Maharashtra State Board Of Technical Education, Mumbai

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

Program Name : Electronics Engineering Group

Program Code : DE / EJ / ET / EX / EN / EQ — **With Effect From Academic Year: 2017 - 18**

Duration of Program : 6 Semesters — **Duration : 16 Weeks**

Semester : Second — **Scheme - I**

S. N.	Course Title	Course Abbreviation	Course Code	Teaching Scheme			Credit (L+T+P)	Examination Scheme												Grand Total
								Theory						Practical						
									ESE		PA		Total	ESE		PA		Total		
				L	T	P		Exam Duration in Hrs.	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	
1	Applied Mathematics	AME	22210	4	2	-	6	3	70	28	30*	00	100	40	--	--	--	--	--	--	100
2	Elements of Electrical Engineering	EEC	22215	4	-	2	6	3	70	28	30*	00	100	40	25#	10	25	10	50	20	150
3	Basic Electronics	BEL	22216	4	-	4	8	3	70	28	30*	00	100	40	50#	20	50	20	100	40	200
4	Electronic Engineering Materials	EEM	22217	3	-	-	3	3	70	28	30*	00	100	40	--	--	--	--	--	--	100
5	C Programming Language	CPR	22218	4	-	4	8	3	70	28	30*	00	100	40	50@	20	50	20	100	40	200
6	Business Communication Using Computers	BCC	22009	-	-	2	2	--	--	--	--	--	--	--	35@^	14	15~	06	50	20	50
			Total	**19**	**2**	**12**	**33**	--	**350**	--	**150**	--	**500**	--	**160**	--	**140**	--	**300**	--	**800**

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

Theory and practical periods of 60 minutes each. Total Marks **: 800**

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

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

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

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

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

Program Name : **Electrical Engineering Program Group & Electronics Engineering Program Group**

Program Code : **DE/EE/EJ/IE/IS/MU/ET/EN/EX**

Semester : **Second**

Course Title : **Applied Mathematics**

Course Code : **22210**

1. RATIONALE

The core technological studies can be understood with the help of potential of applied mathematics. This course is an extension of Basic Mathematics of first semester which is designed for its applications in engineering and technology using the techniques of calculus, differentiation, integration, differential equations and in particular complex numbers and Laplace transform. Derivatives are useful to find slope of the curve, maxima and minima of the function, radius of curvature. Integral calculus helps in finding the area. In analog to digital converter and modulation system integration is important. Differential equation is used in finding the curve and its related applications for various engineering models like LCR circuits. This course further develops the skills and understanding of mathematical concepts which underpin the investigative tools used in engineering.

2. COMPETENCY

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

- **Solve electrical and electronics engineering related broad-based problems using the principles of applied mathematics.**

3. COURSE OUTCOMES (COs)

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

a. Calculate the equation of tangent, maxima,minima,radius of curvature by differentiation.
b. Solve the given problem(s) of integration using suitable methods.
c. Apply the concepts of integration to find the area and volume.
d. Solve the differential equation of first order and first degree using suitable methods.
e. Use Laplace transform to solve first order first degree differential equations.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme											
				Theory						Practical					
				Paper	ESE		PA		Total		ESE		PA		Total	
L	T	P		Hrs.	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 UOs required for the attainment of the COs.
***Legends:** **L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** -Practical; **C** – Credit, **ESE** -End Semester Examination; **PA** - Progressive Assessment*

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

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

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

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

S. No.	Tutorials	Unit No.	Approx. Hrs. Required
1	Solve problems based on finding value of the function at different points	I	2
2	Solve problems to find derivatives of implicit function and parametric function	I	2
3	Solve problems to find derivative of logarithmic and exponential functions.	I	2
4	Solve problems based on finding equation of tangent and normal.	I	2
5	Solveproblems based on finding maxima, minima of function and radius of curvature at a given point.	I	2
6	Solve the problems based on standard formulae of integration.	II	2
7	Solve problems based on methods of integration, substitution, partial fractions.	II	2
8	Solve problems based on integration by parts	II	2
9	Solve practice problems based on properties of definite integration.	III	2
10	Solve practice problems based on finding area under curve, area between two curves and volume of revolutions.	III	2
11	Solve the problems based on formation, order and degree of differential equations.	IV	2
12	Develop a model using variable separable method to related engineering problem.	IV	2
13	Develop a model using the concept of linear differential equation to related engineering problem	IV	2
14	Solve problems based on algebra of complex numbers.	V	2
15	FindLaplace transform and inverse Laplace transformusing related properties	V	2
16	Make use of concept of Laplace transform to solve first order first degree differential equation	V	2
			32

