. 3.3 Transistor as a switch.
Unit – IV Regulators and power supply	4a. Explain the concept of the given type of regulation. 4b. Calculate output voltage of the given regulation. 4c. Describe the working of the given type of as variable regulation.	4.1 Load and line regulation. 4.2 Basic Zener diode voltage regulator. 4.3 Regulator IC: $78XX$, $79XX$, IC 723 as fixed, variable and Dual-Regulated, CC power supply. 4.4 Construction and operation of DC Regulated power supply.
Unit – V Oscillators	5a. Explain the given type of feedback. 5b. Compare the performance of the given two types of feedback. 5c. Calculate frequency of oscillations for the given data. 5d. Describe working of the given type of oscillator with circuit diagram.	5.1 Types of feedback: Positive feedback, Negative feedback, Barkhausen criteria. 5.2 Oscillator: Circuit Diagram and working of LC, RC and Crystal oscillator.

Unit	Unit Outcomes (UOs) (Application Domain)	Topics and Sub-topics
Unit-VI Digital Electronics	6a. Convert the given decimal number into binary, octal and hexadecimal number system. 6b. Describe the given gate to work as universal gate. 6c. Build the given logic operators with the given types of gates. 6d. Construct the given type of flip flop with switches.	6.1 Number System: binary, octal, decimal and hexadecimal number system. 6.2 Boolean algebra: DeMorgan's theorem. 6.3 Logic gates: Logic symbol, logical expression and truth table of AND, OR, NOT, EX-OR and EX-NOR gates. 6.4 Universal gates: NAND and NOR. 6.5 Flip flops: Symbol, truth table and working of SR, JK, D, T and D flip flops.

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	L Level	A Level	Total Marks
I	Semiconductor Diode	05	2	2	2	05
II	Rectifiers and Filters	08	2	2	4	7
III	Transistor	12	3	9	0	15
IV	Regulators and power supply	08	3	4	5	12
V	Oscillators	06	3	2	3	10
VI	Digital Electronics	08	3	2	4	10
Total		48	15	29	26	70

Legend: R=Remember, L=Understand, A=Apply and above Bloom's Revised Taxonomy.

Note: This specification table provides general guidelines to assist design for the planning and a teachers to teach and assess students' work against the attainment of CLOs. They need not adhere to marks at different taxonomy levels for R, L and A in the question paper as a rigid specification 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.

- Prepare projects 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 a chosen circuit.
- He database a market survey of different semiconductor components.
- Trace various electronics components in electrical components.

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.



- c. Massive open online courses (MOOCs) may be used to teach various topics subsequently.
- d. Unit 10, Para 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.
- e. About 15-20% of the topics/sub-topics, which is relatively simple 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 detail).
- f. With respect to item No 10, teachers need to ensure to create opportunities and provisions for co-curricular activities.
- g. Guide students for using data manuals.
- h. Guide students in undertaking mini-projects.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to teacher 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, LOs and ADUs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field based. Each student will have to maintain a record consisting of individual contribution in the project work and give a seminar presentation of a series of findings on. 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 suggested list is given below. Some micro-projects could be added by the concerned faculty.

- a. **Diode** Build a circuit on general purpose PCB to clip a positive or negative half cycle in 1:5 ratio waveform with output signal 5Vp-p and prepare the report. (Duration: 8-10 hours)
- b. **Diode** Build a circuit on general purpose PCB to clamp a waveform at 5Vp using diode and passive components.
- c. **Photodiode** Build a circuit on breadboard to turn the relay on and off by using photo diode and prepare a report.
- d. **Rectifier** Build a half wave rectifier for 6V, 500mA output current in general purpose PCB.
- e. **Rectifier** Build a full wave bridge rectifier with capacitor filter for 6V, 50mA output current in general purpose PCB.
- f. **Voltage Regulator** Build a circuit of 12V regulated power supply in general purpose PCB for 5V and 100mA output.
- g. **Oscillator** Build circuit to generate audio frequency.
- h. **Digital Electronics** Build LED blinking circuit using suitable digital circuit.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Electronic Devices and Circuit Theory	Boylestad, Robert, Nashelsky, Louis	Pearson Education, New Delhi, 2014, ISBN
2	Electronic Devices and Circuit: An introduction	Motterhead, Allen	Goodman Publishing Co. New Delhi, ISBN: 9788176292654

S. No.	Title of Book	Author	Publication
3	The Art of Electronics	Horowitz, Paul, Hill, Winfield	Cambridge University Press, New Delhi 2015, ISBN: 9781107168975
4	Fundamentals of Electronic Devices and Circuits	Bell, David	Oxford University Press, New Delhi, 2017, ISBN: 9780195425149
5	Electronic Devices and Circuits	Malik, Anil K.	Wiley India, New Delhi, ISBN: 9781112651691
6	Princeton Selector Handbook	-	Tower's International Bookshops, London; 1974; ISBN: 9780512006880

14. SOFTWARE/LEARNING WEBSITES

- a. www.tpub.com
- b. www.circuitstoday.com
- c. www.electronicshobby.com
- d. www.tutorize.com
- e. www.circuitstoday.com
- f. www.learn75.com
- g. www.circuitstoday.com
- h. www.khanacademy



S.	Practical Outcomes (PrOs)	Unit	Approx. Hrs.
No.		No.	Required
1	Assemble/disassemble impulse turbine model	1	02
4	Assemble/disassemble reaction turbine model	1	02
5	Identify the components of gas turbine model	11	02
6	Assemble/disassemble gas turbine model	11	02
7	Identify components of 4-stroke diesel engine model	11	02
8	Assemble/disassemble micro-Peltan turbine	11	02
9	Assemble/disassemble micro-turbines turbine	11	02
10	Assemble/disassemble centrifugal pump	11	02
11	Assemble/disassemble hydraulic pump	11	02
12	Assemble/disassemble submersible pump	11	02
13	Perform test on centrifugal pump to calculate overall efficiency	11	02
14	Assemble/disassemble reciprocating air compressor	19	02
15	Assemble/disassemble screw compressor	19	02
16	Assemble/disassemble centrifugal compressor	19	02
17	Identify the components of refrigeration system (VCR)	19	02
18	Identify the components of air conditioning system (VCR)	19	02

Note

* A suggestive list of PrOs is given in the above table. More such PrOs can be added to enhance the skills and competency. A practical test of achievement is set which is practised and is to be performed and to which the practicals marked as "*" are compulsory. In this the student can take the maximum level of Data's Performance Domain Indicators as per the student required by the industry.

ii. The Process and Product related skills associated with each PrOs are assessed according to a suggested criteria given below.

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental setup	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 on time	10
Total		100

The above PrOs also comprise of the following social skills attributes which are Affective Domain Outcomes (ADOs) that are best developed through the experiences like these experiences.

- Follow safety practices.
- Practice good lab discipline.
- Get along and work as a leader's team member.
- Maintain tools and equipment.
- Follow ethical practices.

The ADOs are not specific to any one PrOs 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. However, the level of achievement of the ADOs according to K. L. Mohan's Achievement Domain Framework should gradually increase as planned below.

- * Achieving level at 1st year
- * Organising level at 2nd year
- * Characterising level at 3rd year

7. MAJOR EQUIPMENT/INSTRUMENTS REQUIRED

The major equipment with broad specifications should be purchased here with a list in conformity in conduct of experiments as well as a list of precise equipment by administrators.

S. No.	Equipment Name with Broad Specifications	PrO. S. No.
1	Model of impulse water turbine (suitable for dismantling)	1
2	Impulse steam turbine (suitable for dismantling)	2, 3, 4
3	Model of gas turbine (suitable for dismantling)	5, 6
4	Model of multi-cylinder 4-stroke diesel engine	7
5	Micro-Peltan turbine	8
6	Micro-turbines turbine	9
7	Centrifugal pump (suitable for dismantling)	10
8	Hydraulic test pump (suitable for dismantling)	11
9	Submersible pump (suitable for dismantling)	12
10	Test rig of centrifugal pump to find overall efficiency (to conduct test rig with digital display)	13
11	Two stage reciprocating air compressor (suitable for dismantling)	14
12	Screw air compressor (suitable for dismantling)	15
13	Centrifugal air compressor (suitable for dismantling)	16
14	Unitary refrigeration system (VCR)	17
15	Unitary air conditioning system (VCR)	18

8. UNDERPINNING THEORY COMPONENTS

The following topics/sub-topics should be taught and assessed in order to develop ADOs for achieving the ADO to attain the identified competencies.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – 1 Steam Boilers and Steam Turbines	1a. Describe given thermodynamic properties 1b. Interpret the specified thermodynamic laws 1c. Apply in the working of the specified boiler 1d. Describe the function of the specified component of the	1.1 Specific volume, enthalpy, pressure, temperature, thermodynamic laws 1.2 First and second laws, thermodynamics 1.3 Basic concepts of wet steam, superheated steam, dryness fraction, degree of superheat 1.4 Babcock and Wilcox boiler, Cornish boiler 1.5 Various advantages and disadvantages (without construction details) 1.6 Layout of steam power plant 1.7 Steam nozzles – geometry, equation



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	1c. Explain the working of turbine with sketches.	Types of nozzles, Mach number, applications of nozzles. 1.3 Impulse and reaction turbines, necessity of compounding. 1.9 Control of pollution due to steam boilers.
Unit-II IC Engines and Gas Turbines	2a. Using sketches identify the specified component in the given type of IC engine. 2b. Explain the working of a 4-stroke diesel engine using sketches. 2c. Calculate brake thermal efficiency for the given data of an IC engine. 2d. Identify simple faults for the given situation of a cylinder. 2e. Identify the specified component in the sketch of the given type of gas turbine. 2f. Explain with sketches the working of given gas turbine with its applications. 2g. Explain with sketches the construction and working of a given gas turbine with its applications.	2.1 Types of IC engines, components of IC engines. 2.2 4 stroke diesel engines. 2.3 BHP, heat supplied and brake thermal efficiency of IC engine. 2.4 Common faults in IC engines. 2.5 Remedial measures to rectify the faults. 2.6 Types of gas turbines, applications of gas turbines. 2.7 Open and closed cycle gas turbines. 2.8 Control of pollution due to gas turbines and diesel engines.
Unit-III Fluid Machinery	3a. Identify the specified component in the sketch of the given type of hydraulic turbine. 3b. Explain with sketches the working of the given hydraulic turbine. 3c. Identify the specified component in the sketch of the given type of hydraulic pump. 3d. Explain with sketches the working of given type of hydraulic pump. 3e. Calculate the overall efficiency of the given centrifugal pump avoiding velocity diagram.	3.1 Hydraulic turbines, nozzle and diffuser. 3.2 Pelton turbine, Francis turbine, specific power of Pelton wheel. 3.4 Reciprocating and Rotary pumps. 3.5 Centrifugal pumps, centrifugal and jet pumps.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit-IV Air Compressors	4a. Identify the specified component in the sketch of the given type of compressor. 4b. Explain with sketches the working principle of the given type of compressor. 4c. Select the relevant compressor to be used for the given application with justification. 4d. Suggest the method to reduce energy consumption with justification.	4.1 Types of Air compressors, two stage compressing air, compression screw compressors, centrifugal compressors. 4.2 Methods to reduce power consumption of air compressors.
Unit-V Refrigeration and Air- conditioning	5a. State the HVAC requirement for the given situation. 5b. Identify components of typical refrigeration system in the given diagram with justification. 5c. Explain with sketches the working of specified refrigeration and/or air conditioning system. 5d. Identify the problem for the given failure of the component in the refrigeration. 5e. Suggest the solution for energy saving in the given simple situation with justification.	5.1 HVAC, Refrigeration, air conditioning, need of refrigeration, main components of vapour compression systems. 5.2 Domestic refrigerator and window air-conditioner. 5.3 ODP, thermocool, starting and defrost for direct expansion refrigeration and HP L.P. units. 5.4 Types of air conditioning systems - window, package, central air conditioning systems. 5.5 High and low temperature refrigeration and window air conditioner. 5.6 Methods of energy saving in refrigeration and air conditioning systems.

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	Steam Boilers and Steam Turbines	14	04	08	06	20
II	IC Engines and Gas Turbines	12	02	06	09	17
III	Fluid machinery	06	02	04	09	15
IV	Air compressors	06	02	02	04	08
V	Refrigeration and Air conditioning	10	04	06	09	19
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 crystal stick at the time of setting and to teachers to design and to give students with respect to preparation of QP. The exact distribution of marks at different secondary levels of R, U, and A in the question paper may vary from about 10%.



10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related *researchable* 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. Use collect relevant physical evidences for their student activities which will be useful for their placement interviews.

- Prepare posters based on practical performed in laboratory.
- Prepare a seminar on Solenoids used in power plants.
- Prepare a seminar on Solenoid control systems used in homes.
- Study control system for starting motor of IC engines and Battery Ignition system.
- Prepare a power point presentation on hydraulic turbines.
- Collect online animations showing working of different types of air compressors.
- Make a trouble shooting chart for Domestic refrigerators.
- Collect manufacturers' specifications for various refrigeration cycles.

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.
- Classroom*: Not a class room activity, but 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 students in undertaking minor projects.

12. SUGGESTED MICRO-PROJECTS

Only one minor-project is planned to be undertaken by a student that needs to be assigned to him/her in the **beginning** of the semester. She ought to submit it by the end of the semester to develop the industry-oriented COs. Each minor-project should encompass two or more COs which are in fact, an integration of PROs, TQs and ADRs. The minor-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 tasks and give a seminar presentation at a before submitting. The total duration of the minor-project should not be less than *15 (fifteen) 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 individual's undertaken to build up the self and confidence in every student to become problem solver so that she contributes to the progress of the industry. A suggestive list is given here. Similar micro-projects can be added by the concerned faculty.

- Steam Boilers and Turbines** – Draw electrical lay out of a typical power plant. (08 to 10 hours).
- IC Engines** – Collect leaflets of Diesel engine generator sets from market. Analyze and compare the specifications. (At least 04 different manufacturers) (08 to 10 hours).
- Gas Turbines** – Collect data of gas turbines used for power plants of different capacities from internet and list features like type, power, speed, fuel used. (At least 04) (08 to 10 hours).
- Hydraulic Turbines** – Prepare charts showing parts of different types of commonly used hydraulic turbines from reference books. (08 to 10 hours).

