MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION

Diploma Programme in **Computer Engineering**
I – Scheme

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

PEO 1. Provide socially responsible, environment friendly solutions to Computer engineering related broad-based problems adapting professional ethics.

PEO 2. Adapt state-of-the-art Computer engineering broad-based technologies to work in multi-disciplinary work environments.

PEO 3. Solve broad-based problems individually and as a team member communicating effectively in the world of work.

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

PO 1. ***Basic knowledge:*** *Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad-based Computer engineering problem.*

PO 2. ***Discipline knowledge:*** *Apply Computer engineering discipline - specific knowledge to solve core computer engineering related problems.*

PO 3. ***Experiments and practice:*** *Plan to perform experiments and practices to use the results to solve broad-based Computer engineering problems.*

PO 4. ***Engineering tools:*** *Apply relevant Computer technologies and tools with an understanding of the limitations.*

PO 5. ***The engineer and society:*** *Assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to practice in field of Computer engineering.*

PO 6. ***Environment and sustainability:*** *Apply Computer engineering solutions also for sustainable development practices in societal and environmental contexts and demonstrate the knowledge and need for sustainable development.*

PO 7. ***Ethics:*** *Apply ethical principles for commitment to professional ethics, responsibilities and norms of the practice also in the field of Computer 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 in the Computer engineering field and allied industry.*

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

PSO 1. **Computer Software and Hardware Usage:** Use state-of-the-art technologies for operation and application of computer software and hardware.

PSO 2. **Computer Engineering Maintenance:** Maintain computer engineering related software and hardware systems.

Notes for All the Semesters

1. *Every student has to **separately pass** in **End-Semester-Examination (ESE)** for **both the-ory** 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/ Assign-ment/Quiz/Presentations/attendance according to the nature of the course. The scheme and schedule for progressive assessment should be informed to the students and dis-cussed 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 top-ics/sub-topics, which are relatively simpler or descriptive in nature are to be given to the students for self-study and proper learning of these topics should be assured through classroom presentations by students (see implementation guideline for details).*

5. Passing Criterion for Theory and Practical Courses for all Semesters

   a. ***Passing Criterion for Theory course**: - Each Theory course consists of 2 components, ESE (End Semester Examination) and PA (Progressive Assessment)*

   (i) The passing criterion for each theory course is obtaining minimum 40% of marks allotted to ESE & PA component together. [i.e. for total marks of ESE (70 marks) + PA(30 marks) together = (Total 70+30 =100), obtaining minimum 40 marks are mandatory for passing the Theory course.]

   (ii) To qualify for above condition (i), obtaining minimum 40% of marks allotted to ESE component is mandatory. [i.e. for total marks of ESE = 70, obtaining minimum 28 marks are mandatory. For passing ESE component)

   b. ***Passing Criterion for Practical course**: - Practical course consists of 2 components, ESE (End Semester Examination) and PA (Progressive Assessment)*

   (i) ESE and PA components of Practical course are independent head of passing.

   (ii) The passing criterion for ESE component is obtaining minimum 40 % of marks allotted to ESE component. [i.e. for total marks of ESE= 25, obtaining minimum 10 marks are mandatory for passing in ESE component]

   (iii) The passing criterion for PA component is obtaining minimum 40 % of marks allotted to PA component. [i.e. for total marks of PA= 25, obtaining minimum 10 marks are mandatory for passing in PA component]

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

Maharashtra State Board of Technical Education, Mumbai

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

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

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

Duration of Course: 6 Semesters — **With Effect From Academic Year: 2017 - 18**

Semester : First — **Duration : 16 Weeks**

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

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

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

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

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

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

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

- **Candidate remaining absent in practical examination of any one part of Basic Science course i.e. Physics, Chemistry will be declare as Absent in Mark List and has to appear for examination. The marks of the part for which candidate was present will not be processed or carried forward.**
- **If Candidate not securing minimum marks for passing in the "PA" part of practical of any course of any semester then the candidate shall be declared as "Detained" for that semester.**

MSBTE Final Copy Dt. 07.05.2017

MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION MUMBAI

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

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

Semester : **First**

Course Title : **English**

Course Code : **22101**

1. RATIONALE

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

2. COMPETENCY

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

- **Communicate in English in spoken and written form effectively.**

3. COURSE OUTCOMES (COs)

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

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

4. TEACHING AND EXAMINATION SCHEME

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

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

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

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

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

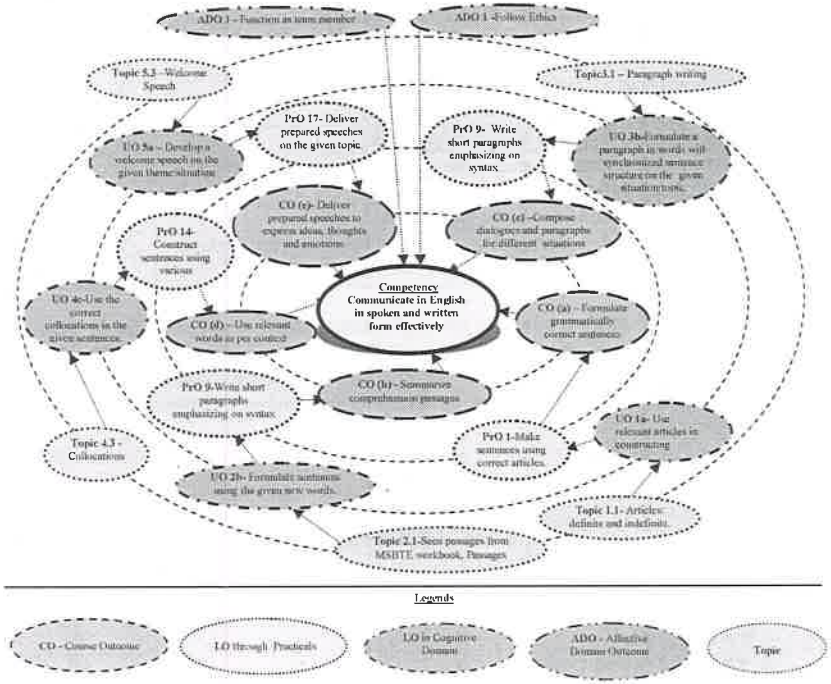

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

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

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

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

Note

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

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

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

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

a. Follow safety practices.
b. Maintain Cleanliness.
c. Demonstrate working as a leader/a team member.
d. Follow ethics.