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

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

- Not applicable -

8. UNDERPINNING THEORY COMPONENTS

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

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Differential Calculus	1a Solve the given simple problems based on functions 1b. Solve the given simple problems based on rules of differentiation 1c Obtain the derivatives of logarithmic,exponential functions. 1d Apply the concept of differentiation to find equation of tangent and normal 1e Apply the concept of differentiation to calculate maxima and minima and radius of curvature of given problem.	1.1 Functions and Limits : a) Concept of function and simple examples b) Concept of limits without examples. 1.2 Derivatives : a) Rules of derivatives such as sum, product, quotient of functions. b) Derivative of composite functions (chain Rule), implicit and parametric functions c) Derivatives of inverse, logarithmic and exponential functions 1.3 Applications of derivative : a) Second order derivative without examples b) Equation of tangent and normal c) Maxima and minima d) Radius of curvature
Unit– II Integral Calculus	2a. Solve the given problem(s) based on rules of integration. 2b. Obtain the given simple integral(s) using substitution method 2c Integrate given simple functions using the integration by parts 2d Evaluate the given simple integral by partial fractions.	2.1 Simple Integration: Rules of integration and integration of standard functions 2.2 Methods of Integration: a) Integration by substitution b) Integration by parts c) Integration by partial fractions
Unit– III Applications of Definite Integration	3a Solve given simple problems based on properties of definite integration. 3b Apply the concept of definite integration to find the area under the given curve(s) 3c Utilize the concept of definite integration to find area between given two curves 3d Invoke the concept of definite integration to find the volume of revolution of given surface	3.1 Definite Integration: a) Simple examples b) Properties of definite integral (without proof) and simple examples 3.2 Applications of integration : a) Area under the curve b) Area between two curves c) Volume of revolution
Unit-IV First Order First Degree Differential Equations	4a Find the order and degree of given differential equations 4b Form simple differential equations for given engineering problem(s) 4c Solve the given differential equations using the method of variable separable 4d Solve the given problems based on linear differential equations	4.1 Concept of differential equation 4.2 Order, degree and formation of differential equation 4.3 Solution of differential equation a Variable separable form b Linear differential equation 4.4 Application of differential equations and related engineering problems

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit –V Complex Numbers and Laplace transform.	5a. Solve given problems based on algebra of complex numbers. 5b. Solvethe given problems based on properties of Laplace transform 5c. Solve the given problems based on properties of inverse Laplace transform. 5d. Invoke the concept of Laplace transform to solve first order first degree differential equations	5.1 Complex numbers: a. Cartesian, polar and exponential form of a complex number b. Algebra of complex numbers. 5.2 Laplace transform: a. Laplace transform of standard functions (without proof). b. Properties of Laplace transform such as linearity, first and second shifting properties (without proof) c. Inverse Laplace transform using partial fraction method, linearity and first shifting property d. Laplace transform of derivatives and solution of first order first degree differential equations

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

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

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

10. SUGGESTED STUDENT ACTIVITIES

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

a. Identify engineering problems based on real world problems and solve with the use of free tutorials available on the internet.
b. Use graphical software's: 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 differential equations and solve these problems.
e. Prepare models to explain different concepts of applied mathematics.
f. Prepare a seminar on any relevant topic based on applications of integration
g. Prepare a seminar on any relevant topic based on applications of Laplace transform to related engineering problems.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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

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. Apply the mathematical concepts learnt in this course to branch specific problems
g. Use different instructional strategies in classroom teaching
h. Use video programs available on the internet to teach abstract topics

12. SUGGESTED MICRO-PROJECTS

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

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

a. Prepare models using the concept of tangent and normal to bending of roads in case of sliding of a vehicle.
b. Prepare models using the concept of radius of curvature to bending of railway track
c. Prepare charts displaying the area of irregular shapes using the concept of integration
d. Prepare charts displaying volume of irregular shapes using concept of integration
e. Prepare models using the concept of differential equations for mixing problem.
f. Prepare models using the concept of differential equations for radio carbon decay
g. Prepare models using the concept of differential equations for population growth.
h. Prepare models using the concept of differential equations for thermal cooling
i. Prepare models using the concept of Laplace transform to solve linear differential equations.