- Air Compressors** – Prepare charts of wiring diagram for a 2 stage compressor having an automatic ordered valve available in laboratory or in large or industry (08 to 10 hours).
- Refrigeration systems** – Students will make charts showing design of design of a 2 ton refrigeration window installation or a table top model. (08 to 10 hours).
- Refrigeration controls** – Make models of refrigeration controls demonstrating their functioning (at least 02) in a shop or workshop. Laboratory under guidance of teacher.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publisher
1	Elements of Mechanical Engineering	Munshi, V.K.	PHI Learning Pvt. Ltd., New Delhi 2012 ISBN: 9788120346799
2	Basic Mechanical Engineering	Agarwal, Basant, Arora, C.M.	WILEY India Pvt. Ltd., New Delhi 2008 ISBN: 9788126587344

14. SOFTWARE/LEARNING WEBSITES

- <http://www.instrumentationeng.com/eng/2013/06/working-principle-of-impulse-turbines.html>
- <https://www.youtube.com/watch?v=4d-gL090C8>
- <https://www.youtube.com/watch?v=s2W-GFFtNPNg>
- <https://www.youtube.com/watch?v=gq5m52x5N0>
- <https://www.grandmag.com/work-12-a-refrigeration.html>
- <https://www.gutenberg.org/resources/knowledge-base/what-is-a-gas-turbine.html>
- <https://www.youtube.com/watch?v=JDS0N75Ykcl>
- <https://www.scribd.com>



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

Program Code: CECBCSC/CHPSP/MECON/EA/WH/ED/EN/EE/ET/EM/ME/LE/

DIRECTOR/CAE/PG/AS/PO/PT/DO/VT/TT

Semester : Second

Course Title : Business Communication Using Computers

Course Code : 22009

1. RATIONALE

Communication is the key factor for growth 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 training subordinates to achieve desired goals at workplace. It is very critical for an entrepreneur to run organization successfully by communicating effectively and skilfully with employees, customers and investors. Thus this course has been designed to enhance the skills to "Communicate effectively and skilfully at workplace".

2. COMPETENCY

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

- Communicate effectively and skilfully at workplace.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skill associated with this course are to be taught and implemented, so that the student derive states the following *industry oriented COs*, associated with the above-stated competency.

- Communicate effectively by avoiding barriers in various formal and informal situations.
- Communicate skilfully 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

Theory Semester			Credit (L+T+P)	Examination Scheme											
L	T	P		Theory						Practical					
				Pages	ESE		PA		Total	ESE		PA		Total	
					Max	Min	Max	Min		Max	Min	Max	Min		Max
—	—	—	—	—	—	—	—	—	—	15	5	20	10	20	20

Note: For only practical courses, the PA (15 marks) has two components under practical marks i.e. An assessment of practical has a weightage of 10% (i.e. 09 marks) and micro-project assessment has a weightage of 40% (i.e. 06 marks). PA is designed to facilitate attainment of COs holistically as there is no theory ESE.



Legend: L= Lecture, T= Tutorial Teacher-Guided Theory, Practical, P= Practical, C= Course, ESE= End Semester Examination, PA= Progressive Assessment.

5. COURSE MAP (with sample COs, POs, PSO, AIOs and Signos)

This course map illustrates an overview of the theme and linkage of the topics at various levels of inferences, details or subsequent outcomes to be attained by the student by the end of the course in 4 domains of learning in terms of the industry employer defined competency depicted at the centre of the map.

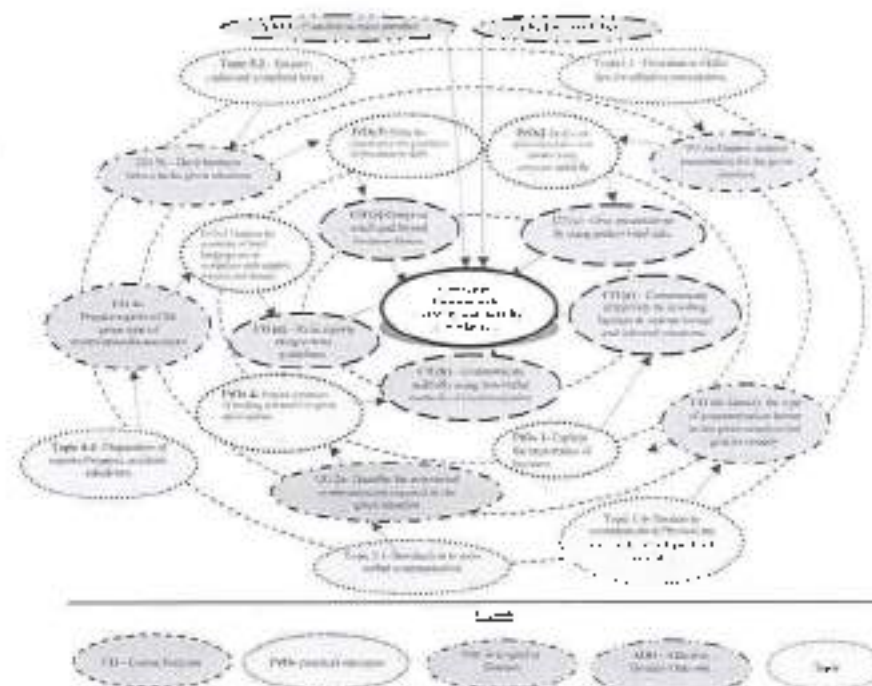


Figure 1 - Course Map

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

The practical in this section are POs 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 (POs)	Unit No.	Approx. Hrs. required
1	Explain the importance of business communication for a business organization using case study.	1	20

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
2	Draft a job application letter with resume using computer	V	2*
3	Identify the examples of body language use at workplace with suitable pictures and images	VI	2*
4	Prepare a minutes of meeting and mail it to give a email address	VII	2
5	Write the importance and guidelines of presentation skills.	VIII	2*
6	Draft a General Progress Report	IX	2*
7	Organize a debate on topics of communication.	I & II	2
8	Summarize an industry report using techniques of summarizing.	IX	2
9	Draft a complaint letter on given topic.	V	2
10	Design Powerpoint presentation on any technical topic	I	2*
11	Explain the eight principles of effective communication.		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 and host barriers to communication using case study	I	2*
16	Present a technical paper using PPT format	III	2*
			12

Note

1. A suggestive list of practical LOs is given in the above table. More such practical LOs can be added to attain the LOs and competency. A judicious mix of minimum 12 or more practical LOs/outcomes need to be performed out of which the practicals marked as * are compulsory, so that the student reaches the 'Proficiency Level' of their 'Competency Domain' as generally required by the industry. The size of batch for the practical should not exceed more than 25 students strictly for the maximum attainment of LOs and PrOs.

2. Hence the Theory and Practical related skills associated with each LO of the laboratory/workshop/field work are to be assessed according to a suggested sample given below.

3. MAJOR EQUIPMENTS / INSTRUMENTS REQUIRED

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

S. No.	Equipment Name with Broad Specifications	Exp. S.No.
1	PCD Processor	All
2	Server 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 LOs in cognitive domain for achieving the COs to attain the identified competencies:

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 meaning 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.	1a. Use different types of verbal and non-verbal communication in the given situation.	1.1 Introduction to Communication- Elements, language Functions 1.2 Types of communication and importance - Verbal (Oral-Written), Formal, Informal, Vertical, Horizontal and Diagonal communication 2. Principles of effective communication 3. Barriers to communication - Physical, mechanical, psychological and linguistic 4. 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	2a. Use relevant facial expressions in the given situation. 2b. 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 and point presentation	3a. Make seminar presentation 3b. Participate in debate speaking for or against the given topic. 3c. Make effective	3.1 Presentation skills-tips for effective presentation 3.2 Guidelines for developing power point presentation 3.3 Presenting /develop of papers.

Unit	Unit Outcomes (UOs) (in cognitive domain)		Topics and Sub-topics
	Writing Skills	Speaking Skills	
	Unit the given topics	computer presentations	
Unit- IV Office Drafting	41. Draft the given notice using the relevant format. 42. Draft the given memorandum using the relevant format. 43. The message dated the given type of meetings. 44. Prepare minutes of the given type of meetings. 45. Prepare reports of the given case of events/episodes/accidents.	41. Read the agenda of the given meeting. 42. Read the report of the given event. 43. initiate telephone calls in given situation. 44. Answer official phone calls in given situation.	4. Office drafting: Format and Guidelines. 4.1 Formulating notices and memoranda. 4.2 Preparation of agenda and writing minutes of meetings. 4.3 Preparation of reports/progress reports/Accident report/ case study. 4.4 Summarizing techniques.
Unit-V Business Correspondence	51. Respond to given job advertisement by writing your CV/Resume. 52. Draft business letters in the given situations. 53. Draft complaint letters for the given situations. 54. Compose e-mails with relevant for the given situations.		5.1 Business correspondence. 5.2 Enquiry, order and complaint letters. 5.3 e-mails and queries. 5.4 Difference - Curriculum vitae- Bio-data and Resume. 5.5 Job application and resume writing.

Note: To attain the UOs on Competency, above listed Learning Outcomes (LOs) need to be undertaken to achieve the 'Application Level' of Bloom's Cognitive Domain Hierarchy. The prescribed LOs should be covered using practical/real time 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
	Introduction to Business Communication	03	03	04	10
II	Non-verbal Communication	02	0	02	04
III	Presentation Skills	02	0	02	04
IV	Office Drafting	02	04	04	10
V	Business Correspondence	02	04	04	10
Total		10	08	14	32

Legend: R-Remember, U-Understand, A-Apply and above (Bloom's Revised taxonomy). Note: The specifications table provides general guidelines to use it during the day's learning and to achieve to reach and assess students with respect to acquisition of UOs and LOs. The content distribution in 3 weeks at different terminals (Weeks 10, 11 and 12) of the semester examination will give above table.

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

Weightage (20 Marks)	Weightage (15 Marks)	Total
A	B	
Assessment based on Profs. practically 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 in 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-led/centric activities which can be undertaken to accelerate the attainment of the various outcomes in the course.

- Collect good articles from newspapers and magazines and read them with correct pronunciation.
- 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 group 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 the course.

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



- h. *Item No. 3* 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.
- i. *Item 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).
- j. With respect to item No.10, teachers need to ensure to create opportunities and provisions for *collaborative 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 group projects in groups as well as individuality.

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. He is also 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 CAs, QAs and ADOs. The micro-project could be industry application-based, internet-based, workshop-based, laboratory-based or field-based. Each student is to have to maintain data/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 *(6/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 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 stores, shops, mall, etc. in the vicinity.
- b. Comparative study of Biosata, Resume and Curriculum vitae.
- c. A critical study of guidelines required for presentation skills.
- d. Summarize technical contents of 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 forms of 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 Raza	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. <http://www.britishcouncil/learnenglish/learn-online>
- b. <http://learnenglish.britishcouncil.org/en/content>
- c. <http://www.bbcenglish.com/>
- d. language.abhyasa.com
- e. www.worldwararticle.com
- f. www.notesdesk.com
- g. <http://www.culturalspice.com>
- h. www.studyext.com/notes.com
- i. studyganza.com
- j. www.studytips.com



Maharashtra State Board of Technical Education, Mumbai

Teaching And Examination Scheme For Post S.S.C. Diploma Courses

Program Name : Diploma in Mechanical Engineering

Program Code : ME

With Effect From Academic Year: 2017 - 18

Duration of Program : 6 Semesters

Duration : 16 Weeks

Semester : Second

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	Applied Science	Physics Chemistry	ASM	22202	2 2	- -	4	8	40 Min	70*#	28	15* 15*	00 00	100	40	25@ 25@	10	25	10	50	20	200
2	Applied Mechanics		AME	22203	3	1	2	6	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150
3	Applied Mathematics		AMP	22206	4	2	-	6	3	70	28	30*	00	100	40	-	-	-	-	-	-	100
4	Engineering Drawing		EDR	22207	3	-	4	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	Mechanical Engineering Workshop		MEW	22010	-	-	4	4	-	-	-	-	-	-	-	50#	20	50-	20	100	40	100
Total					14	3	16	33	-	280	-	120	-	400	-	185	-	165	-	350	-	750

Student Contact Hours Per Week: 33 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 (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.



Program Name : Mechanical and Civil Engineering Program Group

Page Code : NF-CF-FG-YIF-PITG

Schlüsselwort : Sexualität

Course Title : Applied Science (Physics & Chemistry)

Course Code : 22202

1. INTRODUCTION

2. *Exploring emerging issues* (to deal with various arguments and challenges). The study of concepts and principles in science has elements: history, perhaps tension, mystery, human stories, controversies, LARFES, 5-days, minds always burning. Time-intensive materials were chosen and arranged in a field and combination will help the student to select and view relevant material and methods which will be economical, and eco-friendly.

2. COMPETENCY

This is a list of the course it to help the student to attain the following degree identified competencies through various structured learning experiences:

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

3. COURSE OUTCOMES (COs)

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

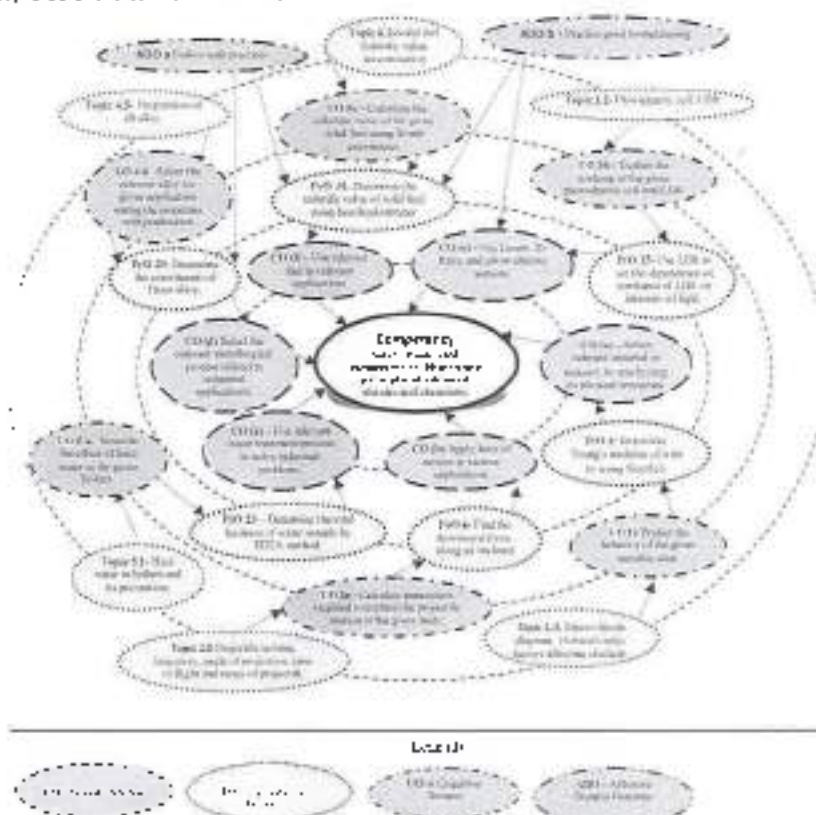
- Select relevant material in industry by analyzing its physical properties
- Apply laws of motion in various applications
- Use LASERs, X-Rays and plasma in various uses
- Select the relevant material/physical process related to industrial applications
- Use scales and water treatment process to solve industrial problems
- Select relevant fluid in the various industrial cases

4. TEACHING AND EXAMINATION SCHEME.

[illegible]

5. COURSE MAP with sample COs, Pre & Post Assessment questions

This course map illustrates in overview the flow and linkages of the topics of course levels of outcomes (table 1) subsequent outcomes to be attained by the student by the end of the course, in all domains of learning in terms of the outcomes, explicitly defined competencies denoted at the centre of the course.