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

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

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

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

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

8. UNDERPINNING THEORY COMPONENTS

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

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

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

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

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

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

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

10. SUGGESTED STUDENT ACTIVITIES

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

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

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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

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

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

12. SUGGESTED TITLES OF MICRO-PROJECTS

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

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

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

13. SUGGESTED LEARNING RESOURCES

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

14. SOFTWARE/LEARNING WEBSITES

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

c. http://www.talkenglish.com/
d. languagelabsystem.com
e. www.wordsworthelt.com

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

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

Semester : **First**

Subject Title : **Basic Science (Physics & Chemistry)**

Subject Code : **22102**

1. RATIONALE

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

2. COMPETENCY

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

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

3. COURSE OUTCOMES (COs)

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

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

4. TEACHING AND EXAMINATION SCHEME

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

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

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

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

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

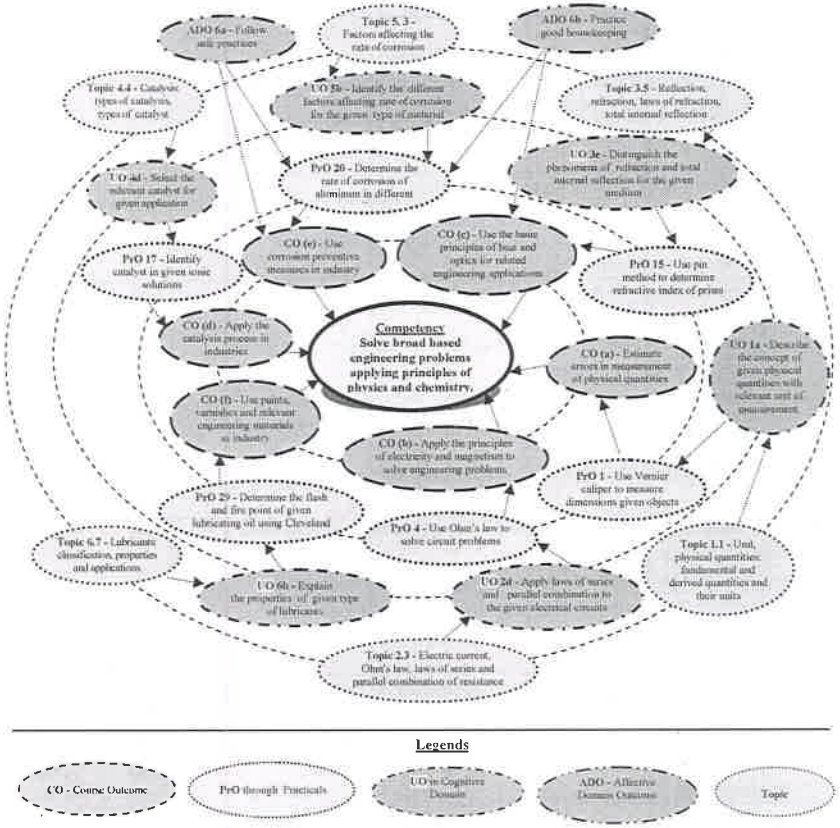

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

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

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

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

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

Note

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

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

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

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

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

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

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

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

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

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

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

8. UNDERPINNING THEORY COMPONENTS

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

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

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Units and Measurements	1a. Describe the given measurement device and its application. 1b. Describe with justification the device required to measure the radius of curvature of the given object. 1c. State with justification the error in the given measurement quantity. 1d. Describe the procedure to determine the dimensions of the given physical quantities.	1.1 Unit, physical quantities: fundamental and derived quantities and their units 1.2 Systems of unit: CGS, MKS, FPS and SI 1.3 Dimensions, dimensional formula 1.4 Errors, types of errors: instrumental, systematic and random error, estimation of errors: absolute, relative and percentage error, significant figures
Unit– II Electricity, Magnetism and Semiconductors	2a. Calculate electric field, potential and potential difference of the given static charge. 2b. Describe the concept of given magnetic intensity and flux with relevant units. 2c. Explain the heating effect of the given electric current. 2d. Apply laws of series and parallel combination in the given electric circuits.	2.1 Concept of charge, Coulomb's inverse square law, Electric field, Electric field intensity, potential and potential difference 2.2 Magnetic field and magnetic field intensity and its units, magnetic lines of force, magnetic flux 2.3 Electric current, Ohm's law, specific resistance, laws of series and parallel combination of resistance, heating effect of electric current
	2e. Distinguish the given conductors, semiconductors and insulators on the basis of energy bands. 2f. Explain the I-V characteristics and applications of the given p-n junction diodes.	2.4 Conductors, Insulators and Semiconductors, Energy bands, intrinsic and extrinsic semiconductors 2.5 p-n junction diode, I-V characteristics of p-n junction, applications of p-n junction diode
Unit– III Heat and Optics	3a. Convert the given temperature in different temperature scales. 3b. Describe the properties of the given good and bad conductors of heat. 3c. Relate the characteristics of the three gas laws. 3d. Determine the relation between specific heats for the given materials.	3.1 Heat, temperature, temperature scales 3.2 Modes of transfer of heat, good and bad conductors of heat, law of thermal conductivity 3.3 Boyle's law, Charle's law, Gay Lussac's law, perfect gas equation 3.4 Specific heat of gas at constant pressure and volume (C_p and C_V), ratio of specific heats
	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
	the given mediums. 3f. Describe light propagation in the given type of optical fiber.	3.6 Optical fiber: Principle, construction and path of light through optical fiber, applications of optical fibers.
	Chemistry	
Unit-IV Chemical bonding and Catalysis	4a. Explain the properties of given material based on the bond formation. 4b. Describe the molecular structure of given solid, liquid and gases. 4c. Describe the crystal structure of the given solids. 4d. Select the relevant catalyst for given application.	4.1 Electronic theory of valency, chemical bonds: types and characteristics, electrovalent bond, covalent bond, coordinate bond, hydrogen bond, metallic bond, metallic properties, intermolecular force of attraction. 4.2 Molecular arrangement in solid, liquid and gases. 4.3 Structure of solids: crystalline and amorphous solid, properties of metallic solids-, unit cell- of simple cubic, body centre cubic, face centre cubic, hexagonal close pack crystals. 4.4 Catalysis: Types of catalysis, Catalyst, Types of Catalyst, Positive Catalyst, Negative Catalyst, Auto-catalyst, Catalytic Promoter and Catalytic inhibitor, Industrial Application of Catalyst
Unit –V Metal Corrosion, its prevention and Electrochemistry	5a. Describe the phenomenon of the given type of corrosion and its prevention. 5b. Identify the different factors affecting rate of corrosion for the given type of material. 5c. Select the protective measures to prevent the corrosion in the given corrosive medium.	5.1 Corrosion: Types of corrosion- Dry corrosion, Wet corrosion. Oxidation corrosion (Atmospheric corrosion due to oxygen gas), mechanism, Types of oxide film, Wet corrosion mechanism (Hydrogen evolution in acidic medium) 5.2 Concentration cell corrosion -oxygen absorption mechanism in neutral or alkaline medium, Pitting corrosion, Waterline corrosion, Crevice corrosion. 5.3 Factors affecting the rate of corrosion control: Modification of environment, Use of protective coatings- coating of less active metal like Tin (Tinning), coating of more active metal like Zinc (Galvanizing), Anodic and cathodic protection, Choice of material-using pure metal and using metal alloys
	5d. Differentiate the salient features of the given electrolytic cell and electrochemical cell. 5e. Distinguish the given	5.4 Electrolyte- strong and weak, Non-Electrolyte, Electrolytic cell, Electrochemical cell. Cathode, Anode, Electrode potential- oxidation and reduction, Construction and working of

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

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

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

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

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

10. SUGGESTED STUDENT ACTIVITIES

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

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

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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

