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		Abbre viation	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

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/EL/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			Credits (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*	12	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.

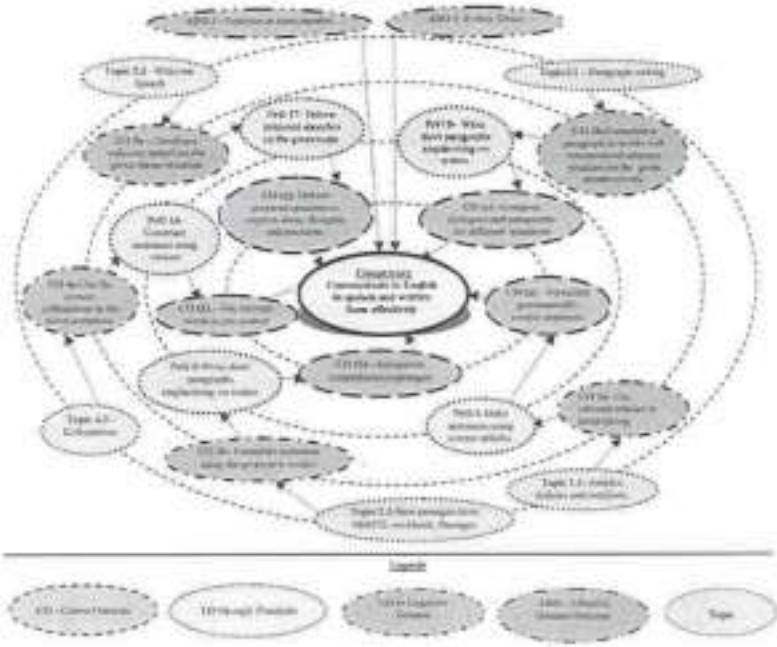

Figure 1 - Course Map

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.	1	2
2	Construct sentences using correct prepositions.	1	2*
3	Formulate sentences using correct conjunctions/connectors.	1	2
4	Rewrite sentences using relevant forms of verbs.	1	2*
5	Change the voice from active to passive and vice –versa.	1	2*
6	Change the narration direct to indirect and vice –versa.	1	2*
7	Repeat words on Language Lab software after listening to them.	1	2*
8	Deliver oral presentations using correct grammar.	1	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 4h. 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. 5h. 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/EI/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*	10	100	40	25@	10	25	10	50	20
2	–	2	4				15*	10			25@	10	25	10	50	20

(*): Under the theory PA, out of 30 marks, 10 marks are for micro-project assessment (3 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.

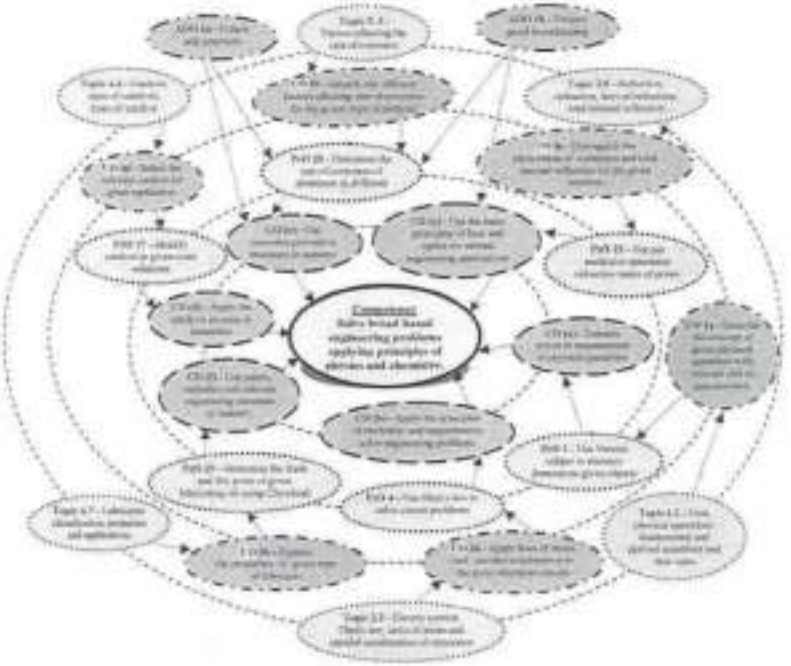

Figure 1 - Course Map

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 Daniel Cell.	V	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
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°C, thermometer, micro ammeter, Ge diode	11
11	pH meter reading up to pH14, ambient temp. -40 to 70° C ; pH/mV resolution:12 bit	24
12	Electronic balance, with the scale range of 0.001g to 500gm pan size 100 mm, response time 3-5 sec. power requirement 90-250 V, 10 watt	13,17, 19, 25, 26, 31
13	Electric oven inner size 18"x18"x18"; temperature range 100 to 250° C with the capacity of 40 lt.	31
14	Ammeter 0-2 amp	25,26
15	Redwood viscometer-I	27
16	Cleveland open cup apparatus	29
17	Abel's close cup apparatus	30

8. UNDERPINNING THEORY COMPONENTS

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

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

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Units and Measurements	1a. Describe the given measurement device and its application. 1b. Describe with justification the device required to measure the radius of curvature of the given object. 1c. State with justification the error in the given measurement quantity. 1d. Describe the procedure to determine the dimensions of the given physical quantities.	1.1 Unit, physical quantities: fundamental and derived quantities and their units 1.2 Systems of unit: CGS, MKS, FPS and SI 1.3 Dimensions, dimensional formula 1.4 Errors, types of errors: instrumental, systematic and random error, estimation of errors: absolute, relative and percentage error, significant figures
Unit– II Electricity, Magnetism and Semiconductors	2a. Calculate electric field, potential and potential difference of the given static charge. 2b. Describe the concept of given magnetic intensity and flux with relevant units. 2c. Explain the heating effect of the given electric current. 2d. Apply laws of series and parallel combination in the given electric circuits.	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.	
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
	6d. 6e. 6f. 6g. 6h.	6.4 Polymer and Monomer, Classification on the basis of Molecular structure, on the basis of monomers (homo polymer and copolymer), on the basis of Thermal behavior(Thermoplastics and Thermosetting) 6.5 Types Polymerization Reaction, Addition Polymerization, Condensation Polymerization, Synthesis, properties and application of Polyethylene, Polyvinyl chloride, Teflon, Polystyrene, Phenol formaldehyde, Epoxy Resin 6. 6. 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