j Prepare models using the concept of Laplace transform to solve initial value problem of first order and first degree.

k Prepare charts displaying various algebraic operations of complex numbers in complex plane

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Higher Engineering Mathematics	Grewal, B.S.	Khanna publications, New Delhi , 2013 ISBN- 8174091955
2	Advanced Engineering Mathematics	Krezig, Ervin	Wiley Publications, New Delhi, 2016 ISBN:978-81-265-5423-2,
3	Advanced Engineering Mathematics	Das, H.K.	S. Chand Publications, New Delhi, 2008, ISBN-9788121903455
4	Engineering Mathematics, Volume 1 (4th edition)	Sastry, S.S.	PHI Learning, New Delhi, 2009 ISBN-978-81-203-3616-2,
5	Getting Started with MATLAB-7	Pratap, Rudra	Oxford University Press, New Delhi,2009 ISBN- 0199731241
6	Engineering Mathematics (third edition).	Croft, Anthony.	Pearson Education, New Delhi,2010 ISBN 978-81-317-2605-1

14. SOFTWARE/LEARNING WEBSITES

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

Program Name : **Electronics Engineering Program Group and Computer Engineering Program Group**

Program Code : **DE/EJ/IE/IS/CO/CM/CW/IF/ET/EN/EX**

Semester : **Second**

Course Title : **Elements of Electrical Engineering**

Course Code : **22215**

1. RATIONALE

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

2. COMPETENCY

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

- **Use electrical equipment in industrial applications.**

3. COURSE OUTCOMES (COs)

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

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

4. TEACHING AND EXAMINATION SCHEME

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

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.
***Legends: L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** - Practical; **C** – Credit*
***ESE** - End Semester Examination; **PA** - Progressive Assessment*

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

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

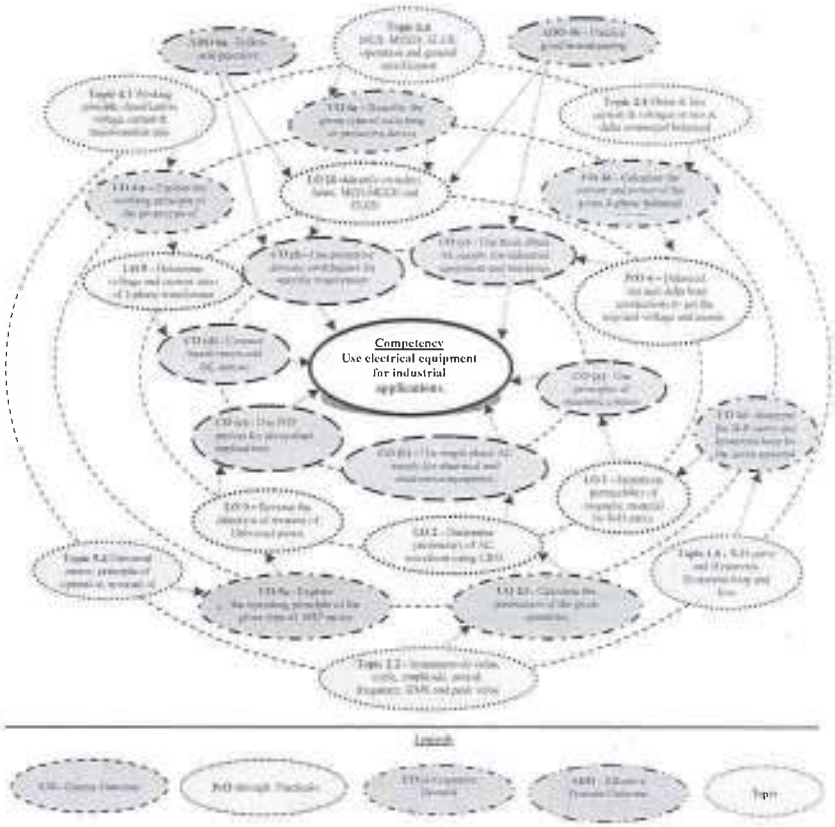

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

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

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Determine the permeability of magnetic material by plotting its B-H curve.	I	02*