Flange 1 - Couise Mud

6. SINGH, S. T. 1973. *Journal of the National Science Foundation*.

The trajectories in this sector are Poincaré submanifolds of the C -fibre foliation $\mathcal{F}_C$ and are assessed in the student for the attainment of the corresponding

S. No.	Practical Outcomes (POs)	Unit No.	Approx. Hrs. Required
	Physics		
1	Use Searle's method to determine the Young's modulus of given	1	52

S. No.	Practical Outcomes (POs)	Unit No.	Approx. Hrs. Required
	PHYSICS		
1	Apply Archimedes' principle to determine the buoyant force on a solid immersed in liquid.	I	02
2	Determine the coefficient of viscosity of given liquid by Stokes' method.	I	10
3	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
4	Predict the range of the projectile from the initial launch speed and angle.	II	02*
5	i) Find the dependence of the stopping potential on the frequency of light source in photoelectric effect experiment. ii) Find the dependence of the stopping potential on the intensity of light source in photoelectric effect experiment.	III	02
6	Determine the I-V characteristics of photoelectric cell and LDR.	III	02*
7	Determine the divergence of laser beam.	III	01
	CHEMISTRY		
8	Standardization of KMnO_4 solution using standard oxalic acid and determine the percentage of iron present in a given Hematite ore as KMnO_4 solution.	IV	12*
9	Determine the percentage of copper in given copper ore.	IV	02
10	Determine total hardness, temporary hardness and permanent hardness of water sample by EDTA method.	V	02*
11	Determine the alkalinity of given water sample.	V	02
12	Determine the turbidity of given water sample by Nephelometric method.	V	02
13	Determine the moisture and ash content in given coal sample using proximate analysis.	VI	02*
14	Determine the ultimate values of given solid fuel using Bomb calorimeter.	VI	02*
15	Determine the percentage of Sulphur in given coal sample by ultimate analysis (Gravimetric analysis).	VI	02
	Total		02

Note

- Suggested list of POs is given in the above table. More such POs can be added to attain the COs and competencies. A judicious mix of programs (if any) practical need to be performed from which the practicals mentioned are taken compulsory, so that the student reaches the 'Frontier Level' of Quality Performance Domain Functionary as generally expected by the industry.*
- The 'Process' and 'Product' related skills associated with each PO is to be assigned 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	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 POs also comprise of the following 'social skill' activities, which are Affective Domain Outcomes (AOs) that are best developed through the laboratory field based experiences.

- To follow safe practices.
- Practice good housekeeping.
- Practice energy conservation.
- Demonstrate working as a leader's team member.
- Follow ethical Practices.

The AOs are not specific to any one PO, but are embedded in many POs. Hence, the acquisition of the AOs takes place gradually in the student when s/he undertakes a series of practical experiments over a period of time. Moreover, the level of achievement of the AOs according to Kothandaram's 'Attention Domain Taxonomy' should gradually increase as planned below.

- 'Working Level' in 1st year.
- 'Organizing Level' in 2nd year.
- 'Characterising Level' in 3rd year.

5. MAJOR EQUIPMENT/INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will confer an uniformity in conduct of experiments as well as add to possess equipment by attainments.

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 material)	3,4
4	Stoke's apparatus (glass tube, viscous liquid, spherical balls of varying sizes)	2
5	Stop watch	4,5
6	Photo transducer	4
7	Timer	4
8	Projectile motion detector	3
9	Photo electric effect apparatus	5
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 < 5 sec., power requirement 50-250 V, 10 watt.	A1
14	Electric oven (inner size - 6"X18"X18", temperature range 100 to 250 ^o C with the capacity of 40 lb.	14, 15
15	Bomb calorimeter	5

S. No.	Equipment Name with Broad Specifications	Exp. No.
20.	Kettle furnace, Temperature up to 900°C digital temperature controller with an accuracy of $\pm 3^\circ\text{C}$	14.10
21.	Autochameter (Auto-ranging from 2 to 200 N/mm ² $\pm 1\%$ load reading, max. 1.1 N/mm ² power 220 Volts $\pm 10\%$ AC 50 Hz)	14

4. UNDERPINNING THEORY COMPONENTS

The following topics/steps should be taught and assessed in order to develop 100% on 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 concepts of elasticity and plasticity for the given material.	1.1 Deformation force and Restoring force: Elasticity, Plasticity, Rigidity
	1b. Establish relation between given types of modulus of elasticity.	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.	3 Stress-Strain diagram, Factors affecting elasticity
	1d. Explain pressure-depth relation for the given law.	4.4 Fluid friction, pressure, pressure-depth relation, Pascal's law, Archimedes' principle
Unit – II Types of Motion	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 by Stokes' method, effect of temperature and adulteration on viscosity of liquids
	1g. Describe the salient features in 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
	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
Unit – III Thermodynamics	2b. Calculate the angular velocity of the given body.	3.1 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.	3.2 Momentum, impulse, impulse 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
Unit – IV Metals, alloys, Cement, and Refractory materials	3a. Explain the concept of the given parameters of the given material.	3.1 Projectile motion: trajectory, angle of projection, time of flight, range of projectile with formulae
	3b. Explain the working of the given photoelectric device.	3.2 Planck's hypothesis, properties of photons, Photo electric effect, threshold frequency, threshold wave length, stopping potential, Work function, characteristics of photoelectric effect, Einstein's photo electric equation
	3c. Explain the production of X-Rays of the given material with properties and applications.	3.3 Photoelectric cell and LED, principle working and applications
	3d. Differentiate between LASER and given colour of light.	3.4 Production of X-rays by modern Crookes tube, properties and applications
Unit – V Chemistry	3e. Explain the given terms with examples.	3.5 Laser, properties, absorption, spontaneous and stimulated emission, applications of Laser
	4a. Describe construction and working of the given type of furnace.	4.1 Population inversion, active medium, optical pumping, three energy level system, He-Ne laser
	4b. Describe the extraction process of the given ore with chemical reaction.	4.2 Metallurgy: Metallurgical gangue, flux, slag
	4c. Explain purposes and preparation methods of making the given alloy.	4.3 Types of furnace: Muffle furnace, Blast furnace
Unit – VI Engineering Materials	4d. Select the relevant alloy for the given application stating the properties with justification.	4.4 Extraction processes of ferrous: cuprous sulphate, iron, oxidizing, concentration, reduction, refining
	4e. Describe the good points, handling and setting process of the given type of cement.	4.5 Properties of iron and copper, Hardness, tensile strength, toughness, malleability, ductility, refractoriness, thermal expansion, specific gravity, specific heat, brazing, castability, stiffness
	4f. Select the relevant refractory for given application stating the properties with justification.	4.6 Properties of alloys: brass and steel, compression method
		4.7 Ferrous alloys: Low carbon, medium carbon, high carbon steels
Unit – VII Engineering Materials		4.8 Non-ferrous alloys: Brass, Bronze, Duralumin, Titanium, solder, Wires, metals
		4.9 Cement: Types: Portland and Portland cement, constituents, setting and hardening applications
		4.10 Refractory: Classification, constituents, setting and hardening applications
		4.11 Laser: 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 terminology related to hard water and their effects. 5b. Describe the given process for softening of the given water sample. 5c. Describe with sketches the purification of the given type of water. 5d. Describe the given type of waste water treatment.	5.1 Hardness, Classification 5.2 Hard water in boilers and prevention: Boiler corrosion, caustic embrittlement, priming and foaming, scales and sludges. 5.3 Water softening: lime soda process, hot lime soda and cold lime soda processes, zeolite process, ion exchange process (cation exchange and anion exchange). 5.4 Potable water treatment: Sedimentation, coagulation, filtration and sterilization. 5.5 Waste water treatment: sewage treatment, DCO and BOD of sewage water, Reverse Osmosis, recycling of waste water.
Unit-VI Fuels and Combustion	6a. Describe salient properties of the given type of fuel. 6b. Explain the given type of analysis of the given type of coal. 6c. Calculate the calorific value of the given solid fuel using Dulong's method. 6d. Describe composition, properties of given gaseous fuel with their applications. 6e. Calculate the mass and volume of air required for complete combustion of the given fuel.	6.1 Fuel: Calorific value and ignition temperature, classification. 6.2 Solid fuels: Coal: Classification and composition, proximate analysis, ultimate analysis, Bomb calorimeter, Carbonization of waste by Clegg-Holmes's oven. 6.3 Liquid fuels: Fractional distillation of crude petroleum, boiling range, composition, properties, Knocking, cracking, octane number and cetane number. 6.4 Gaseous fuels: Biogas, LPG and CNG, Combustion equation of gaseous fuels, mass and volume of air used for complete combustion.

Note: To obtain the COs and competencies, above listed UOs need to be undertaken to achieve the Alignment Chart and extent 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					
1	Properties of matter and TMT	14	03	05	06	14
2	Optics and motion	08	02	02	04	11
3	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	05	10
VI	Fuels and combustion	11	03	04	04	11
Total		64	15	22	27	70

Legend: R=Remember, U=Understand, A=Apply and above them is termed as higher.

Note: This specification table provides general guidelines to every 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 develop the aptitude of the students to overcome their wants:

- Summarizing 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 learn various topics and topics.
- Unit from No. 4 does not mean only the traditional lecture method, but different types of teaching methods and resources 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 student for self-directed learning and assess the development of the UOs through classroom presentations (see implementation guideline for details).
- With respect to unit No.10, teachers need to ensure to create opportunities and provisions for *concurrent learning* in fields.
- Guide student to undertake 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. The right to submit it by the end of the semester to develop the industry oriented UOs. Each micro-project should encompass two or more COs which are in fact, an integration PCOs, UOs and ACOs. 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 contributions 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 the difficulties to the parents of the industry. A suggestive list is given here. Similar more projects could be added by the concerned faculty.

- Elasticity:** Prepare working model to demonstrate the stress – strain behavior of different wires of different thickness and material.
- Viscosity:** Collect 5 to 5 liquid and prepare a working model to determine the viscosity on the basis of viscosity and demonstrate their applications.
- Motion:** Prepare model of ball falling down on inclined plane to demonstrate the conservation of energy and motion of an object on inclined plane.
- Photo Sensors:** Prepare simple photo sensor using LDR.
- Properties of Laser:** Use Key chain laser to differentiate laser with ordinary light.
- Water analysis:** Collect water samples from different water sources and find the characteristics like acidity, conductivity, dissolved solids, suspended particles.
- Water treatment:** Collect 5 to 5 water samples to find the dosage of bleaching powder required for its sterilization.
- Water analysis:** Prepare model to find the soap washing capacity of hard water on addition of soda ash.
- Fluids:** Prepare chart showing different types of fluid, their showing their relative values and data.
- Cement:** Collect 5 Percent samples of cement and find their initial and final setting time.
- Refractory materials:** Prepare chart showing properties of refractory materials.
- Metal properties:** Prepare chart showing different industrial application of metal and relate it with required properties or properties using internet.
- Alloy steel:** Find the effect of alloying elements like Mn, Cr, Ni, W, V, Si 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.

12. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Physics Textbook Part I and Part - Class XI	Narinder, J. V., Joshi, A. W., Mahajan, Anand J. et al	National Council of Educational Research and Training, New Delhi, 2012, ISBN: 8174535037
2	Physics Textbook Part I and part II - Class XII	Narinder, J. V., Joshi, A. W., Ghatak A. K. et al	National Council of Educational Research and Training, New Delhi, 2013, ISBN: 8174536314
3	Engineering Physics	Bhattacharya, D. K., Garden Purnan	Oxford Publishing, New Delhi, ISBN: 9789325514
4	Principles of Engineering Physics-I	Md. Nazim Khan and S. Anandharaman	Cambridge University press, New Delhi, 2016, ISBN: 9781107693543
5	Engineering Physics	Palanisamy, P. K.	SCITECH Publications, Chennai, ISBN: 9788185711012
6	Principles of Physics	Walker, J., Halliday, D. Resnick, R.	Wiley Publications, New Delhi, 10 th edition, ISBN: 9788126557466
7	Textbook of Engineering Physics	Ayazdharab, M. N., Kalraagar, P. G.	S. Chand and Co., New Delhi, 2015, ISBN: 9788121958177
8	Engineering Chemistry	Agarwal, Shikha	Cambridge university press, New Delhi, 2015, ISBN: 9781107476537

S. No.	Title of Book	Author	Publication
9	Engineering Chemistry	Datta, S. S., Umate, S. S.	S. Chand and Co. Publication, New Delhi, 2011, ISBN: 8171997359
10	Engineering Chemistry	Jain & Jain	Dhanraj Publications, New Delhi, 2013, ISBN: 9397155057
11	Engineering Chemistry	Vairam, S.	Wiley India Pvt. Ltd, New Delhi, 2012, ISBN: 9788126543342
12	Chemistry for engineers	Agarwal, Rajesh	Wiley India Pvt Ltd, New Delhi, 2014, ISBN: 9788126556789

14. SOFTWARE/LEARNING WEBSITES

- <http://nptel.ac.in/course.php?disciplineId=115>
- <http://nptel.ac.in/courses.php?disciplineId=1154>
- <http://openphysics.phy-washington.edu/libase/tpd.html>
- www.physicsclassroom.com
- www.fearofphysics.com
- www.phet.org
- www.sciencehowsthebooks.com
- <http://phet.colorado.edu>
- www.chemistryteaching.com
- www.cymathlearning.com
- www.chem1.com
- www.mhchemistry.com
- www.ck12.org
- www.chemcollective.org
- www.wgn.org
- www.chem-21.org



Program Name	: Mechanical, Civil, Chemical and Fabrication Technology and Freelance Engineering Program Group
Program Code	: AE/CE/CH/FG/MC/PT/PG
Semester	: Second
Course Title	: Applied Mechanics
Course Code	: 22203

1. RATIONALE

In a world by joining the joint 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 type and effect 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 for given purposes.
- Determine unknown from static different engineering systems.
- Check the stability of various force systems.
- Apply the principles of friction in various conditions for useful purposes.
- Find the centre of mass and centre of gravity of various components in engineering systems.