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

12. SUGGESTED MICRO-PROJECTS

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

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

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

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

13. SUGGESTED LEARNING RESOURCES

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

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

14. SOFTWARE/LEARNING WEBSITES

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

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

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

Semester : **First**

Course Title : **Mathematics**

Course Code : **22103**

1. RATIONALE

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

2. COMPETENCY

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

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

3. COURSE OUTCOMES (COs)

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

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

4. TEACHING AND EXAMINATION SCHEME

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

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

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

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

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

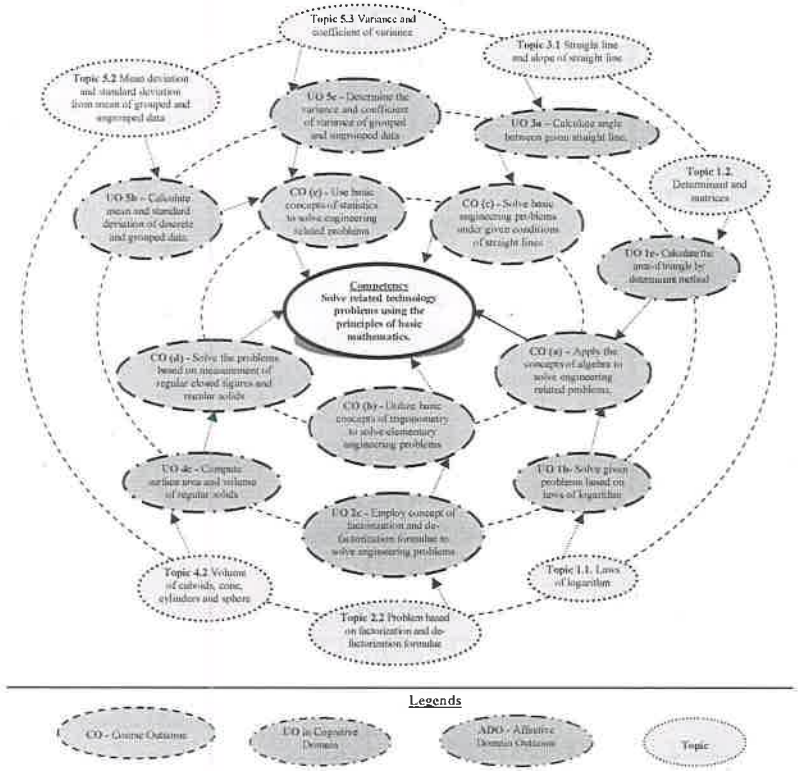

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

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

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

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

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

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

- Not applicable -

8. UNDERPINNING THEORY COMPONENTS

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

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

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

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

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

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

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

10. SUGGESTED STUDENT ACTIVITIES

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

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

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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

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

development of the UOs/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. Apply the mathematical concepts learnt in this course to branch specific problems.

12. SUGGESTED MICRO-PROJECTS

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

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

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

13. SUGGESTED LEARNING RESOURCES

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

14. SOFTWARE/LEARNING WEBSITES

a. www.scilab.org/ - SCI Lab
b. www.mathworks.com/products/matlab/ - MATLAB
c. www.dplot.com/ - DPlot
d. www.allmathcad.com/ - MathCAD
e. www.wolfram.com/mathematica/ - Mathematica
f. https://www.khanacademy.org/math?gclid=CNqHuabCys4CFdOJaAoddHoPig

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

Program Name : **All Branches of Diploma in Engineering and Technology.**
Program Code : **CE/CR/CS/CH/PS/CM/CO/IF/CW/DE/EJ/EN/EQ/ET/EX/IE/MU/EE/EP/EU/IS/IC/AE /FG/ME/PG/PT/DC/TX/TC/BC**
Semester : **First**
Couse Title : **Fundamentals of ICT**
Couse Code : **22001**

1. RATIONALE

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

2. COMPETENCY

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

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

3. COURSE OUTCOMES (COs)

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

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

4. TEACHING AND EXAMINATION SCHEME

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

*(~[1]): For the courses having **ONLY practical** examination, the PA has two components under practical marks i.e. the assessment of practicals (seen in section 6) has a weightage of 60% (i.e. 15 marks) and micro-project assessment (seen in section 12) has a weightage of 40% (i.e. 10 marks). This is designed to facilitate attainment of COs holistically, as there is no theory ESE.*

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

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

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

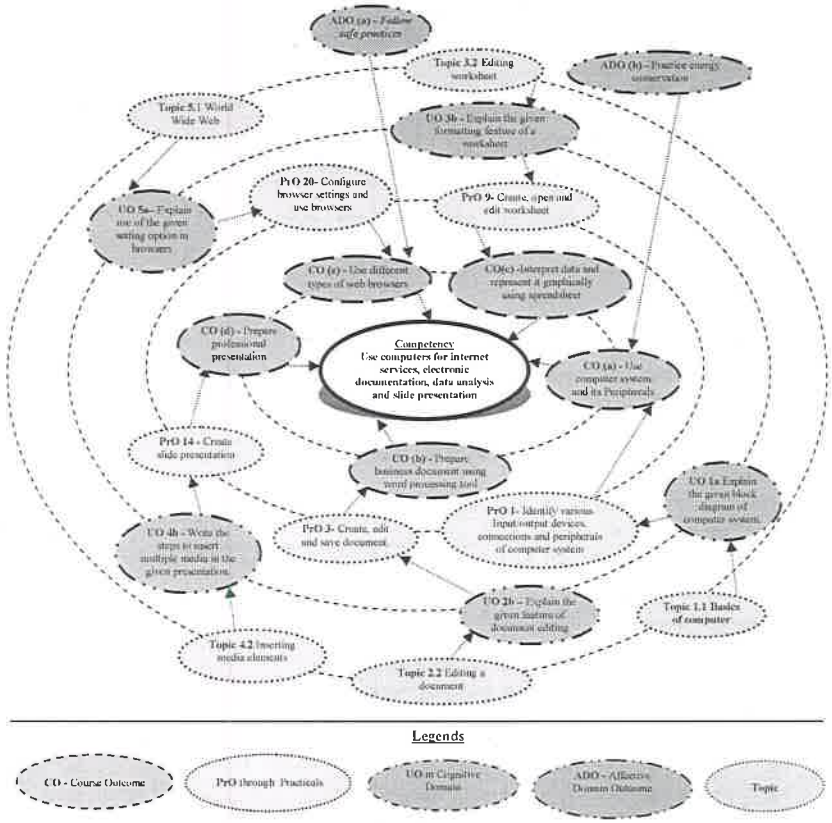

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

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

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

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

'': compulsory practicals to be performed.*

Note

i. A suggestive list of practical UOs is given in the above table, more such PrOs can be added to attain the COs and competency.