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

Note

i *A suggestive list of **PrOs** is given in the above table. More such PrOs can be added to attain the COs and competency. A 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 %
1	Selection of suitable component, apparatus/instrument	20
2	Preparation of experimental set up	10
3	Setting and operation	10
4	Safety measures	10
5	Observations and Recording	10
6	Interpretation of result and Conclusion	20
7	Answer to sample questions	10

S.No.	Performance Indicators	Weightage in %
8	Submission of report in time	10
	Total	**100**

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

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	Single Phase Transformer: 1kVA, single-phase, 230/115 V, air cooled, enclosed type.	1,5
2	Single phase auto transformer (Dimmerstat) - Single-Phase, Air cooled, enclosed model, Input: 0 ~ 230, 10A, Output: 0 ~ 270Volts	1,2,3,5
3	CRO – 20 MHz, Dual channel	2,3
4	Three phase Auto Transformer -15 kVA, Input 415 V, 3 phase, 50 Hz, Output 0-415 V, 30 A per Line, Cooling air natural	4
5	Loading Rheostat - 7.5 kW, 230V, 3 phase, 4 wire, Balanced load. (Each branch having equal load). Load : Wire Wound Fixed Resistors	4
6	Lamp Bank - 230 V 0-20 A	5
7	DC shunt motor coupled with DC shunt Generator	6,7
8	Single phase Induction motor – ½ HP,230 V,50 Hz, AC supply	8
9	Universal motor -1/4 Hp	9
10	Digital Multimeter - 3 1/2 digit	Common
11	DC and AC Ammeters: 0-5-10 Amp	
12	DC and AC Voltmeters: 0-150-300 V	
13	Tachometer: Non contact type, 0-10000 rpm	
14	Rectifier: solid state, Input- 415 V, 3-Phase, AC, Output – 230 V DC regulated, 20 Amp	

UNDERPINNING THEORY COMPONENTS

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

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Magnetic Circuits	1a Describe the salient features of the given type of circuits. 1b Apply Fleming's left hand rule and Lenz's law to determine direction of induced EMF in the given circuit. 1c Explain the given type(s) of induced emf. 1d. Interpret the B-H curve and hysteresis loop for the given material	1.1 Magnetic flux, flux density, magneto motive force, magnetic field strength, permeability, reluctance 1.2 Electric and magnetic circuits 1.3 Series and parallel magnetic circuits 1.4 Faraday's laws of electromagnetic induction, Fleming's right hand rule, Lenz's law 1.5 Dynamically and statically induced emf, self and mutual inductance 1.6 B-H curve and hysteresis, hysteresis loop and hysteresis loss
Unit– II AC Fundamentals	2a. Describe the salient features of the given type of power supply 2b. Represent the given AC quantities by phasors, waveforms and mathematical equations. 2c Explain the response of the given pure resistive, inductive and capacitive AC circuits with sketches 2d. Calculate the parameters of the given circuit. 2e. Calculate impedance, current, power factor and power of the given AC circuit.	2.1 A.C. and D.C. quantity, advantages of A.C. over D.C. 2.2 Single phase A.C. sinusoidal A.C. wave: instantaneous value, cycle, amplitude, time period, frequency, angular frequency, R.M.S. value, Average value for sinusoidal waveform, Form factor, Peak factor 2.3 Vector representation of sinusoidal A.C. quantity, Phase angle, phase difference, concept of lagging and leading – by waveforms, mathematical equations and phasors 2.4 Pure resistance, inductance and capacitance in A.C. circuit 2.5 R-L and R-C series circuits 2.6 Impedance and impedance triangle 2.7 Power factor and its significance 2.8 Power – active, reactive and apparent, power triangle
Unit– III Polyphase AC Circuits	3a. Describe the salient features of the given type of AC power supply. 3b Explain the concept of symmetrical system and phase sequence of the given AC supply 3c Distinguish the characteristics of the given type(s) of star (or delta) connections with sketches. 3d. Calculate the current and power of the given three phase balanced system	3.1 3 phase system over 1 phase system 3.2 3-phase emf generation and its wave form 3.3 Phase sequence and balanced and unbalanced load 3.4 Phase and line current, phase and line voltage in star connected and delta connected balanced system 3.5 Current, power, power factor in a 3 phase balanced system 3.6 Star and delta connections
Unit-IV Transformer and DC Motors	4a Explain the working principle of the given type of transformer 4b Distinguish the construction of the given type of transformer 4c. Describe the construction and working of the given type of DC motor. 4d. Select relevant type of DC motor for the given application with justification	4.1 Transformer: Working principle, emf equation, Voltage ratio, current ratio and transformation ratio, losses 4.2 Auto-transformer – comparison with two winding transformer, applications 4.3 DC motor construction - parts its function and material used 4.4 DC motor -Principle of operation 4.5 Types of D.C. motors, schematic diagram, applications of dc shunt, series and compound motors
Unit –V Fractional Horse Power (FHP) Motors	5a Explain the working principle of the given type of FHP motor 5b. Select relevant FHP motor for the given application with justification. 5c Describe the procedure to connect the given type of FHP motor for the given application with sketches. 5d Describe the procedure to connect stepper motor for the given application with sketches	5.1 FHP: Schematic representation, principle of operation and applications of: split phase Induction motor, capacitor start induction run, capacitor start capacitor run and permanent capacitor motors, shaded pole motors 5.2 Universal motor: principle of operation, reversal of rotation and applications 5.3 Stepper motor: types, principle of working and applications
Unit-VI Protective Devices and Switchgear	6a Describe the features of the given type of protective device. 6b. Select the relevant protective device for the given application with justification 6c. Select suitable switchgear for the given situation with justification 6d. State the I.E. rule related to be applied for the given type of earthing with justification	6.1 Fuse: Operation, types 6.2 Switch Fuse Unit and Fuse Switch Unit: Differences 6.3 MCB, MCCB and ELCB: Operation and general specifications 6.4 Earthing: Importance of earthing, factors affecting earthing 6.5 Methods of reducing earth resistance, I.E rules relevant to earthing