4. TEACHING AND EXAMINATION SCHEME

Learning Scheme	C	T	P	Cred. (L+T+P)	Examination Scheme							
					Theory				Practical			
					Paper I (50%)	Max	Min	Total	C+F	PA	Max	Min
1	1	2	6	9	3	20	10	30	10	10	20	10

Fig. 1.01: Learning Scheme. The student must pass the paper-based examination to achieve a minimum of 50% and the remaining 50 marks is the average of 2 units to be taken during the semester. The student must also complete the engineering design (ED) required for the completion of the COs.

Legend: L=Lecture, T=Tutorial, Teacher-Guided Theory, Project, P=Practical, C=Classroom ESE, End-Semester Examination, PA=Progressive Assignment.

5. COURSE MAP (with sample COs, POs, DCs, ADOs and links)

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.

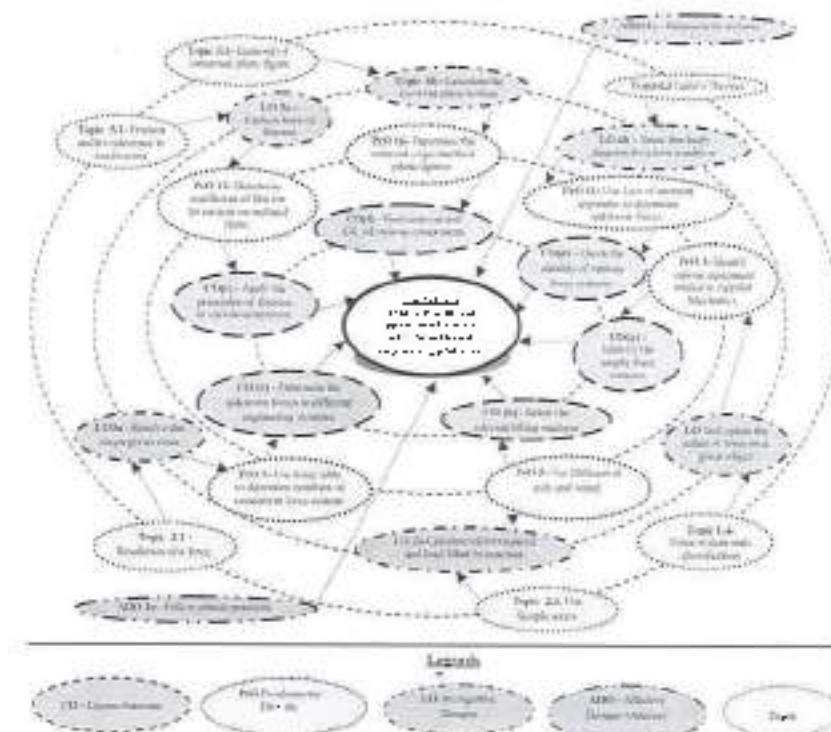
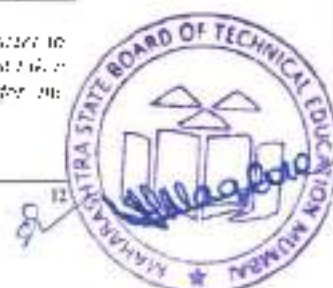


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/EXERCISES

The projects in this section are POs (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 (POs)	Unit No.	Approx. Hrs. required
1	Identify various equipment related to Applied Mechanics.	I to VI	02
2	Use 2-Block of axle and wheel.	II	07*



S. No.	Practical Outcomes (PrOs)	Estim. No.	Approx. Hrs. required
3	Use Sample screw jack.	II	02
4	Use worm and worm wheel.	II	02
5	Use sample double pulley block.	II	02
6	Use Weston's differential or worm gear pulley block.	II	02
7	Use force table to determine resultant of concurrent force system applying Law of Polygon of forces. (Part-I)	II	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

- A suggestive list of PrOs is given in the above table. More such PrOs can be added to enrich the CEs and competencies. A student has to minimum 12 or more practicals need to be performed out of which the practicals marked as '*' are compulsory, so that the student reaches the 'Proficient Level' of Outcome 'Psychomotor Domain: Performance' as generally expected by the employer.
- 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	0
4	Observations and Recording	20
5	Interpretation of result and Conclusion	20
6	Answer to sample questions	10
7	Submission of report on time	10
Total		100

The above PrOs also comprise of the following social skill/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.
- Absorption 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 experiments 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 specifications mentioned here will assist in uniformity in conduct of experiments as well as aid in procuring equipment by manufacturers.

S. No.	Equipment Name with Broad Specifications	Exp. No.
1	2. Differential axle and wheel (axle) mounted unit with the wheel of 40 cm diameter and axles are steps of 20 cm and 10 cm reducing diameter.	2
2	Sample screw Jack (table mounted metallic body), screw with a pitch of 1 mm carrying a double flanged turn table of 20 cm diameter.	3
3	Worm and worm wheel (axle) mounted unit with threaded spindle (rod) driven effort wheel with holes for various weights, finger and threads.	4
4	Single Purchase Crab with (table mounted heavy cast iron body). The effort wheel is of CI 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 with (Hanging assembly) same as above but with double set of gearing arrangement.	5
6	Weston's Differential pulley block consisting of two pulleys, one larger and other smaller.	6
7	Weston's Differential worm geared pulley block consists of a metal (preferably steel) cogged wheel of about 20 cm along with a protruded 'rod' diam of 10 cm dia to suspend the weights of 10 kg, 20 kg-2 weights and a 50 kg weight(s).	6
8	Universal Force Table (Consists of a circular 40 cm dia. Aluminium case, graduated in 360 degrees), with all accessories.	7-10
9	Law of moments apparatus consisting of a stainless steel graduated beam (12.5 cm square in section, 1 m long, pivoted at centre).	9
10	Henry, Reaction apparatus (The apparatus is with two circular dial type Hooke).	1
11	Friction apparatus for motion along horizontal and inclined plane (base on which a sector with graduated arc and vertical scale is provided. The plane may be changed at any angle up to 45 degrees, pan. Two weight boxes each of 5 gm, 10 gm, 20 gm, 50 gm, 200 gm weights).	11
12	Models of geometrical figures.	12



8 UNDERPINNING THEORY COMPONENTS

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

Unit	Unit Outcomes (U.Os) (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. Force (unit, mass, particle body, rigid body). 1.3. Scalar and vector quantity: Unit and measurement of force, 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 machines. 2.2. Ideal machine, friction, 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, Simple screw jack, Weston's differential pulley block, geared pulley block. 2.4. Graphs of Load versus Effort, Load versus ideal Effort, Load versus effort lost in friction, Load versus V.A. Load versus Efficiency.
Unit – III Resolution and composition	3a. Resolve the given angle 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 coplanar force systems, Triangle rule, parallelogram and polygon of forces. 3.3. Graphical statics, graphical representation

Unit	Unit Outcomes (U.Os) (in cognitive domain)	Topics and Sub-topics
	4a. Draw triangle and law of parallelogram.	4.1. Force, Space diagram, Force diagram, polar diagram and Lami's polygon. 4.2. Graphical method of determination of resultant for concurrent and parallel coplanar force systems.
Unit – IV Equilibrium	4a. Draw the free body diagram for the given condition. 4b. Determine reaction 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 Equilibrium, free body and Free body diagram, Analytical and graphical determination of equilibrium. 4.2. Equilibrium of force systems analytically. 4.3. Lami's Theorem. 4.4. Types of beams, supports (simple, hinged, roller and fixed) and classification of beams (vertical and inclined point load, U.D 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 U.D 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 condition's for friction for the given situation. 5c. Determine friction force in the given machine. 5d. Identify the various forces acting on a ladder for the given condition using free body diagram.	5.1. Friction and its relevance in engineering types and laws of friction, limiting equilibrium, limiting friction, coefficient of friction, angle of friction, angle of repose, relation between coefficient 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. Centroid of Gravity of simple solids (C, F, cuboid, cone, cylinder, sphere, hemisphere). 6.4. Centre of Gravity of composite solid composed of not more than two simple solids.



Note: To attain the skill and competency, where based COs 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	Examples and Force System	04	02	02	02	06
I	Simple Lifting Machines	08	02	02	06	12
II	Resolution and Composition	9	02	04	02	14
IV	Equilibrium	10	02	02	06	14
V	Friction	08	02	02	06	12
VI	Centroid and Centre of Gravity	08	02	02	06	12
Total		48	12	18	40	70

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

Note: This spec. document is for providing general guidelines to assist student for their learning and to teachers to teach and assess students with regard to attainment of COs. The actual distribution of marks in different questions, levels (R, U and A) in the question paper will 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 and topics.
- 21st century* Now it does not mean only the traditional lecture method, but different types of learning 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 procedure for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for co-curricular activities.
- Guide students in undertaking mini-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 POs, COs 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 a chart showing real-life examples indicating various types of forces.
- Lifting Machine:** Collect photographs of specific simple lifting machines and relate these machines with the machines being studied and prepare contacts about the lifting machines using tools in "MECHANICS" and "MECHANICS".
- Types of supports:** 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, overhanging 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.
- Center 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: 9788121918451
2	Engineering Mechanics	Ramamurthy, S.	S Chand & Co, New Delhi 2008 ISBN: 9788121922314
3	Foundations and Applications of Applied Mechanics	Ram, H. D. Chhabra, A. K.	Cambridge University Press, Thomson Press India Ltd, New Delhi, 2015, ISBN: 9781107496356
4	Engineering Mechanics- Statics, Vol. I	Mottram, J. L., Krane, L. G.	Wiley Publications, New Delhi, ISBN: 978-81-255-4296

14. SOFTWARE/LEARNING WEBSITES

- <http://www.khanacademy.org/>
- www.youtube.com for videos regarding principles and applications. (friction)
- www.geogebra.org
- www.demonstratingphysics.com



Program Name : Mechanical and Chemical Engineering Program Group
 Program Code : AL, CH, EG, ME, PT
 Semester : Second
 Course Title : Applied Mathematics
 Course Code : 122001

1. RATIONALE

Subject of applied mathematics is being introduced in diploma courses to provide mathematical background to the students. This course focuses in developing theory and competency needed for a wide range of engineering applications. In particular the topics of limits, differentiation, integration, differential equations and probability distribution for modeling and analysis in a wide range of applications. This course further develops the skills and understanding of mathematical concepts which underpin the investigative tools used in Mechanical 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 mechanical engineering related 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 at different points.
- 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 method.
- Understand basic concepts of probability distribution to solve elementary engineering problems.

4. TEACHING, ASSESSMENT AND SCHEDULE

Teaching Scheme			Credit (L:P)=1:1	Examination scheme									
I	II	P		Theory					Practical				
				Hours	Max	Min	Max	Min	Hours	Max	Min	Max	Min
1	1	1	2	10	25	25	25	25	10	10	10	10	10

(P) : Under the theory, P = test at all intervals. It marks the first major project assignment to give idea to a project of 10% and the remaining 25 marks in the assignment. (2) : Under the action during the semester for the assessment of the engineering drawing skills acquired for the completion of the COs.

Legend: L= Lecture, T= Tutorial, P= Practical, O= Open Project, P= Project, L= Credit
 L&P= Live Assessment, L&P= Progressive Assessment.

5. COURSE MAP (with sample COs, Unit Outcomes (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 topics in this column are suggested units of the COs to be developed, as assessed in the student, to lead to the attainment of the competency.

S. No.	Exercises	Unit No.	Approx. Hrs. Required
1	Solve problems based on finding value of the function at different points.	1	1
2	Solve problems in first derivatives on implicit function and parametric function.	1	1
3	Solve problems on first derivative of logarithmic and exponential functions.	1	1

S. No.	Tutorials	Unit No.	Approx. Hrs. Required
2	Solve problems based on finding equation of tangent and normal.		2
3	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 revolution.	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 in related engineering problem.	IV	2
13	Develop a model using the concept of linear differential equation in related engineering problem.	IV	2
14	Solve problems based on Binomial Distribution related to engineering problems.	V	2
15	Solve problems based on Poisson Distribution related to engineering problems.	V	2
16	Solve problems based on Normal Distribution related to engineering.	V	2
Total			22

Note: 20 theory, practical activities are for questions only. The remaining practical hours are for exercises and projects.

7. MAJOR EQUIPMENT/INSTRUMENTS REQUIRED

- Not applicable -

8. UNDERPINNING THEORY COMPONENTS

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

Unit	Unit Outcomes (UOs) in degree 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 logarithmic, exponential functions. 1d) Apply the concept of differentiation to find given	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) Derivative of composite functions (chain Rule, implicit and

Unit	Unit Outcomes (UOs) in degree domain	Topics and Sub-topics
	1a) equation of tangent and normal. 1c) Apply the concept of differentiation to calculate maxima and minima and radius of curvature of given problem.	a) 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 problems based on rules of integration. 2b) Obtain the given integrals 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 curves. 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 simple given engineering problems. 4c) Solve given differential equations using the method of variable separable. 4d) Solve the given simple problems based on linear differential equations.	4.1 Concept of differential equation 4.2 Order, degree and form 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 - A Probability Distribution	5a. Make use of probability distribution to identify discrete and continuous probability distributions	5.1 Probability distribution
	5b. Solve given problems based on repeated trials using Binomial distribution	5.2 Discrete Probability distribution
	5c. Solve given problems when number of trials are large and probability is very small.	5.3 Binomial distribution
	5d. Utilize the concept of normal distribution to solve related engineering problems.	5.4 Poisson's distribution
		5.5 Normal distribution

Note: To attain the COs and competencies, above listed UOs need to be undertaken to achieve the 'Appreciation level' and above of Bloom's Cognitive Domain taxonomy.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	C 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	06	10
IV	First Order First Degree Differential Equations	08	02	02	04	08
V	Probability Distribution	12	02	03	07	12
Total		64	12	21	35	70

Legend: R=Remember, C=Understand, A=Apply and analyse (Bloom's Revised taxonomy)

Note: The specification table provided is general guidelines to assist student for data handling and not design to match and above with respect to examination of UOs. The actual distribution of marks in different examination levels for R, C and A levels, question paper design, may vary as follows.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related comprehensive 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 online calculator on the internet.
- Use graphing software's EXCEL, PLOT and GRAPH for related topics.
- Use Mathematica or Maple 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 probability distribution to solve 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/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/COs through classroom presentations (see implementation guideline for details).
- With respect to item No. 9 teachers need to ensure to create opportunities and provide access 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. She 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 AOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to undertake work during assignment of a final report and submit 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 student confidence in every student to become problem solver so that she contributes to the projects of the industry. A suggested list is given here. Suitable modifications could be added by the concerned faculty.