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

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

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

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

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

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

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

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

S. No.	Equipment Name with Broad Specifications	Exp. S.No.
1	Computer system with all necessary components like: motherboard, random access memory (RAM), read-only memory (ROM), Graphics cards, sound cards, internal hard disk drives, DVD drive, network interface card.	1
2	Double side printing laser printer.	1,6,12,13
3	Hubs, Switches, Modems.	1, 16,17
4	Any operating system.	2 to18
5	Any Office Software.	2 to 15
6	Any browser.	16,17,18

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

8. UNDERPINNING THEORY COMPONENTS

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

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

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

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		Orientation, Header and Footer, Insert Page Breaks, Set Background. 3.4. **Working with Formula:** Creating Formulas, Copying Formulas, Common spreadsheet Functions such as sum, average, min, max, date, In, And, or, mathematical functions such as sqrt, power, applying conditions using IF. 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 Colours, 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 to a Presentation - Insert Images into a Presentation, insert audio clips, video/animation, Add Shapes, Add Visual Styles to Text in a Presentation, Edit Graphical Objects on a Slide, Format Graphical Objects on a Slide, Group Graphical Objects on a Slide, Apply an Animation Effect to a Graphical Object, Add Transitions, Add Speaker Notes, Print a Presentation. 4.3 **Working with Tables:** Insert a Table in a Slide, Format Tables, and Import 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, Import Charts from Other Office Applications.
Unit– V Basics of Internet	5a. Explain use of the given setting option in browsers. 5b. Explain features of the specified web service. 5c. Describe the given characteristic of cloud. 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 retrieving bookmarks, use search engines effectively for searching the content. 5.2 **Web Services**: e-Mail, Chat, Video Conferencing, e-learning, e-shopping, e-Reservation, e-Groups, Social Networking.

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

- Not Applicable -

10. SUGGESTED STUDENT ACTIVITIES

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

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

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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

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

12. SUGGESTED MICRO-PROJECTS

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

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

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

13. SUGGESTED LEARNING RESOURCES

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

14. SOFTWARE/LEARNING WEBSITES

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

MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION MUMBAI

Course Name : **Mechanical, Electrical, Chemical, Civil & Textile Program Group**

Course Code : **AE/CE/CR/CS/CH/EE/EP/EU/ME/PG/PT/PS/FG/DC/TC/TX**

Semester : **First**

Subject Title : **Engineering Graphics**

Subject Code : **22002**

1. RATIONALE

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

2. COMPETENCY

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

- **Prepare engineering drawing manually using prevailing drawing instruments.**

3. COURSE OUTCOMES (COs)

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

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

4. TEACHING AND EXAMINATION SCHEME

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

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

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

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

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

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

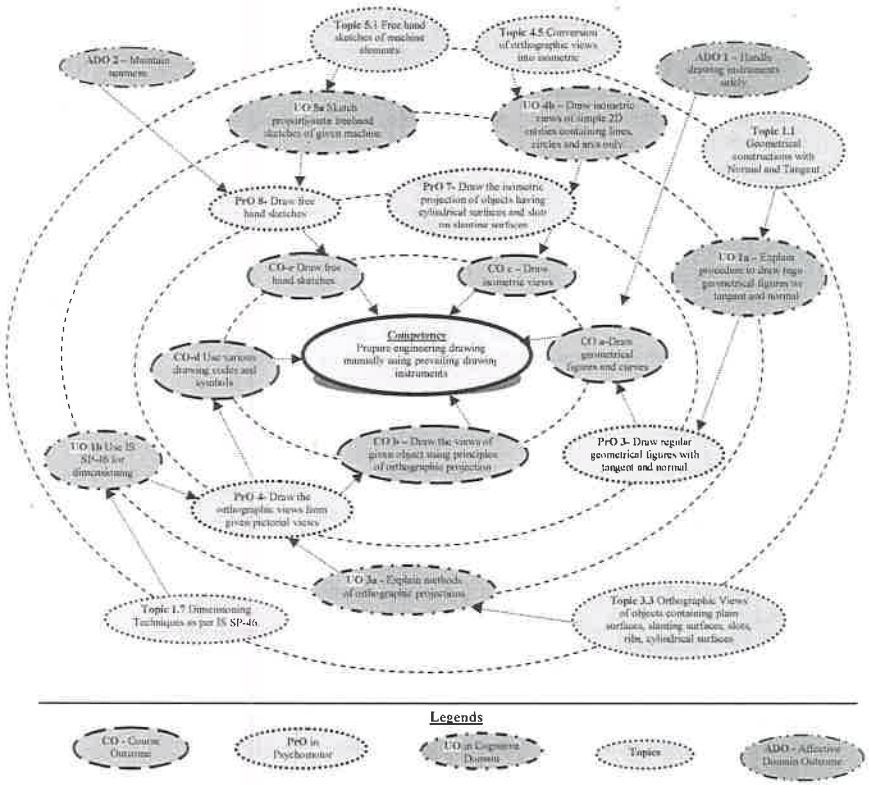

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

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

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

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

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

All practicals are to be performed.

Note

i. *A suggestive list of PrOs is given in the above table, more such PrOs can be added to attain the COs and competency.*

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

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

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

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

a. Follow cleanliness and neatness.
b. Follow ethics and standards.

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

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

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

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

S. No.	Equipment Name with Broad Specifications	Exp. S.No.
1	Drawing Table with Drawing Board of Full Imperial/ A1 size.	All
2	Models of objects for orthographic / isometric projections	4,5,6,7
3	Models/ Charts of objects mentioned in unit no. 5	-
4	Set of various industrial drawings being used by industries.	All
5	Set of drawings sheets mentioned in section 6.0 could be developed by experienced teachers and made used available on the MSBTE portal to be used as reference/standards.	All
6	Drawing equipment's and instruments for class room teaching-large size: a. T-square or drafter (Drafting Machine) b. Set squares (45^0 and 30^0- 60^0) c. Protractor d. Drawing instrument box (containing set of compasses and dividers)	All
7	Interactive board with LCD overhead projector	All

8. UNDERPINNING THEORY COMPONENTS

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

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

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

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

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

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

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)
Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of LOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.
This specification table also provides a general guideline for teachers to frame internal end semester practical theory exam paper which students have to undertake on the drawing sheet.

10. SUGGESTED STUDENT ACTIVITIES

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

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

   ii. Type of lines.
   iii. Redraw the figures (any one).
   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-5.
   viii. Note- Problems on sheet and in the sketch book should be different.

b. Students should collect Maps, Production drawings, Building Drawings, Layouts from nearby workshops/industries/builders/contractors and try to list
   i. Types of lines used
   ii. Lettering styles used
   iii. Dimension styles used
   iv. IS code referred.

c. List the shapes and curves you are observing around you in real life with name of place and item. (For Ex. ellipse, parabola, hyperbola, cycloid, epicycloids, hypocycloid, involute, spiral helix).

d. Take one circular shape. Assume one point on circumference and mark it. Roll that shape on flat and circular surface. Observe the path of the point and try to correlate with the theory taught in the class

e. 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

f. Each student should explain at least one problem for construction and method of drawing in sheet to all batch colleagues. Teacher will assign the problem of particular sheet to be explained to each student batch.

g. Each student will assess at least one sheet of other students (May be a group of 5-6 students identified by teacher can be taken) and will note down the mistakes committed by them. Student will also guide the students for correcting the mistakes, if any.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. ***'L' in 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 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. Guide student(s) in fixing the sheet and mini drafter 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 industrial drawing/drawing sheets developed by experienced faculty to teach standard symbols and current industrial/teaching practices