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

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

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

10. SUGGESTED STUDENT ACTIVITIES

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

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

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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

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

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

   Then select the motor which you would like to purchase. Give justification for your selection in short.
g. Each batch will visit Institute workshop and prepare a report which includes the following points:
   i. Different types of prime movers used, their specifications and manufacturers
   ii. Method of starting and speed control

iii. Different protective and safety devices used
iv. Maintenance

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

13. SUGGESTED LEARNING RESOURCES

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

14. SOFTWARE/LEARNING WEBSITES

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

Program Name : **Diploma in Electrionics Program Group**

Program Code : **DE/EE/EJ/IE/IS/MU/ET/EN/EX**

Semester : **Second**

Course Title : **Basic Electronics**

Course Code : **22216**

1. RATIONALE

Diploma engineers have to deal with the various electronic components while maintaining various electronics equipment. The study of basic operating principles and handling of various electronics devices will help them to troubleshoot electronics equipment. This course is developed in such a way that, students will be able to apply the knowledge to solve broad electronic engineering application problems.

2. COMPETENCY

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

- **Maintain electronic circuits comprising of discrete electronic components.**

3. COURSE OUTCOMES (COs)

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

a. Use relevant diode in different electronics circuits.
b. Maintain rectifiers comprising of diodes.
c. Use BJT in electronics circuits.
d. Use FET in electronics circuits.
e. Maintain DC regulated power supply.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme											
				Theory						Practical					
L	T	P		Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
4	-	4	8	3	70	28	30*	00	100	40	50#	20	50	20	100	40