- Prepare models using the concept of tangent and normal to bending of roads to save of a sharp of a vehicle.
- Prepare models using the concept of radius of curvature to bend up or railway track.
- Prepare charts displaying the area of irregular shapes using the concept of integration.
- Prepare charts displaying the volume of irregular shapes using concept of integration.
- Prepare models using the concept of differential equations for moving problem.
- Prepare models using the concept of differential equations for radioactive decay.
- Prepare models using the concept of differential equations for population growth.
- Prepare models using the concept of differential equations for thermal cooling.
- Prepare a chart of binomial distribution by collection of suitable manufacturing industry base data.
- Prepare a chart of normal distribution by collection of suitable manufacturing industry base data.
- Prepare a chart of Poisson distribution by collection of suitable manufacturing industry base data.

13. SUGGESTED LEARNING RESOURCES



S. No.	Title of Book	Author	Publication
1	Higher Engineering Mathematics	Grewal, D.S.	Khanna publications, New Delhi, 2010 ISBN: 8174091955
2	A Text Book of Engineering Mathematics	Dutta, D.	New Age Publications, New Delhi, 2005, ISBN: 978-81-224-1689-3
3	Advanced Engineering Mathematics	Krezig, Ervin	Wiley Publications, New Delhi, 2016 ISBN: 978-81-265-5422-2
4	Advanced Engineering Mathematics	Das, H.K.	S. Chand Publications, New Delhi, 2008, ISBN: 9788121903455
5	Engineering Mathematics, Volume I (4 th edition)	Sastry, S.S.	Pill Learning, New Delhi, 2007 ISBN: 978-81-203-3616-2.
6	Comprehensive Basic Mathematics Volume 2	Veena, G.R.	New Age Publications, New Delhi, 2005 ISBN: 978-81-224-1684-X
7	Getting Started with MATLAB, 2 nd ed.	Pratap, Rudra	Oxford University Press, New Delhi, 2009, ISBN: 978-0199771241
8	Engineering Mathematics (5 th edition)	Craig, Anthony	Pearson Education, New Delhi, 2010 ISBN: 978-81-317-2605-1

14. SOFTWARE/LEARNING WEBSITES

- a. www.sclab.org/ - SCI Lab
- b. www.mathworks.com/products/matlab/ - MATLAB
- c. Spreadsheet applications
- d. www.dp-plot.com/ - DPlot
- e. www.allmathcad.com/ - MathCAD
- f. www.wolfram.com/mathematics/ - Mathematica
- g. <http://focsec.in/>
- h. <https://www.khanacademy.org/math?gid=C.Nq-HuabCys4CFdUJaAuddlloPg>
- i. www.easycalculation.com
- j. www.math-maple.com



Program Name	: Mechanical Engineering Program Group
Program Code	: ME, ME/PT/PE
Semester	: Second
Course Title	: Engineering Drawing
Course Code	: 3220

1. RATIONALE

Engineering drawing is the language of engineers. The concepts of drawing language are used in visualizing the situation, materializing the ideas, conveying the instructions which are used in carrying out engineering jobs. The course aims at developing the ability to draw and read projections of lines, planes, solids and develops imagination and translating skills in drawing orthographic, sectional, missing views and auxiliary views of common engineering components. Knowledge of conventional representation of various joints helps in read and draw joints in production drawings. This course also aims at building foundation for further courses related to engineering drawing and other allied courses in coming semesters.

2. COMPLETIONS

This area of the course is to help the student attain the following industry identified competencies through various teaching learning experiences:

- Prepare engineering drawings using prevailing drawing standards and instruments.

5. COI RSE DI TITOLAZIONE (CDS)

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 projections of 2D and 3D standard regular entities.
- Draw sectional views of objects.
- Draw orthographic, pictorial and isometric views.
- Draw auxiliary views of objects.
- Use chamfer-filing edges, dimensions and symbols as per IS:15024.
- Draw free-hand sketches of a given engineering component.

4. TEACHING AND EXAMINATION SCHEME

[illegible]

For $t \geq 1$, the t th entry of $\hat{Q}_t$ (one of d entries) is given by an average over $\hat{Q}_t$ entries in the t th row and column of $\hat{Q}_t$ and the corresponding $\hat{Q}_t$ entries in the entries of $\hat{Q}_t$ in the t th row and column. The entries of $\hat{Q}_t$ are given by the entries of $\hat{Q}_t$ in the t th row and column of $\hat{Q}_t$ and the entries of $\hat{Q}_t$ in the t th row and column of $\hat{Q}_t$.

Legend: L-Lactate; T-Triose Phosphate; Glc-6P-Glucose 6-phosphate; P-Pyruvate; C-Citrate
E-Ethanol; EAc-Acetate; B-Biotin; P4-Pyruvate decarboxase

+ COLRST MAP (with sample CO_2 , N_2O , CH_4 , C_2H_6 and peaks)

The course map it contains in overview of the flow and linkages in the terms at various levels of economies (details in subsequent sections) to be achieved by the student by the end of the course in all domains of learning, in terms of (a) not, the employer required competencies demanded by the nature of this map.

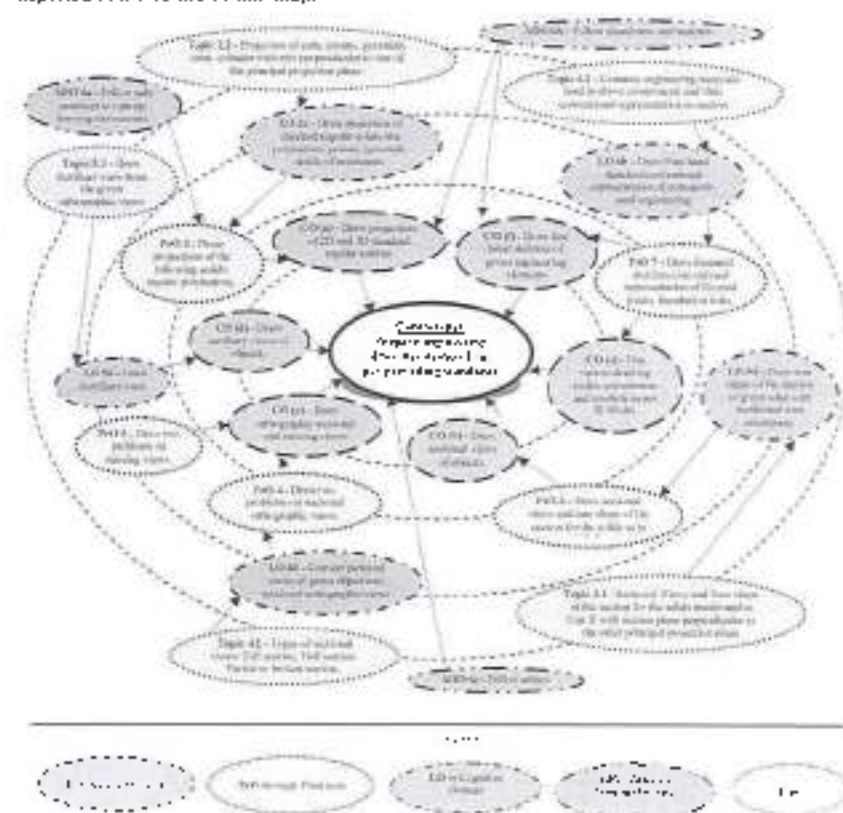


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/EXERCISES

The parameters in this section are 'true' values computed from the data to be developed and analysed in this study, for the attainment of the consistency.

S. No.	Practical Outcomes (POs)	Unit No.	Approx. Hrs. Required
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S. No.	Practical Outcomes (POs)	Unit No.	Approx. Hrs. Required
1.	Draw two problems on projection of straight lines Part I	I	02*
2.	Draw two problems on projection of planes Part I	I	02
3.	Draw projections of Regular polyhedron Part I	I	02*
4.	Draw projections of Regular polyhedron Part II	II	02
5.	Draw projections of Regular prisms Part II	II	02
6.	Draw projections of Regular pyramids Part IV	II	02
7.	Draw projections of Regular solids of revolution Part V	II	02
8.	Draw sectional views and true shape of the section for the solids mentioned in S. No 3-6 Part I	III	02*
9.	Draw sectional views and true shape of the section for the solids mentioned in S. No 3-6 Part I	III	02
10.	Draw sectional views and true shape of the section for the solids mentioned in S. No 3-6 Part III	III	02
11.	Draw sectional views and true shape of the section for the solids mentioned in S. No 3-6 Part IV	III	02
12.	Draw sectional views and true shape of the section for the solids mentioned in S. No 3-6 Part V	III	02
13.	Draw two problems on sectional orthographic views Part I	IV	02*
14.	Draw two problems on sectional orthographic views Part II	IV	02
15.	Draw two problems on sectional orthographic views Part III	IV	02
16.	Draw two problems on sectional orthographic views Part IV	IV	02
17.	Draw two problems on missing views Part I	V	02*
18.	Draw two problems on missing views Part I	V	02
19.	Draw two problems on missing views Part II	V	02
20.	Draw two problems on missing views Part IV	V	02
21.	Draw two problems on missing views Part V	V	02
22.	Draw two problems on missing views Part V	V	02
23.	Draw auxiliary view from the given orthographic views - one problem Part I	V	02
24.	Draw auxiliary view from the given orthographic views - one problem Part II	V	02
25.	Draw auxiliary view from the given orthographic views - one problem Part III	V	02
26.	Draw principal view from the given auxiliary view and other principal view - one problem Part IV	V	02
27.	Draw principal view from the given auxiliary view and other principal view - one problem Part V	V	02
28.	Draw principal view from the given auxiliary view and other principal view - one problem Part V	V	02
29.	Draw free hand sketches/conventional representation of	VI	02*



S. No.	Practical Outcomes (POs)	Unit No.	Approx. Hrs. Required
	- Draw 'Isometric' sheet, at least 10 sketches/conventional representation of: - Riveted joints: Lap Joint, Single and Double Riveted		
30.	Draw free hand sketches/conventional representation of: - Bolt Joint - Single Strap, Double Strap, - Foundation bolts: Eye and Levers	VI	02
31.	Draw free hand sketches/conventional representation of: - Couplings: Muff, Protected Flange and Flexible Flange - Pulleys: Rope and V-Belt	VI	02
32.	Draw free hand sketches/conventional representation of: - Welding joints - Common dry-mechanical systems used in practice and their conventional representation of section	VI	02
Total			64

17. Additional problems to be performed

Note

- It suggested that at practical POs is given in the above table, more problems and POs can be added to meet the CLOs and competency.
- The first six items (problems) of each block mentioned with marks POs is to be covered in writing as a suggested sample given below.

S. No.	Performance Indicators	Weightage in %
1.	Neatness, Cleanliness in drawing sheet	7
2.	Use of instruments in drawing and the work	9
3.	Creating given drawing	40
4.	Dimensioning the given drawing and writing text	20
5.	Answer to sample questions	10
6.	Submission of drawing on time	10
Total		100

The above POs also comprise of the following social skill/competencies which are Affective Domain Outcomes (ADOs) that are not developed through the laboratory field based experiences

- Follow safe practices to operate drawing instruments.
- Follow cleanliness and neatness.
- Follow ethics and standards.

The ADOs are not specific to any one PO, but are embedded in many POs. 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 Group 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 specifications mentioned here will facilitate an institution in conduct of experiments, as well as aid in procure equipment by administrators.

S. No.	Equipment Name with Broad Specifications	Exp. No.
1	Drawing Table with Drawing Board of A1 or full imperial size	All
2	Drawing sheet of A1 or half imperial size	All
3	Models of various types of solids	7
4	Models of cut section of various solids	5
5	Models of cut sections of objects	4
6	Models of Mechanical Components	5
7	Models of objects with inclined surfaces	6
8	Specimen library of various rivet heads, foundation bolts, welding joints, valves and pipe fittings	7
9	Set of various industrial drawings being used by industries	All
10	Set of drawings sheets mentioned in section 8.0 could be developed by experienced teachers and made available on the NISDE portal to be used as reference standards	All
11	Drawing equipment's and instruments to classroom 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
12	Interactive board with LCD overhead projector	All

8. UNDERPINNING THEORY COMPONENTS

The following topics/sub-topics should be taught and assessed in order to develop LOR in cognitive domain facilitating the COs to attain the identified competencies.

Unit	Unit Outcomes (UOs) in cognitive domain	Topics and Sub-topics
Unit – I Projection of straight lines and planes	1a. Classify various planes of lines with respect to projection planes. 1b. Draw projection of lines in different positions based on given situation. 1c. Classify various types of planes according to orientations. 1d. Draw projection of planes with different orientations based on given situation.	1.1 Projection of straight lines with following positions: a) Parallel to both the planes. b) Perpendicular to one plane. c) Inclined to one plane and parallel to the other. d) Inclined to both the planes. 1.2 Projection of Planes: 1.3 Projection of Planes with following orientations: a) Plane parallel to one principal plane and perpendicular to the other. b) Plane inclined to one principal plane and perpendicular to the other.
Unit – II Projection	2a. Classify various types of solids.	2.1 Types of Solids 2.2 Projection of the following solids.