12. SUGGESTED MICRO PROJECTS

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

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

a. **Helical springs:** Each batch will collect 5 open coil and closed coil helical springs of various sizes. Each student will measure the significant parameters of one spring and draw corresponding helix curve in his sketch book.
b. **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.
c. **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.
d. **Isometric views**: Each student of a batch will select a household/industrial real item and will draw its isometric view in the sketch book.
e. **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.
f. **Isometric views**: The teacher will assign one set of orthographic projections and ask the student to develop 3D thermocol models of the same.
g. **Involute curves:** Each batch will try to develop cardboard/thermocol working models which can generate involute curve of any regular geometrical shape.
h. **Cycloidal curves:** Each batch will collect 3 different sizes bicycle tyres and compare the locus of tube air valve by rolling them on flat road.
i. **Conic curves:** Each batch will go to institute's play ground and one student standing on the boundary throws a ball to the wicket keeper who is 30 meters away from the thrower and the ball has reached a maximum height of 20 meters from the ground, draw the path of the ball and identify the type of conic curve it has traced in air.
j. **Involute and Cycloidal curves:** Each batch will collect one Involute and one cycloidal tooth profile spur gear and find out the Involute function.

13. SUGGESTED LEARNING RESOURCES

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

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

14. SOFTWARE/LEARNING WEBSITES

a. https://www.youtube.com/watch?v=TJ4jGyD-WCw
b. https://www.youtube.com/watch?v=dmt6_n7Sgcg
c. https://www.youtube.com/watch?v=_MQScnLXL0M
d. https://www.youtube.com/watch?v=3WXPanCq9LI
e. https://www.youtube.com/watch?v=fvjk7PlxAuo
f. http://www.me.umn.edu/courses/me2011/handouts/engg%20graphics.pdf
g. https://www.machinedesignonline.com

Program Name : **Computer & Electronics Program Group**
Program Code : **CO/CM/IF/CW/DE/EJ/EN/EQ/ET/EX/IE/MU/IS/IC**
Semester : **First**
Course Title : **Engineering Graphics**
Course Code : **22003**

1. RATIONALE

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

2. COMPETENCY

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

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

3. COURSE OUTCOMES (COs)

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

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

4. TEACHING AND EXAMINATION SCHEME

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

(**) marks should be awarded on the basis of internal end semester theory exam of 50 marks based on the specification table given in S. No. 9.
*(~²): For the courses having **ONLY practical** examination, the PA has two components under practical marks i.e. the assessment of practicals (seen in section 6) has a weightage of 60% (i.e. 30 marks) and micro-project assessment (seen in section 12) has a weightage of 40% (i.e. 20 marks). This is designed to facilitate attainment of COs holistically, as there is no theory ESE.*

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

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

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

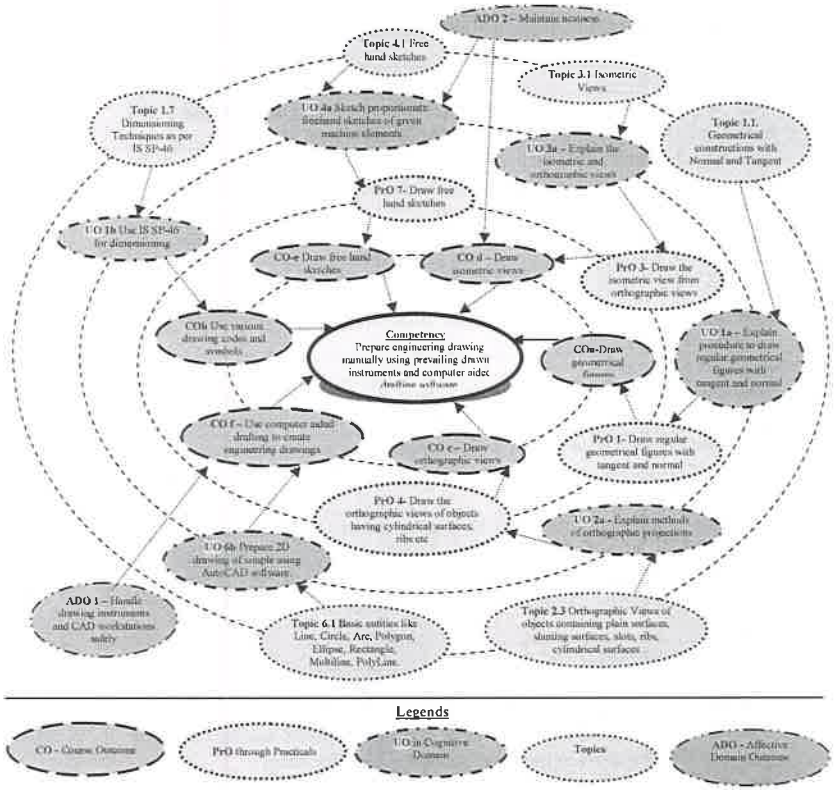

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

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

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

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

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

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

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

All practicals are to be performed.

Note

i. *A suggestive list of PrOs is given in the above table, more such PrOs can be added to attain the COs and competency.*

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

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

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

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

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

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

i. Follow cleanliness and neatness.
ii. Follow ethics and standards.

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

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

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

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

S. No.	Equipment Name with Broad Specifications	Experiment S.No.
1	Drawing Table with Drawing Board of Full Imperial/ A1 size.	All
2	Models of objects for orthographic / isometric projections	1 to 20
3	Models/ Charts of objects mentioned in unit no. 4	-
4	Set of various industrial drawings being used by industries.	All
5	Set of drawings sheets mentioned in section 6.0 could be developed by experienced teachers and made used available on the MSBTE portal to be used as reference/standards.	All
6	Set of various industrial drawings being used by industries. Drawing equipments and instruments for class room teaching-large size: a. T-square or drafter (Drafting Machine). b. Set squires (450 and 300-600) c. Protector. d. Drawing instrument box (containing set of compasses and dividers). e. Drawing sheets, Drawing pencils, Eraser. f. Drawing pins / clips	All
7	Drawing equipment's and instruments for class room teaching-large size: a. T-square or drafter (Drafting Machine) b. Set squares (45^0 and 30^0- 60^0) c. Protractor d. Drawing instrument box (containing set of compasses and dividers)	1 to 23
8	Interactive board with LCD overhead projector	All
9	CAD Workstation: 2 GB RAM, 320 GB HDD, 17" Screen, 1 GHz. (Minimum requirement)	24 to 32
10	Plotter: Print resolution Up to 1200 x 600 dpi, 16 MB Memory	24 to 32
11	Licensed latest network version of AutoCAD software	24 to 32

8. UNDERPINNING THEORY COMPONENTS

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

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

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

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

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

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

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

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

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

10. SUGGESTED STUDENT ACTIVITIES

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

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

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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

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

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

12. SUGGESTED LIST OF MICRO PROJECTS

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

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

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

13. SUGGESTED LEARNING RESOURCES

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

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

14. SOFTWARE/LEARNING WEBSITES

a. https://www.youtube.com/watch?v=TJ4jGyD-WCw
b. https://www.youtube.com/watch?v=dmt6_n7Sgcg
c. https://www.youtube.com/watch?v=_MQScnLXL0M
d. https://www.youtube.com/watch?v=3WXPanCq9LI
e. https://www.youtube.com/watch?v=fvjk7PlxAuo
f. http://www.me.umn.edu/courses/me2011/handouts/engg%20graphics.pdf
g. https://www.machinedesignonline.com

MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION MUMBAI

Program Name : **Mechanical, Civil Chemical & Plastic Program Group.**
Program Code : **CE/CR/CS/CH/PS/CM/EE/EP/AE/FG/ME/PG/PT**
Semester : **First**
Courset Title : **Workshop Practice**
Course Code : **22004**

1. RATIONALE

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

2. COMPETENCY

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

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

3. COURSE OUTCOMES (COs)

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

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

4. TEACHING AND EXAMINATION SCHEME

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

*(~[2]): For the courses having **ONLY practical** examination, the PA has two components under practical marks i.e. the assessment of practicals (seen in section 6) has a weightage of 60% (i.e. 30 marks) and micro-project assessment (seen in section 12) has a weightage of 40% (i.e. 20 marks). This is designed to facilitate attainment of COs holistically, as there is no theory ESE.*
***Legends: L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** - Practical; **C** – Credit, **ESE** - End Semester Examination; **PA** - Progressive Assessment*

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

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

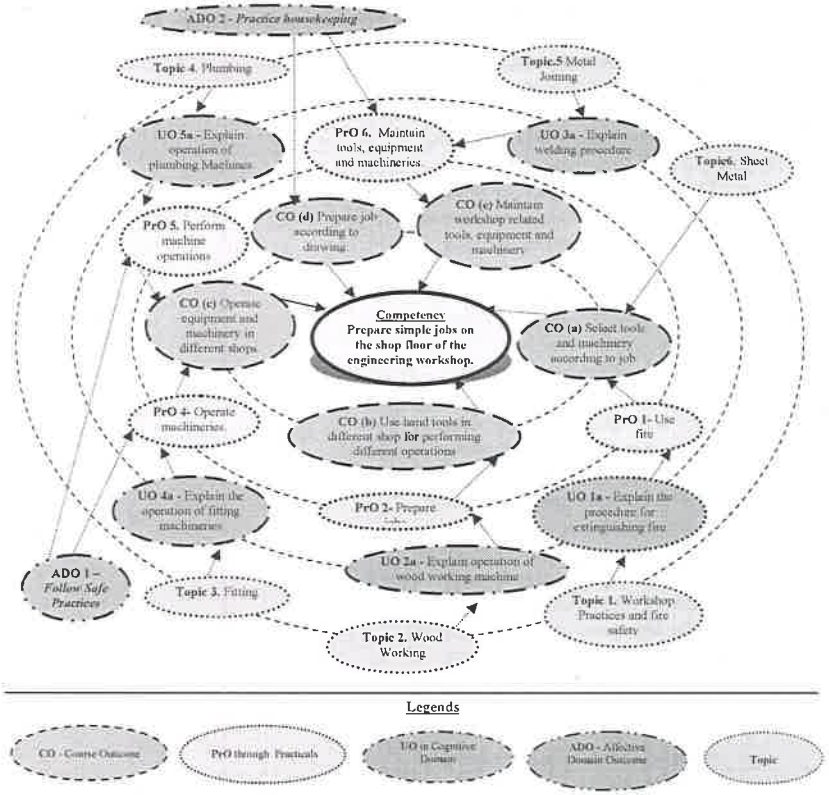

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

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

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

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

S. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. required
	g. tapping operation as per drawing		
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 bill of material for given pipeline layout – Part I	III	2*
13	Prepare bill of material for given pipeline layout – Part II	III	2
14	Prepare lap joint using gas welding as per given drawing – Part I	IV	2*
15	Prepare lap joint using gas welding as per given drawing – Part II	IV	2
16	Prepare butt joint using gas welding as per given drawing – Part I	IV	2
17	Prepare butt joint using gas welding as per given drawing – Part II	IV	2*
18	Prepare utility job(like stool, benches, tables or similar jobs) involving arc welding and artificial wood as per given drawing (in group of 4 to 5 students) – Part I a. Fabrication operation involve measuring, marking, cutting, edge preparation, welding b. Carpentry operation involve measuring, marking cutting and assembly with fabrication part.	IV, V	2 *
19	Prepare utility job(like stool, benches, tables or similar jobs) involving arc welding and artificial wood as per given drawing (in group of 4 to 5 students) – Part II a. Fabrication operation involve measuring, marking, cutting, edge preparation, welding b. Carpentry operation involve measuring, marking cutting and assembly with fabrication part.	IV, V	2
20	Prepare utility job(like stool, benches, tables or similar jobs) involving arc welding and artificial wood as per given drawing (in group of 4 to 5 students) – Part III a. Fabrication operation involve measuring, marking, cutting, edge preparation, welding b. Carpentry operation involve measuring, marking cutting and assembly with fabrication part.	IV, V	2*
21	Prepare utility job(like stool, benches, tables or similar jobs) involving arc welding and artificial wood as per given drawing (in group of 4 to 5 students) – Part IV a. Fabrication operation involve measuring, marking, cutting, edge preparation, welding b. Carpentry operation involve measuring, marking cutting and assembly with fabrication part.	IV, V	2
22	Prepare utility job(like stool, benches, tables or similar jobs)	IV,	2

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

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

Note

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

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

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

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

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

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

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

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

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

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

S. No.	Equipment Name with Broad Specifications	Exp. S.No.
1	Fire buckets of standard size.	I, II, III, IV,V, VI
2	Fire extinguisher A,B and C types	I, II, III, IV,V, VI
3	Wood Turning Lathe Machine, Height of Centre: 200mm, Distance between Centers: 1200mm, Spindle Bore: 20mm with Taper, Range of Speeds: 425 to 2800 with suitable Motor Drive. with all accessories	II
4	Circular Saw Machine, Diameter of saw blade 200 mm, Maximum Depth of Cut 50 mm, Table Size -350 x 450 mm, Table Tilting - 45^0	II
5	Wood working tools- marking and measuring tools, saws, claw hammer, mallet, chisels, plans, squares,	II
6	Carpentry Vice 200 mm	II
7	Work Benches- size:1800 x 900 x 750 mm	III
8	Bench Drilling machine (upto 13 mm drill cap.) with ½ H.P. Motor 1000 mm. Height.	III
9	Power Saw machine 350 mm mechanical with 1 HP Motor & all Accessories.	III
10	Bench Grinder 200 mm Grinding Disc diameter 200 mm. with 25 mm. bore 32 mm. with ½ HP/1HP Motor.	III
11	Vernier height Guage 450 mm	III

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

8. UNDERPINNING THEORY COMPONENTS

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

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

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

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

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

- Not applicable.-

10. SUGGESTED STUDENT ACTIVITIES

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

a. Prepare work diary based on practical performed in workshop. Work diary consist of job drawing, operations to be perform, required raw materials, tools, equipments, date of performance with teacher signature.
b. 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.
c. Prepare/Download a specifications of followings:
   a) Various tools and equipment in various shops.
   b) Precision equipment in workshop
   c) Various machineries in workshop
d. Undertake a market survey of local dealers for procurement of workshop tools, equipment machineries and raw material.
e. Visit any fabrication/wood working/sheet metal workshop and prepare a report.

11. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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

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

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

12. SUGGESTED TITLES OF MICRO-PROJECTS

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

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

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

Note:

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

13. SUGGESTED LEARNING RESOURCES

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

14. SOFTWARE/LEARNING WEBSITES

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

Program Name : **Computer Program Group**
Program Code : **CM/CO/IF/CW**
Semester : **First**
Course Title : **Workshop Practice**
Course Code : **22005**

1. RATIONALE

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

2. COMPETENCY

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

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

3. COURSE OUTCOMES (COs)

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

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

4. TEACHING AND EXAMINATION SCHEME

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

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

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

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

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

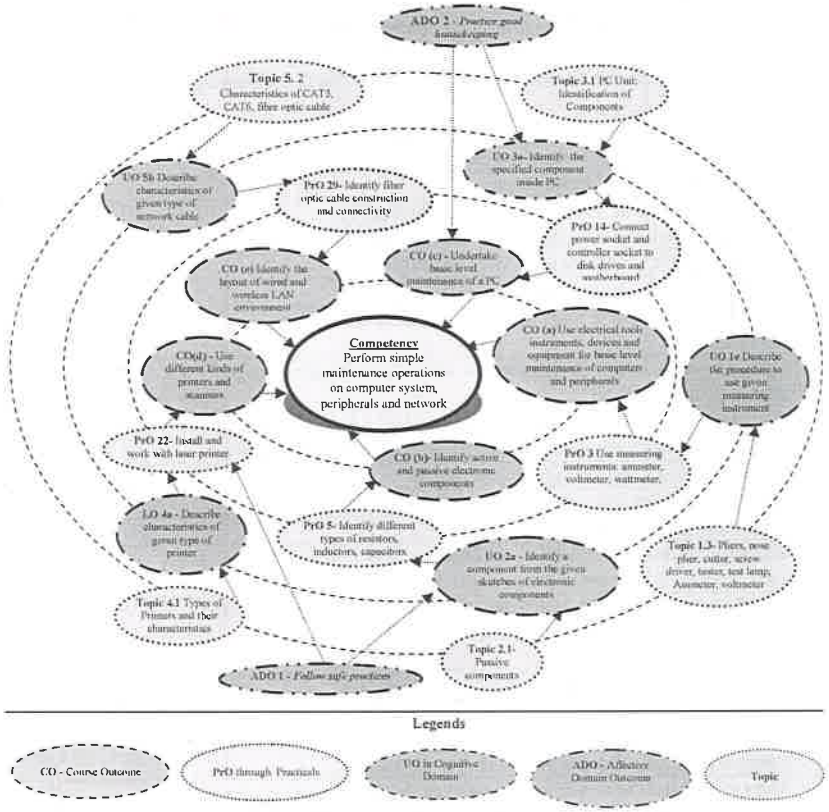

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

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

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

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

Note

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

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

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

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

a. Follow safe practices
b. Practice good housekeeping
c. Practice energy conservation.
d. Demonstrate working as a leader/a team member.
e. Maintain tools and equipment.
f. Follow ethical practices.

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

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

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

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

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

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

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

8. UNDERPINNING THEORY COMPONENTS

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

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit – I Electrical Tools, Cables and Switches	1a. Explain the characteristics of given type of wires, cables, light sources and switches. 1b. Explain use of the given type of switch. 1c. Describe the procedure to use given electrical Tool. 1d. Describe application of the given type of uninterrupted power supply. 1e. Describe the procedure to use the given measuring instrument.	1.1 Electrical: Basic wiring- Single core cable, multicore cable, single strand wire, multi strand wire, shielded wire 1.2 Use of different types of switches ; Toggle switch, Rotary switch, Push button switch, micro switch, circuit breakers; MCB, ELCB, Regulators. 1.3 Using Pliers, nose plier, cutter, screw driver, tester, test lamp, Ammeter, voltmeter, wattmeter, clip on meter, Multimeter, Megger, Solder iron, solder-stand, solder-wire, flux, desolder pump, De-solder wick 1.4 Using Uninterrupted power supply units-online, offline, batteries and their types
Unit– II Electronic Components	2a. Identify a component from the given sketch of electronic components. 2b. Describe the applications of the given active electronic component.	2.1 Passive components: Different types of: resistors, inductors, capacitors, potentiometers, Thermistor, Transformer, auto transformer 2.2 Active components: Diodes, LED, Photo diode, BJT, Photo transistor, LDR, Opto-coupler, seven segment display
Unit– III Inside the Computer system	3a. Identify the specified component inside PC. 3b. Describe applications of the specified device drives. 3c. Explain procedure of Connecting the given cable/ device in a PC. 3d. Describe procedure to handle laptop safely.	3.1 PC Unit: Identification of Components- Motherboard, RAM, ROM, Add-on Cards, CMOS battery, SMPS, Hard disk, DVD, flash Memory And PEN DRIVE, Power Connection, Controller Connection, NIC Cards. 3.2 Connecting and disconnecting LAN Cable, External Hard disk, Modem, Motherboard Supply, Basic handling of laptop, Connecting computer with LCD Projector
Unit– IV Computer Peripheral and Devices	4a. Describe characteristics of the given type of printer. 4b. Classify given type of scanner. 4c. Explain procedure to connect given printer/scanner to computer. 4d. Explain procedure of scanning the given document/ image using a scanner. 4e. Describe working principle of the given type of mouse.	4.1 Types of Printers and their characteristics- DOT Matrix, Laser, Inkjet, Connecting and sharing printer, Scanner – flatbed scanner, hand held scanner, setting scanning parameters, scanning documents and saving in different formats 4.2 Keyboards, different types of mouse- Optical, mechanical, Wireless, trackball, Connecting mouse to ports
Unit– V Network Devices and Components	5a. Explain Application of NIC and the given connecting devices. 5b. Describe characteristics of the given type of network cable. 5c. Describe features of the given type of network 5d. Identify components of the given wired/wireless network set-up.	5.1 Applications of Network interface cards (NIC), HUB, Switches, Routers, Modem 5.2 Characteristics of CAT5,CAT6, fibre optic cable, use of crossover and straight cable, RJ-45 connectors, SC, ST, FC, LC type fibre connectors 5.3 Concept of LAN, MAN, WAN Wireless network and devices; Wi-Fi, Access point, repeaters, Bluetooth

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

- Not Applicable -

10. SUGGESTED STUDENT ACTIVITIES

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

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

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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

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

12. SUGGESTED MICRO-PROJECTS

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

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

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

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

13. SUGGESTED LEARNING RESOURCES

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

14. SOFTWARE/LEARNING WEBSITES

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

Course Name : **All Branches of Diploma in Engineering and Technology**
Course Code : **DE/EJ/EN/EQ/ET/EX/IE/MU/ IS/IC**
Semester : **First**
Subject Title : **Workshop Practice**
Subject Code : **22006**

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 circuits in the workshop. This course will develop skills in handling tools, equipments 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 competency through various teaching learning experiences:

- **Build /test simple electronic circuit on breadboards and PCBs.**

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:

a. Use firefighting equipment and other safety related accessories.
b. Use fitting and sheet metal tools in the electronics workshop.
c. Identify active and passive electronics components.
d. Perform soldering and de-soldering using soldering tools.
e. Build simple jobs in the electronics workshop.