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

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

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

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

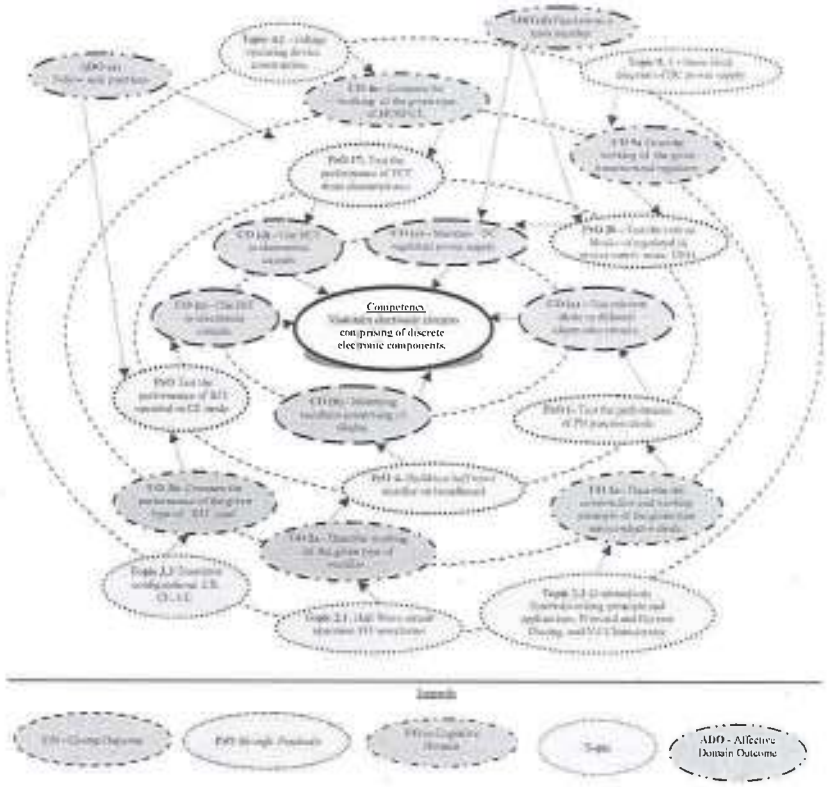

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

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

S. No.	Practical Outcomes(PrOs)	Unit No.	Approx. Hrs. Required
1	Test the performance of PN junction diode	I	2*
2	Test the performance of zener diode.	I	2
3	Test the performance of photo diode by varying the light intensity as well as distance of the light source	I	2

S. No.	Practical Outcomes(PrOs)	Unit No.	Approx. Hrs. Required
4	Build/test half wave rectifier on breadboard	II	2
5	Build/test half wave rectifier on breadboard with filter- Part I	II	2*
6	Build/test half wave rectifier on breadboard with filter- Part II	II	2
7	Build/ test full wave rectifier on breadboard using two diodes	II	2*
8	Build/ test full wave rectifier on breadboard using two diodes	II	2
9	Build/ test full wave bridge rectifier on breadboard	II	2
10	Use LC filter with fullwave rectifier to measure ripple factor	II	2
11	Use π filter with bridge rectifier to measure ripple factor	II	2
12	Assemble positive clipper circuit on breadboard and test the performancs	II	2
13	Assemble Negative clipper circuit on breadboard and and test the performancs	II	2
14	Build the combinational Clipper on breadboard and test the performance. - Part I	II	2*
15	Build the combinational Clipper on breadboard and test the performance - Part II	II	2
16	Build positive clamper on breadboard and test the performance - Part I	II	2
17	Build positive clamper on breadboard and test the performance. - Part II	II	2
18	Build Negative clamper on breadboard test the performance	II	2
19	Identify the terminals of the PNP and NPN transistor using different methods - Part I	III	2*
20	Identify the terminals of the PNP and NPN transistor using different methods - Part II	III	2
21	Find specifications of a given transistor using data sheets	III	2
22	Test the performance of BJT working in CE mode	III	2
23	Test the performance of BJT working in CB mode	III	2
24	Test the assembled BJT voltage divider bias circuit for given input. - Part I	III	2
25	Test the assembled BJT voltage divider bias circuit for given input - Part II	III	2
26	Test the performance of FET drain characteristics , transfer characteristics and calculate trans-conductance. - Part I	IV	2*
27	Test the performance of FET drain characteristics , transfer characteristics and calculate trans-conductance. - Part II	IV	2
28	Build / test zener voltage regulator for the given voltage	V	2
29	Test the performance of transistorized series voltage regulator for the given load regulation.	V	2
30	Test the performance of transistorized shunt voltage regulator for the given load regulation	V	2
31	Test the various blocks of regulated dc power supply	V	2
32	Find out faults at different stages of regulated dc power supply	V	2
33	Trouble shoot given DC regulated power supply. - Part I	V	2*
34	Trouble shoot given DC regulated power supply. - Part II	V	2
	Total		**68**