Unit	Unit Outcomes (UOs) in cognitive domain	Topics and Sub-topics
of solids	2b. Explain orientation of axes with respect to projection planes. 2c. Draw projections of given standard regular solids like polyhedron, prisms, pyramids, solids of revolution.	a) Regular Polyhedron: Tetrahedron, Hexahedron (Cube) b) Regular prisms and Pyramids: Triangular, Square, Pentagonal, Hexagonal c) Regular solids of Revolution – Cylinder, Cone, Sphere With Axis: Perpendicular to one of the principal projection plane. Inclined to one of the principal plane and parallel to the other. Parallel to both principal planes.
Unit – III Sections of solids	3a. Describe cutting planes and their orientation with respect to given solid and projection planes. 3b. Explaining significance of sectional view and true shape. 3c. Draw sectional view of given solid. 3d. Draw true shape of the section of given solid with mentioned axis orientation.	3.1 Sections, Views and True shape of the section for the solids mentioned in Unit I with section plane in following positions: i) parallel to one of the principal projection plane ii) inclined to one and perpendicular to the other principal projection plane Note: Projection of solids is constructed in the following: Axis parallel to both principal projection planes i) Axis perpendicular to one and parallel to the other principal projection plane
Unit – IV Sectional orthographic views	4a. Classify various types of sectional views. 4b. Explain sectioning and hatching conventions. 4c. Convert pictorial views of given object into sectional, orthographic views. 4d. Interpret the given drawing.	4.1 Cutting plane and 4.2 Types of sectional views: Full section, Half section, Part section, Broken section, Revolved section, Removed section, Offset section, Aligned section 4.3 Sectioning Conventions: 4.4 Hatching or section lines 4.5 Conversion of pictorial views into sectional orthographic views
Unit – V Missing and Auxiliary views	5a. Interpret the given views. 5b. Draw the missing view from given situation. 5c. Interpret given Auxiliary view. 5d. Draw Auxiliary view based on given situation.	5.1 Draw Missing lines and corners from the given orthographic views. 5.2 Auxiliary planes and views 5.3 Draw Auxiliary view from the given orthographic views. 5.4 Complete the section view from the given auxiliary and other principal views.
Unit VI	6a. Identify various	6.1 Draw Free hand sketches-conventions



Unit	Unit Outcomes (UOs) Cognitive Domain	Topics and Sub-topics
Free Hand sketches on conventional representation	Engineering components and their details in the given sectional view. Draw free hand sketches/conventional representation of given engineering components	representation of i. Rivet heads ii. Riveted joints, Lap Joint - Single and Double Riveted, Butt Joint - Single strap, Double Strap iii. Foundation bolts: Eye and Lewis iv. Couplings: Muff, Protected Flange and Flexible Flange v. Pulleys: Rope and V-Belt vi. Welding joints 6.2 Common engineering materials used in above components and their conventional representation in section.

Note: To attain the COs and competency above listed UOs need to be undertaken to achieve the Application Level of Basic & Engineering Drawing Proficiency.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	L Level	A Level	Total Marks
I	Projection of straight Lines and Planes	16	01	02	03	16
I	Projection of solids	05	01	02	10	12
II	Sectional solids	05	01	02	10	12
IV	Sectional orthographic views	08	01	02	10	12
V	Isometric and Auxiliary views	12	02	04	10	18
VI	Free hand conventional representation	04	04	02	01	06
Total		48	16	14	50	70

Legend: R=Remember, L=Understand, A=Apply and create (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student in their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different marking levels at R, L 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 the course:

- Students should maintain a separate A2 size sketch book which will be the part of term work and submit it along with drawing sheets. Following assignments should be drawn in the sketch book.
 - Minimum 5 problems each on Unit No I to VI.
 - Free hand sketches: All types of machine elements mentioned in Unit no-VI.
 - Note: Problems on sheet and in the sketch book should be different.
- Students should collect Production drawings (layouts from nearby workshops/industries and try to visualize the part from the given views.

- Each student should experience at least one problem for construction and method of drawing on sheet in all batch colleagues. Teacher will assign the problem of nature for sheet assignment 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:

- Make open online courses (MOOCs) may be used to teach various topics/sub-topics.
- Unit 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 by *self-directed learning* and assess the development of the UOs through classroom presentations (per implementation guideline for details).
- With respect to item No.19, teachers need to ensure to create opportunities and provisions for co-curricular activities.
- Guide students in undertaking micro-projects.
- Show video animation films to explain sectional orthographic and missing views and other topics.
- Use charts and robust drawing/drawing sheets developed by experienced faculty to teach standard symbols and object industries teaching practices.
- Assign different types of minor projects.
- Use wooden models to explain the problems.
- Show the actual parts/ models of machine elements mentioned in Unit VI.
- Use Computer Aided Instructional software for teaching various concepts.

12. SUGGESTED MICRO-PROJECTS

One micro-project is planned to be undertaken by a student assigned to a minor in the beginning of the semester. She 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 Parts I, COs and ADOs. The micro-project could be industry application based, student-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-projects could 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 she contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

- Wood/Thermocol Related Jobs:** Students should use the wooden/thermocol models and verify the correctness of free-view drawn in the problems solved in the sketch book.
- Production drawings:** Each student of the batch should collect at least one production drawings from local workshops or industry and list various types of sections used in the drawings.



- c. **Production drawings:** Each student should be given 10 problems in which two views of the objects are given with missing lines. Student should identify the missing lines and complete the views.
- d. **Isometric Models:** The teacher will assign one set of orthographic views-an auxiliary view and ask the student to develop 3D isometric models of the same.
- e. Students should collect samples / catalogues of the standard mechanical components available in the market.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	Engineering Drawing	Bhat, N.D.	Charotar Publishing House Pvt. Anand Gujarat Ltd., ISBN No. 978-93-80358-93-0
2.	Machine Drawing	Hitar, N.D., Panchal, V. M.	Charotar Publishing House Pvt. Ltd. Anand Gujarat, ISBN No. 978-93-80358-69-7
4.	Engineering Drawing	Narayana, K.L., Karmurthi, P.	Scitech Publications India Pvt. Ltd. ISBN No. 978-81-8371-422-6
5.	Machine Drawing	Singh, Ajay	Tata McGraw Hill Education, New Delhi ISBN No. 0-07-065992-3
6.	Engineering Drawing	Agrawal, Hasant, Agrawal, C. M.	Tata McGraw Hill Education, New Delhi ISBN No. 0-07-068863-9

14. SOFTWARE/LEARNING WEBSITES

- a. <http://www.youtube.com/watch?v=ulYFp2u5YYQ>
- b. <http://www.youtube.com/watch?v=9AGJ4chCg&feature=plcp>
- c. <http://www.youtube.com/watch?v=nd3NLS2t-OU>
- d. <http://www.youtube.com/watch?v=15KVs4N1-Q>
- e. <http://www.youtube.com/watch?v=3MScHBB0S6M>
- f. <http://www.youtube.com/watch?v=Uy2GfJhA8du4>
- g. <http://www.youtube.com/watch?v=ei63xhqb91s>
- h. <http://www.youtube.com/watch?v=kWC49rD1Hw>
- i. http://www.youtube.com/watch?v=ng_hnU3jia8&feature=related
- j. <http://www.youtube.com/watch?v=PXg3DadG1IE>
- k. Engineering Graphics & Drawing V. I II from Cognitron



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

Program Code: CEECB/CN/CLPS/CN/CONF/CW/DE/TF/ENV/EO/ET/EN/IL/MUTE.

100% (N=3) were of the following type: 1N+1C

Semester 1 Semester 2

Course Title : Business Communication I and Computers

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L. R. KUHNSMUE

Communication is the key factor for a 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 obtain the following industry identified competencies through various teaching learning experiences:

- Communicate effectively and skillfully at work/study.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with the course are to be taught and implemented, so that the students develop a far-fall using industry oriented tools associated with the above mentioned concepts.

- Communicate effectively by giving feedback in various formal and informal situations.
- Communicate skillfully using non-verbal messages in communication.
- Give presentations by using 2 different media.
- Write reports using correct guidelines.
- Use case formal and informal business letters.

4. TEACHING AND EXAMINATIONS SCHEMATIC

Teaching Strategy			$\alpha = \frac{r}{n+1}$	Examining Scheme												
I	J	K		Theory						Practical						
				Type Item.	L.Sk.	M.M.	M.Avg.	S.D.	Total	Avg.	M.M.	S.D.	Total			
001	001	1	2													

For our practice courses, the ECE 3 marks has two components: major program marks (i.e. the assessment of practical has a weighting of 60% i.e. 9 marks) and micro-project assessment, has a weighting of 40% i.e. 6 marks). This is designed to facilitate attainment of CCE holistically, as there is no direct ECE.



$\{ \text{logrank}(t_1), \text{logrank}(t_2), \dots, \text{logrank}(t_{n-1}) \}$ and $\{ \text{logrank}(t_1), \text{logrank}(t_2), \dots, \text{logrank}(t_{n-1}) \}$ are the logrank statistics for the two groups. The logrank statistic for the first group is $\sum_{i=1}^{n-1} \text{logrank}(t_i) \cdot \mathbb{I}_{\{t_i \leq t\}}$ and the logrank statistic for the second group is $\sum_{i=1}^{n-1} \text{logrank}(t_i) \cdot \mathbb{I}_{\{t_i \leq t\}}$. The logrank statistic for the first group is $\sum_{i=1}^{n-1} \text{logrank}(t_i) \cdot \mathbb{I}_{\{t_i \leq t\}}$ and the logrank statistic for the second group is $\sum_{i=1}^{n-1} \text{logrank}(t_i) \cdot \mathbb{I}_{\{t_i \leq t\}}$.

5. COURSE MAP (with sample CCS, ECE, ADG, and other)

This course rapidly traces an overview of the firm and linkages of a company to its stakeholders at different stages of its subsequent evolution to be managed by the student by the end of the course in all domains of learning in terms of the industry employer identified competencies demanded at the senior level of business.

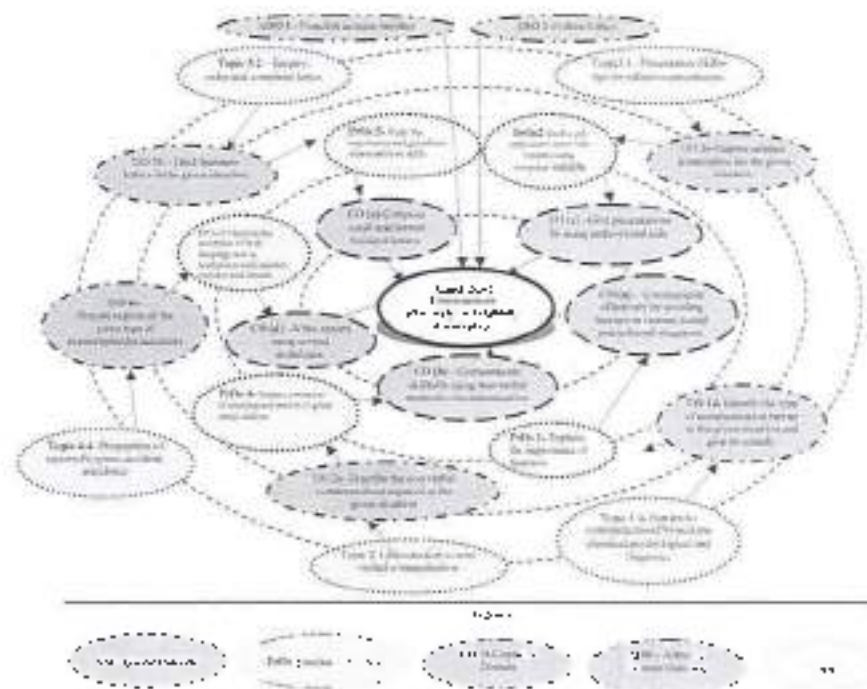


Figure 1 - Course Map

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

[illegible]

S. No.	Practical Outcomes (POs)	Unit No.	Apprais. This required
1	Explain the importance of business communication for an entrepreneur in business. study.		20

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
3	Draft a job application letter with resume using computer.	V	2*
4	Mention the examples of body language use at workplace with suitable pictures and images.	VI	2*
4	Prepare a minutes of meeting and mail it to given email address.	VII	2
5	Write the importance and guidelines of presentation skills.	IX	2*
6	Draft a detailed Progress Report.	IX	2*
7	Organize a debate on topic of a communication.	I & II	2
8	Summarize an industry report using techniques of summarizing.	IX	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 appearance for a professional.	II	2*
14	Draft a memo on given topic.	V	2
15	Present any Two barriers in communication using case study.	I	2*
16	Present a technical paper using IEEE format.	III	2*
			32

Note

1. A suggested list of practical LOs is given in the above table. Each practical LOs can be added to attain the COs and Competency. A minimum list of minimum 12 or more practical LOs/activities need to be performed. Out of which, the practicals marked as * are compulsory, so that the student reaches the 'Proficient level' in Oup's *Proficiency in English Language* as generally required by the industry. The size of tasks for the practicals should not exceed more than 20 students ideally for the maximum attainment of LOs and PrOs.

2. Hence, the 'Process' and 'Product' related skills associated with each LO of the laboratory, workshop/lab work are to be assessed according to a suggested sample prescription.

2. 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 universities concerned.

S. No.	Equipment Name with Broad Specifications	Exp. S.No.
1	PCO/Printer	All
2	Smart Board with networking	All
3	Laptop/Lab with internet	All
4	Printer	Wherever Applicable

8. UNDERPINNING THEORY COMPONENTS

The following topics/sub-topics 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 English or Japanese)		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 elements 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. Introduction to Communication - Elements, Importance, Functions. 2. Types, meaning and importance - Verbal (Oral - Written - Formal - Informal, Verbal - Horizontal and Diagonal communication). 3. Principles of effective communication. 4. Barriers to communication - Physical, mechanical, psychological and linguistic. 5. Business communication - Meaning, characteristics and importance.
Unit- II Non-Verbal Communication	2a. Describe the non-verbal communication aspects in the given situation. 2b. Describe personal appearance expected in the given communication situation. 2c. Describe the given facial expressions.	2e. Use relevant facial expressions in the given situation. 2f. 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 (clothing 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 a reference.	3.1. Presentation skill - tips for effective presentation. 3.2. Guidelines for developing power point presentation. 3.3. Presenting - important papers.