4. TEACHING AND EXAMINATION SCHEME

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

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

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

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

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

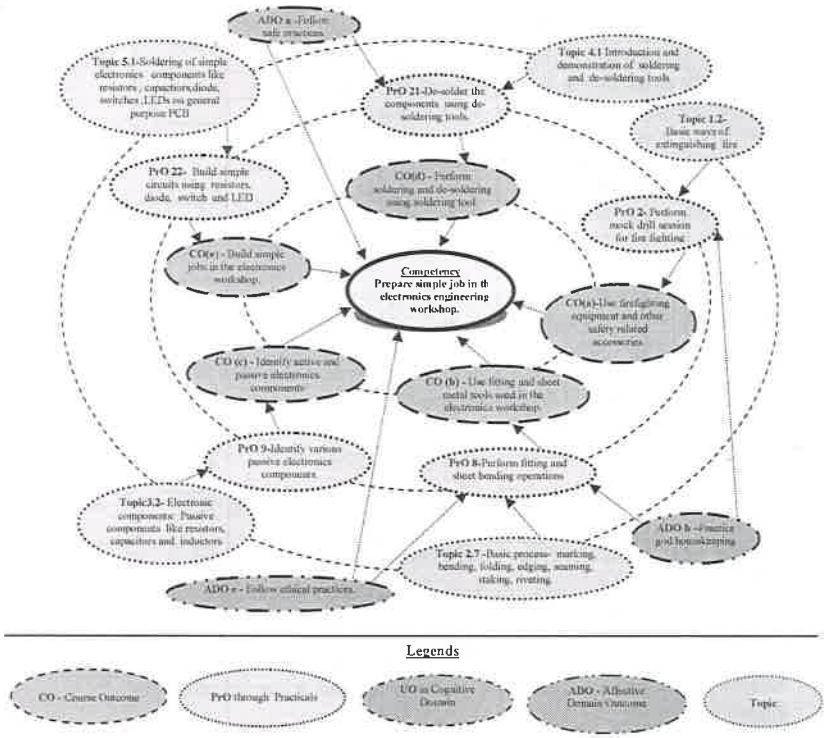

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

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

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

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

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

Note

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

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

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

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

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

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

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

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

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

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

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

8. UNDERPINNING THEORY COMPONENTS

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

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

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

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

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

- Not applicable –

10. SUGGESTED STUDENT ACTIVITIES

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

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

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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

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

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

12. SUGGESTED MICRO-PROJECTS

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

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

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

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	A Course in Workshop Technology	Raghuwanshi, B.S.	Dhanpat Rai sons, New Delhi ; 2011, or latest edition. ISBN:0000017108
2	A Textbook of Manufacturing Process (Workshop Technology)	Gupta, J.K.; Khurmi, R.S.	S.Chand and Co. New Delhi, or latest edition, ISBN:81-219-3092-8
3	Electronic Components Handbook	Jones, Thomas H.	Reston Publishing, Reston, Virginia, United states latest edition, ISBN: 9780879092221
4	Principles of Electronics	Mehta ,V.K.; Mehta, Rohit	S. Chand and Co. Ram Nagar, New Delhi-110 055, 2014, ISBN: 9788121924504

14. SOFTWARE/LEARNING WEBSITES

a. www.nptel.iitm.ac.in

b. http://www.eleccircuit.com
c. http://www.electroschematics.com
d. http://www.asnu.com.au
e. http://fireextinguishertraining.com/
f. www.youtube.com/watch?v=WE-SislzSMY
g. www.youtube.com/watch?v=lUojO1HvC8c
h. https://mightyohm.com/files/soldercomic/FullSolderComic_EN.pdf
i. http://www.aura-o.aura-astronomy.org/aura/sites/default/files/files/Referencia_Bibliografica

Program Name : **Textile Program Group**
Program Code : **DC/TC/TX**
Semester : **First**
Course Title : **Workshop Practice**
Course Code : **22007**

1. RATIONALE

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

2. COMPETENCY

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

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

3. COURSE OUTCOMES (COs)

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

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

4. TEACHING AND EXAMINATION SCHEME

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

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

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

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

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

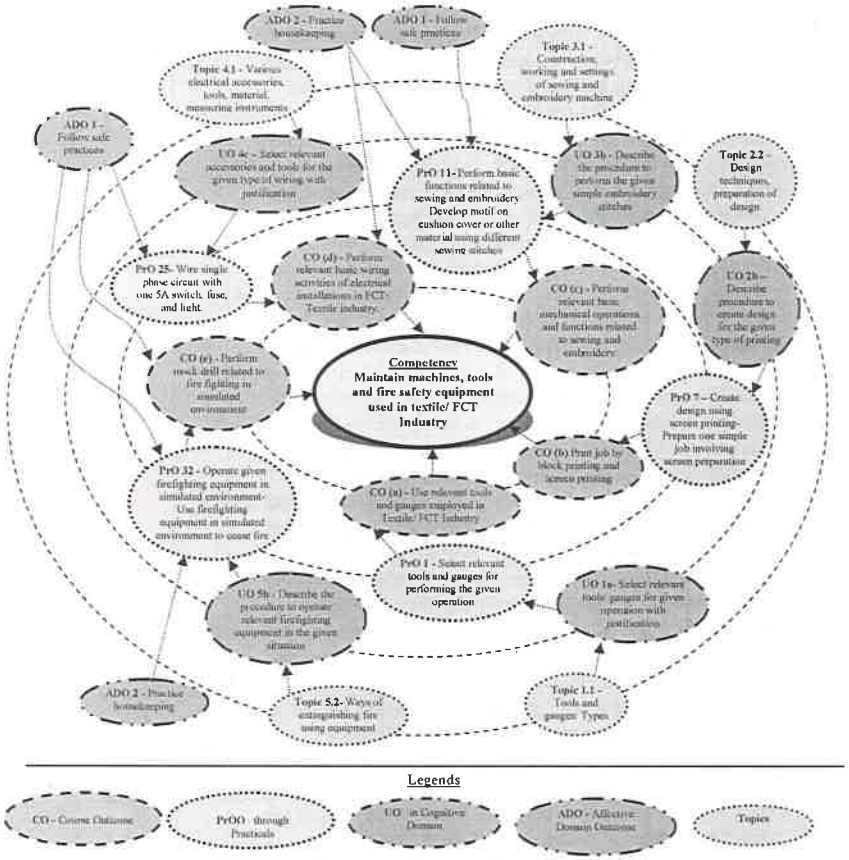

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

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

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

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

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

Note

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

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

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

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

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

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

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

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

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

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

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

8. UNDERPINNING THEORY COMPONENTS

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

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

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

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

- Not applicable -

10. SUGGESTED STUDENT ACTIVITIES

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

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

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

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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

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

12. SUGGESTED TITLES OF MICRO-PROJECTS

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

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

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

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

13. SUGGESTED LEARNING RESOURCES

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

14. SOFTWARE/ LEARNING WEBSITES

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