- h. *The term* **Assessment** 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.
- i. About 15-20% of the topics/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 guidelines for details).
- j. With respect to part (b), teachers need to ensure to create opportunities and provisions for *extracurricular activities*.
 - a. Arrange various communication activities using functional grammar.
 - b. Show video/film material to develop listening skills and enhance vocabulary.
 - c. Use real objects 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 'complete' in the *beginning* of the semester. It is required 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 turn an integration of CRAs, CRIs and ALOs. 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 individual & 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 suggested list is given here. Similar micro-projects could be solved 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 slide.
- 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 or 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. Detail account of business etiquettes observed in organization.
- k. Summarize two 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 P. S. Datta	Oxford University Press
3	Personality Development and Soft Skills	Bhagat K. Mishra	Oxford University Press

14. SOFTWARE/LEARNING WEBSITES

- a. <https://www.brite-learn.com/learning/learn-enr.htm>
- b. <http://learn.english-to-telugu.com/learn-enr.htm>
- c. <http://www.talkenglish.com>
- d. <http://language.10system.com>
- e. www.englishworldhelp.com
- f. www.notesdesk.com
- g. <http://www.internationalspan.com>
- h. www.study-education.com
- i. totalcommunication.com
- j. www.speakingtips.com

Program Name : Mechanical Engineering Program Group

Program Code : AE-ME

Semester : Second

Course Title : Mechanical Engineering Workshop

Course Code : 22010

1. RATIONALE

Diploma holders in engineering are expected to develop advanced workshop skills. Further involving fitting, smithy operations, rivet, chain work, v-belt and shaper operations. These operations are widely found in Indian 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000.

2. COMPETENCY

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

- Perform repairing work of utility jobs in the mechanical engineering workshop.

3. COURSE OUTCOMES (COs)

The theory, practical experience and relevant soft skills associated with this course are to be taught and experienced, so that the student demonstrate the following *industry oriented* outcomes with the following examples.

- Select tools and machinery according to job.
- Use hand tools in different shops for performing different operations.
- Operate equipment and machine in various shops.
- Prepare composite utility jobs according to drawing.
- Measure workshop related tools, instruments and machines.

4. TEACHING AND EXAMINATION SCHEME

Learning Scheme	C	T	P	Credit (C+T+P)	Examination Scheme											
					Theory						Practical					
					Paper I (MCQ)	ESK	PS	Total	ESK	PS	Total	ESK	PS	Total	ESK	PS
1	1	1	1	3	10	10	10	30	10	10	20	10	10	20	10	10

(1) In the practical only section, the 'A' marking represents 'performance' marks i.e. the competency is perceived to have been achieved to the degree of 60% i.e. 30 marks out of 50 marks. The 'B' marking represents 'theoretical' marks i.e. the degree of 40% i.e. 20 marks. This is designed to facilitate understanding of the competency at the end of the course.

Legend: C - Lecture, T - Tutorial/Teacher Guided Learning, P - Practical, C+T+P = Total Credit, ES - End Semester Examination, PS - Progress Assessment.

5. COURSE MAP (Sample COs, POs, LOs, ASOs 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 in the end of the course, in all domains of learning in terms of the industry employer identified competency depicted in the centre of the map.

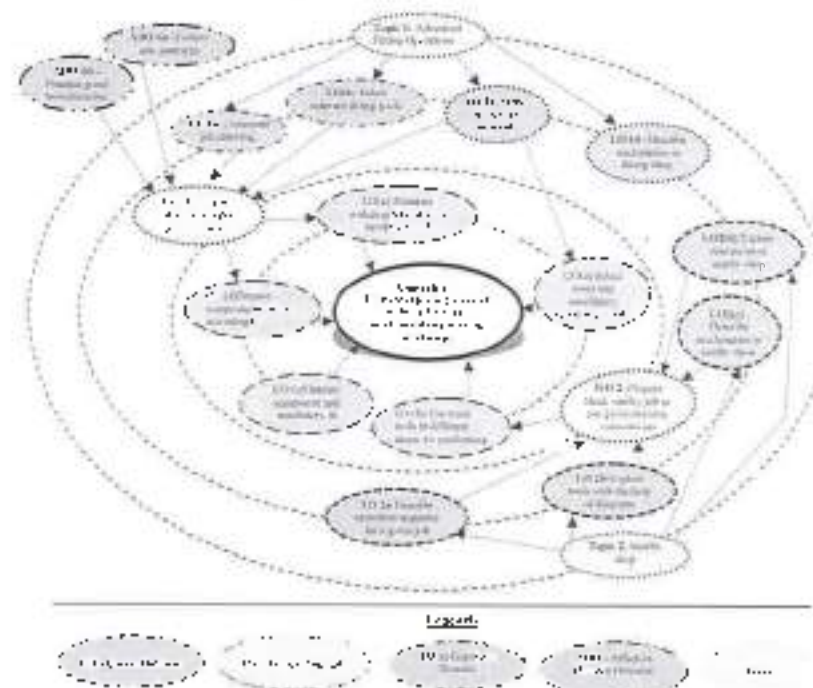


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

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

S. No.	Practical Outcome (POs)	Unit No.	Approx. Hrs required
1	Prepare fitting job on a lathe and turn the assembly types as per given drawing or job with following operations: Marking operation, Punching operation, Drilling operation, Cutting operation, Filing operation, Finishing operation (male and female assembly), Checking correctness of fit of mating parts. Part I	1	2
2	Prepare fitting job on a lathe and turn the assembly types as per given drawing or job with following operations: Marking operation, Punching operation, Drilling operation, Cutting operation, Filing operation, Finishing operation (male and female assembly), Checking correctness of fit of mating parts. Part II	1	2



S. No.	Practical Outcome (POs)	Unit No.	Approx. Hrs. required
1	Filing operation, Fitting operation (male and female assembly), Checking correctness of fit of mating parts. Part II		
2	Prepare fitting job (male and female assembly type) as per given drawing or job with following operations: Marking operation, Punching operation, Drilling operation, Cutting operation, Filing operation, Fitting operation (male and female assembly), Checking correctness of fit of mating parts. Part II	I	1
4	Prepare fitting job (male and female assembly type) as per given drawing or job with following operations: Marking operation, Punching operation, Drilling operation, Cutting operation, Filing operation, Fitting operation (male and female assembly), Checking correctness of fit of mating parts. Part IV	I	2
5	Prepare fitting job (male and female assembly type) as per given drawing or job with following operations: Marking operation, Punching operation, Drilling operation, Cutting operation, Filing operation, Fitting operation (male and female assembly), Checking correctness of fit of mating parts. Part V	I	1
6	Prepare fitting job (male and female assembly type) as per given drawing or job with following operations: Marking operation, Punching operation, Drilling operation, Cutting operation, Filing operation, Fitting operation (male and female assembly), Checking correctness of fit of mating parts. Part VI	I	2
7	Prepare fitting job (male and female assembly type) as per given drawing or job with following operations: Marking operation, Punching operation, Drilling operation, Cutting operation, Filing operation, Fitting operation (male and female assembly), Checking correctness of fit of mating parts. Part VII	I	2
8	Prepare block on the job like Hook, peg, flat chisel, bolt head or any hardware items as per given drawing or job with following operations: Cutting operation, Heating operation, Upsetting operation, Punching operation, Swaging operation, Fullering operation, Bending operation. Part I	II	2*
9	Prepare block on the job like Hook, peg, flat chisel, bolt head or any hardware items as per given drawing or job with following operations: Cutting operation, Heating operation, Upsetting operation, Punching operation, Swaging operation, Fullering operation, Bending operation. Part I	II	2
11	Prepare block on the job like Hook, peg, flat chisel, bolt head or any hardware items as per given drawing or job with following operations: Cutting operation, Heating operation, Upsetting operation, Punching operation, Swaging operation, Fullering operation, Bending operation. Part I	II	2
11	Prepare block on the job like Hook, peg, flat chisel, bolt head or any hardware items as per given drawing or job with following operations: Cutting operation, Heating operation, Upsetting operation, Punching operation, Swaging operation, Fullering operation, Bending operation. Part I	II	2



S. No.	Practical Outcome (POs)	Unit No.	Approx. Hrs. required
	operation, Bending operation. Part A		
7	Prepare block on the job like Hook, peg, flat chisel, bolt head or any hardware items as per given drawing or job with following operations: Cutting operation, Heating operation, Upsetting operation, Punching operation, Swaging operation, Fullering operation, Bending operation. Part A	II	2
12	Prepare block on the material along with estimated cost according given drawing of jobs, such as: preparing of class room furniture, book shelves, metal door, motor cycle guard, electric stand with locking device concerning the following operations: a. Marking operation as per drawing b. Cutting operation as per drawing c. Upsetting operation as per drawing d. Edge preparation operation as per drawing e. Filing operation as per drawing f. Bending operation as per drawing g. Welding operation as per drawing	III	2*
14	Prepare steel frame structure of utility job like stool, benches, tables, drawing desk, window grill, ventilation door frame or similar job involving the welding joint as per given drawing or job. Part I	II	2
15	Prepare steel frame structure of utility job like stool, benches, tables, drawing desk, window grill, ventilation door frame or similar job involving the welding joint as per given drawing or job. Part I	II	2
16	Prepare steel frame structure of utility job like stool, benches, tables, drawing desk, window grill, ventilation door frame or similar job involving the welding joint as per given drawing or job. Part II	II	2
17	Perform fabrication operation to prepare job like wire mesh tray, drawing sheet holder and guard sheet stand as per given drawing. Part I	III	2*
18	Perform fabrication operation to prepare job like wire mesh tray, drawing sheet holder and guard sheet stand as per given drawing. Part II	III	2
19	Perform fabrication operation to prepare job like wire mesh tray, drawing sheet holder and guard sheet stand as per given drawing. Part III	III	2
20	Perform Cutting operation operations to prepare small metal brace for your workshop or similar using self hard rubber cloth with bedding as per given drawing.	IV	2*
21	Perform Flaring operation operations to prepare small metal brace for your workshop or similar using self hard rubber cloth.	V	2

S. No.	Practical Outcome (POs)	Unit No.	Approv. Hrs. required
	Unit building as per given drawing		
22	Continue experiment No. 20 and perform <i>Round turning</i> operations to prepare small scale finished job per workshop manual using soft board, select work with building as per given drawing	IV	2 ^h
23	Continue experiment No. 20 and perform <i>Turning</i> operations to prepare small scale job per workshop manual using soft board, select work with building as per given drawing	IV	2
24	Continue experiment no. 20 and 22 and complete the small article being for your workshop using soft board, select work with building as per given drawing by performing <i>Finishing</i> operations	IV	2
25	Continue experiment no. 20 and 22 and complete the small article being for your workshop using soft board, select work with building as per given drawing by performing <i>Finishing</i> operations	IV	2
26	Prepare simple turning job with facing operation as per drawing	V	2 ^h
27	Perform centering operation as per drawing to prepare simple turning job	V	2
28	Prepare simple turning job with <i>Plane</i> turning operation as per drawing	V	2
29	Prepare simple turning job with <i>Step</i> turning operation as per drawing	V	2
Total			58

Note:

- Suggested list of practical POs is given in the above table, more tasks per unit POs can be added to attain the POs and competency.
- The *Preparer* and *Product* related skills associated with each PO is to be assessed according to suggested sample given below.

S. No.	Performance Indicators	Weightage in %
1.	Prepare experimental set-up	20
2.	Prepare tool using different operations	30
3.	Follow Safety measures	10
4.	Check the quality of finished job	20
5.	Answer in, write and questions	5
6.	Submit journal report on time	5
7.	Self housekeeping	5
8.	Attendance and punctuality	5
Total		100



The above POs also comprise of the following *skill* modules, which are *Assessable Learning Outcomes (ALOs)* that are best developed through the laboratory field based experiences.

- Follow safe practices.
- Practice good housekeeping.
- Practice energy conservation.
- Function as a team member.
- Function as a team leader.
- Follow ethics.

The ALOs are not specific to any one POs, but are embedded in many POs. Hence, the sequencing of the ALOs takes place gradually in the student when she undergoes a series of practical experiences over a period of time. Moreover, the level of achievement of the ALOs, according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as follows below:

- 'Knowing 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 assist institutions in conduct of experiments, as well as aid in procure equipment by a manufacturer.

S. No.	Equipment Name with Broad Specifications	Exp. S. No.
1.	Marking table with scribers. Black Cast iron surface flat, non magnetic non glowing, planing accuracy as per IS - size 1600mm x 600mm x 150mm of workshop grade with scribe grade scriber 150mm.	1
2.	Surface plate, C.I. 50 face plate, planed, hand scraped and seasoned, Brown and sharp type ribbing complete with handles for lifting and wooden protective covering, conforming to IS- 2285 - 1983, 1140 mm x 450 mm or 2140 mm x 600 mm.	
3.	Measuring Instruments, Marking Instruments, Fitting Hand Tools: Vice block, height gauges, vernier calipers, outside and inside calipers, micrometers, bevel protractor, files of different sizes and grades, hacksaw, frame, chisel, steel rules, try squares, drills, surface gauge, knurder punch, dot punch, divider, Angle plate, wire, files, spanners etc.	2
4.	Tap and Die Set: Ball tap and die set complete in box with accessories. 1-10 BA, 1-14 " to 1" BSF, 1-20 3-4" NF, 1-4" to 3-4" NC, metric, 1mm, 1mm metric, one set each.	3
5.	Bench Drilling Machine: Firm capacity mounted drilling machine, with 5 HP motor, 250 - 11420 rpm, with motor starter with 1.5 kW capacity, cast iron chuck, V belt with 100 mm working span.	4
6.	Bench Grinder: Double ended bench or intermediate size 750 mm x 150 mm with standard accessories with single phase 0.25 HP motor high speed.	5
7.	Vice: Bench Vice 150 mm	6
8.	Electrically operated Hand Drilling Machine (pistol Type) 5mm capacity steel drilling. Power from 300-400 W.	7
9.	Power Hack Saw Machine: Mechanical type hacksaw machine equipped	8

S. No.	Equipment Name with Brand Specifications	Exp. S.No.
	with coolant pump, vice, length gauge, machine drive belt guard, with capacity to cut round materials up to 125mm and square materials 150mm x 150mm. Blade size 550mm x 25mm and 1 HP AC 440 V, 50/1440 RPM Electric motor and starter.	
10	Foot Pedal Grinder: 200mm spindle speed 2600 to 3000 rpm, diameter of wheel 200mm width 25mm.	1
	Hand Grinder: Two speed flexible shaft, 370watts, full load speed 6400 rpm and 665 rpm.	
11	Work Bench: 1800x1200x750mm	
12	Hearth with blower: Centrifugal motorized blower 4 HP 1440/750 with Ganges pipe fittings valves. Hearth Size Made of M. S. Sheets 750 max x 750 mm with water meter. Length of 2.5 m. 1 with chimney.	2
13	Anvil: Single Horn 150 kg castable cast iron with stand.	2
14	Leg vice: Saw size.	2
15	Smagor Black: Wrought iron or Mild steel cast iron 15450 x 450 x 100 mm size 250 mm x 100 mm.	2
16	Tools and Gauge: Hammers of different size, Long Chisel, Hammers, Saws, Dies, Bench, Drilling.	2
17	Power Hammer: 1 frame capacity, motorized, equipped with foot lever, operated, clutch to control, strokes spring loaded hand lever, in adjustment of strokes, 10 mm and 12.5 mm and the vertical pin line. 1 HP 440 V A.C. 1/50 Hz, 250 rpm electric motor and starter, having net weight about 70 kg; maximum 10-15 mm strokes, measure 100 to 200, hammers up to diameter 40 mm to 50 mm.	2
18	Bench Grinders: Double ended bench grinder with 142/3 phase 50 cycles 440 V and one side rough and other side smooth 250mm x 25mm x 15mm grinding wheel complete with wheel guard, tool rest and rotary switch.	2
19	Work Bench: With vice 1800x1200x750mm	2
20	Arc Welding Transformer: Three phase with standard accessories. Welding Transformer to provide current from 50 amps to 600 amps for single operator and 25 amps to 400 amps for two operators at 60% open current. The max voltage of 100% open circuit provision, reset switch for quick selection of current with following technical specifications conforming to IS 1551-1975 Standard Accessories: 1. Copper cable single core one fitting to IS 9557-1978 for 600 amps. 2. Electrode holder up to 600 amps. 3. Hand Saws. 4. Earth clamp, comby bar type. 5. Panel welders Goggles. 6. Welders apron. 7. Welders glass.	3,4,5
21	Single Phase Air-cooled arc Welding Transformer with Accessories: Single phase air-cooled arc welding transformer, step less variable current regulator for welding current range 40 to 300 amps, 1-60mm g.m. % 85-107%.	3,4,5
22	Light Duty Spot Welding Machine: Portable type spot Welder rating 2.5 KVA, for welding up to 2mm - 2mm M. S. Sheet. Max throat depth 30 mm.	3,4,5



S. No.	Equipment Name with Brand Specifications	Exp. S.No.
23	Band Saw: Heavy duty vertical band saw machine, size of cut on table 900 mm x 400 mm, 2HP 440 V, 50 Hz, 3 phase AC motor with starter, Dia of wheel 450mm, width of wheel 25mm, depth of cut 300mm with standard accessories including dust collector.	5
24	Band saw and Circular Saw Sharpener: 150 mm to 1054 mm dia circular saw 06 mm to 150 mm wide band saw blades, a large size sharpening machine, equipped with roller sawing, 10 turn spindle revolving on motor for level of blade teeth. Feeds 40 and 50 teeth per min, provided with 1 HP AC 440 V 3 Phase 50 Hz. Electric motor with starter, cast iron pedestal grinding wheel, Motor pulley and V Belt.	5
25	Chain and Chisel Shifting Machine: Foot pedal operated with endless chain, cutter to chisel, breakstock counter balanced, table has no component slide in lateral movement by screw adjustment and longitudinal traverse by hand wheel provided with quick screw clamp having capacity maximum size of 100 mm x 100 mm, max. size of chain 25 mm, depth of cut 150 mm, longitudinal table movement 775 mm, lateral movement 100 mm, complete with 3ph A.C. 440 V 50 Hz electric motor and switch.	6
26	Vertical Sanders: Vertical sanders and polisher flat surface capacity 40 mm input ball load 400 watts No load speed 2200 rpm Full load speed 1200 rpm.	6
27	Heavy Duty Circular Saw: 3 HP with 5800rpm. Compact and well balanced. Power motor for maximum performance. 100 mm ball and roller bearings construction. Reversible motor clamp flange.	6
28	Heavy Duty Variable Speed Reciprocating Saw: 680 watts 2400rpm Variable speed, full and full motor construction. Low vibration, rubber foot. High cutting blade position. Externally replaceable brushes. Capacity-144 mm.	6
29	Single Speed Impact Drill: Powerful motor for maximum performance. Compact and well balanced, helical gear system. Bearing block for precision gear and spindle alignment. Capacity-13mm.	6
30	Angle Grinder: Powerful long life motor, spindle lock. Durable and reliable design. Maximum in flow with zero dynamic fan system. Compact gear case. External brush access panel. Capacity-100mm.	6
31	Rotating Clay: Fanmeters, Spindlers and torque wrench. Power Allen keys.	
32	Centre Lathe (General type): Max. swing over bed 450 mm, Max. swinging gear 750 mm. Admit between centres 555 mm Spindle bore 52 mm. Power at motor 3hp 3 phase 50Hz. With accessories.	7
33	Hydraulic Power: Hacksaw Machine, Length of stroke Max 2200mm for cutting round and square material (Max 130mm) speed 1440 rpm. Power of motor 1.5 kW 1 AC 440 V 3 phase 50 Hz. Accessories Vice for holding bar saw blade, tank, pump with fittings, cone clutch, bar rest assembly set of wrenches and belts.	7
34	Shaping Machine: Max. Length of stroke 1600 mm, length and width of ram 314 x 175 mm Max. distance table to ram 400 mm. Max. distance table to ram 1300 mm. Max. distance of table to ram 1600 mm. Max. Vertical travel of table 250 mm. No. of speeds of ram 4 Max. Travel of table 150 mm. Revolving of table 100 mm. Max. distance of table to ram 1600 mm. Power of motor 1.5 kW 1 AC 440 V 3 phase 50 Hz. Accessories: Auto Lubrication.	7

S. No.	Equipment Name with Broad Specifications	Exp. Cost
25	Measuring Instruments and Tools: Vernier Caliper: 0 to 200 mm, Dial Caliper: 0-50 mm, Vernier Depth Gauge: 0 to 100 mm, Dig. cal Height Gauge: 0 to 25 mm, Dig. cal Micrometer: 0 to 25 mm, Combination Set	7

K. UNDERPINNING THEORY COMPONENTS

The following topics/sub-topics to be taught and assessed in order to develop UO for relevant the COs to attain the identified competencies:

Unit	Unit Outcomes (UO) (in cognitive domain)	Topics and Sub-topics
Unit-I Advanced Fitting Operations	a. Interpret the given job drawing. b. Select relevant fitting tools for the given job. c. Select proper raw material for the given condition. d. Describe the specified machinery in fitting shop. e. Explain the maintenance procedure of the given tool/equipment in fitting shop.	1.1 Fitting tools-holding tools like bench vice, V-block, set square, C-clamp, Marking and measuring tools like surface plate, angle plate, universal scribing block, try square, combination set, scriber, odd leg caliper, divider, punches, calipers, Vernier caliper, Vernier depth gauge, Vernier height gauge, outside micrometer, inside micrometer, bore gauge, screw driver, spanners and their specifications. 1.2 Cutting tools-Hacksaw, Chisels, combination plane, nose plane, twist drill, taps and tap wrenches, dies and die holder, bench drilling machine, portable electric drill, reamers. 1.3 Finishing tools-File: Hand file, flat file, square file, triangular file, half round file, round file. 1.4 Fitting shop machinery-shaping machine, power saw grinder their specification care and maintenance. 1.5 Basic processes - chipping, filing, scraping, grinding, marking, sawing, drilling, tapping, slotting, reaming. 1.6 Marking and measuring angles, safety practices.
Unit-II Smithy shop work	2a. Describe operation sequence for a given job. 2b. Explain the function of the given tool with the help of diagrams. 2c. Describe the given machinery in smithy shop. 2d. Describe the specified operations in the smithy shop.	2.1 Tools and equipment- bench, anvil, swage block, leg vice, hammers, tongs, flat anvil, round, square bit tongs, round bit tongs, pick up tongs. 2.2 Forging operations-upsetting, drawing down and fulling, flattening, swaging, bending, twisting, piercing, punching and drifting, welding, finishing, riveting, cutting and cold chisels. 2.3 Safety practices.

	2e. Explain the maintenance procedure for tools, equipment and machinery.	
Unit-III Domestic Fabrication work	3a. Select the relevant welding tool for weld of the given job. 3b. Describe the function of the given machinery in fabrication shop. 3c. Describe the fabrication procedure in given situation. 3d. Explain maintenance procedure for the given equipment in the fabrication shop.	3.1 Arc welding equipment- Power source for arc welding, transformers, motor generators and rectifiers. 3.2 Arc welding hand tools-welding electrodes, electrode holder, ground clamp, wire brush, clapping hammer, dressing table and cabin, face shield, apron, hand gloves. 3.3 Technique of welding- preparation of work, striking an arc, weaving, effect of current and speed, welded joints, welding positions. 3.4 Operation of machinery in welding shop-arc welding transformer, their specification and maintenance. 3.5 Safety practices.
Unit-IV Advanced carpentry work	4a. Describe with sketches the function of the given advanced furniture making and carpentry tool(s). 4b. Select the relevant furniture making tool for the given job. 4c. Describe the operation of the given wood working machine. 4d. Explain maintenance procedure for the given equipment in carpentry shop.	4.1 Types of artificial wood-veneer, ply wood, block board, hard board, laminated boards, veneer, fibre board and their applications. 4.2 Furniture making hand tools - Marking and measuring tools-steel rule, steel tape, marking gauge, try square, compass and divider, scriber, marking knife, level. 4.3 Holding tools-carpenters vice, C-clamp, test clamp. 4.4 Planning tool-back plane, smoothing plane, rebate plane, plough plane. 4.5 Cutting tools-saws - crosscut and hand saw, rip saw, tenon saw, dovetail saw, chisels, finger joint, dovetail chisel, mortise chisel. 4.6 Drilling and boring tools-bit, augers, brace, hand drill, auger bit, hand drill, g. vice. 4.7 Mixed functions tools-let, power, claw hammer, screw driver, wood rasp, file, leadawl. 4.8 Safety practices.
Unit-V Workshop machines	5a. Describe with sketches the function of the given work and hold holding device. 5b. Explain with sketches the working principle of the given lathe operation. 5c. Calculate speed, feed, depth of cut of lathe machine for the given	5.1 Working principle and types of lathe. 5.2 Parts of lathe-bed, headstock, tailstock, carriage or saddle, compound rest, tool post, tool holder, aprons. 5.3 Work holding methods-three jaw chuck, four jaw chuck, face plate, lathe dogs and driving plate. 5.4 Measuring instruments- outside and inside caliper, vernier caliper, micrometer. 5.5 Cutting parameters-cutting speed, feed



job	detail of cut, tools/materials, tools geometry
Ex. Explain working principle of the given workshop machine	3.6 Lathe operations: turning & Shaper machine - Working principle and operation, classification, main parts and their functions

Note: To attain the 1. Overall competency, *assess* listed COs need to be undertaken to achieve the Application level of Bloom's Cognitive Domain Taxonomy.

9. SUGGESTED SPECIFICATION TABLE FOR EXISTING 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.

- Prepare work diary based on practical performed in workshop. Work diary consist of identifying operations to be performed, required raw materials, tool & equipment & date of performance with teacher's guidance.
- Prepare journals- content of free hand sketches of tools and equipments in each shop detail identification and precautions to be observed while using tools and equipment.
- Prepare Download a specification of followings:
 - Various tools and equipment in various shops
 - Pre-specified equipment in workshop
 - Various machinery in workshop
- Undertake a market survey of local dealers for procurement of workshop tools, equipment, machines and raw material.
- Visit any fabrication or end workshop sheet metal workshop and prepare a report.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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

- Use open online content (MOOCs) may be used to teach various topics on topics.
- Use 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 *hypercurriculum* 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.16, teachers need to ensure to create opportunities and provisions for co-curricular activities.
- Guide students in undertaking micro-projects.
- Arrange visit to nearby industries and workshop for understanding various manufacturing process.
- Show video-animation films to explain functioning of various processes of turning operations and shaping operations.
- Prepare maintenance charts for various workshop machines.
- In respect of item 17 above, teachers need to ensure to create opportunities and provisions for such co-curricular activities.

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. She 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 at best an integration of PrOs (COs, AOs). The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or task-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 a 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 of every student to become problem solver so that she contributes to the projects of the industry. A suggested list is given here. Similar micro-projects could be added by the concerned faculty.

- Black Smithy Jobs:** Each batch will collect minimum 3 different articles/parts of plates, mostly from the local workshop / market. Each student will measure the significant parameters and draw the sketch. Each student will also note the material of the article's jobs and their local applications.
- Fabrication Utility Jobs:** Each batch will collect information related to fabrication utility jobs including name of job, sketch, material used, information process and their field applications of minimum 3 different jobs of fabrication used in any household item from the local market.
- Fabrication Utility Jobs:** Each batch will select at least one fabrication utility job used in any construction and prepare steel frame / structure of utility job like window grill, ventilator, door frame or similar job involving arc welding including drawing, field application of selected job.
- Wood Related Jobs:** Each batch will collect minimum 4 different samples of artificial woods such as plywood, block board, fibre board, laminated board, veneer, etc. and write their applications.
- Wood Related Jobs:** Each batch will collect and record the information related to furniture making tools and furniture used in educational institutes from the local carpenter / furniture workshop with their inner specifications and sketch.
- Miscellaneous Jobs:** Each batch will prepare jobs like tree guards, stand etc. by using appropriate material and method of fabrication.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	Workshop Practice	Hosay, H.S.	McGraw Hill Education, New Delhi, ISBN-13: 978-0070671195
2.	A Textbook of Manufacturing Process (Workshop Tech.)	Gupta, J.K. Khurmi, K.N.	S. Chand and Co. New Delhi ISBN, 81-219-3691-5
4.	Introduction to Basic Manufacturing Process and Workshop Technology	Singh Rajender	New Age International New Delhi 2014, ISBN: 978-81-224-3070-1
A	Workshop Technology Vol-I and II	Engluvarshi B.S.	Deepnarai, New Delhi 2014, ISBN 4567144775



14. SOFTWARE/LEARNING WEBSITES

- a. <http://www.ashtools.com>
- b. <http://www.shantools.com/downloads/Woodworking%20Carpentry%20Tools.pdf>
- c. <http://www.weldingtechnology.org>
- d. <http://www.newspapers.nlshers.com/samplechapter0301499.pdf>
- e. <http://www.youtube.com/watch?v=7gD-X6gBj11W>
- f. <http://www.youtube.com/watch?v=CHFE0j5NHrc&andfeature=related>
- g. <http://www.youtube.com/watch?v=Ks1w9CAst4&andfeature=related>
- h. <http://www.pisiblog.com>
- i. <http://sourcing.indiamart.com/engineering/articles/materials-used-hard-tools/>
- j. http://www.youtube.com/watch?v=9_cnk0AblQk