Note

*i A suggestive list of **PrOs** is given in the above table More such PrOs can be added to attain the COs and competency A 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 %
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 experiments, as well as aid to procure equipment by authorities concerned

S. No.	Equipment Name with Broad Specifications	Exp. S. No.
1	Variable DC power supply 0- 30V, 2A, SC protection, display for voltage and current	1,2,3,9,10, 12,13,15, 16,17,18, 19,20 21
2	Cathode Ray Oscilloscope Duel Trace 20Mhz, 1MegaΩ Input Impedance	4,5,6,7,8,9,10,11,12, 13,14, 22
3	Function Generator 0-2 MHz with Sine , square and triangular output with variable frequency and amplitude	4,5,6,7,8,9,10,11,12, 13
4	Digital Multimeter : 3 1/2 digit display, 9999 counts digital	All

S. No.	Equipment Name with Broad Specifications	Exp. S. No.
	multimeter measures: V_{ac}, V_{dc} (1000V max) , A_{dc}, A_{ac} (10 amp max), Resistance (0 - 100 MΩ) , Capacitance and Temperature measurement	
5	Lux meter 3000 Lumen, Battery operated hand held type	3
6	Electronic Work Bench : Bread Board 840 -1000 contact points: Positive and Negative power rails on opposite side of the board , 0-30 V, 2 Amp Variable DC power supply, Function Generator 0-2MHz, CRO: 0-30 MHz, Digital Multimeter	All

8. UNDERPINNING THEORY COMPONENTS

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

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Semiconductor Diode	1a Describe the construction and working principle of the given type semiconductor diode 1b. Differentiate between the given type of insulator, conductor and semiconductor based on energy band theory 1c. Describe working principle, characteristics, and application of the given type of diode. 1d. Describe effect of temperature on the given type of diode.	1.1 Different types of Semiconductor Diodes and their materials 1.2 Energy band theory and effect of temperature 1.3 Construction, Symbol , working principle , applications, Forward and Reverse Biasing and V-I Characteristic of following diodes: PN junction, Zener, LED, Photo diode
Unit– II Applications of diodes	2a Describe working of the given type of rectifier 2b Describe the need and working of the given type of rectifier filter circuit 2c Select clipper or clamper for obtaining the given waveform 2d Calculate ripple factor, PIV and efficiency of the given type of rectifier	2.1 Types of Rectifiers: Half Wave, Full Wave Rectifier (bridge and center tapped): circuit operation I/O waveforms for voltage and current 2.2 Parameters of rectifier: Average DC value of current and voltage ripple factor ripple frequency PIV of diode, TUF, efficiency of rectifier 2.3 Types of Filters: Shunt capacitor, Series inductor, LC and π filter, bledder resistor 2.4 Clipper and Clamper circuits
Unit– III Bipolar Junction Transistor	3a Describe the working principle of the given type of transistor 3b Compare the performance of the given type of transistor configurations 3c. Justify the biasing method for the given circuit.	3.1 Current operating device 3.2 Different types of transistors: PNP, NPN 3.3 Transistor configurations: CB, CE, CC Transistor characteristics (input, output,) in different transistor configurations

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	3d Describe the procedure to minimize the thermal runaway effect for the given type of transistor baising circuit	3.4 BJT biasing: DC load line, operating point, stabilization, thermal runaway, types of biasing, fixed biasing, base bias with emitter feedback, voltage divider
Unit– IV Field Effect Transistor	4a Explain the working of FET for the given application 4b Explain the given type of FET biasing method. 4c Compare the working of the given type of MOSFET. 4d. Differentiate the working principle of FET and MOSFET on the basis of the given transfer characteristic curve.	4.1 Voltage operating device Construction of JFET (N-channel and P- channel), symbol, working principle and characteristics (Drain and Transfer characteristics) 4.2 FET Biasing: Source self bias, drain to source bias 4.3 Applications of FET 4.4 MOSFET: Construction, working principle and characteristics of Enhancement and depletion MOSFET, MOSFET handling
Unit– V Regulators and power supply	5a. Describe working of the given transistorized regulator 5b. Describe the working of the given block of the DC regulated power supply in the block diagram 5c. Calculate output voltage of the given zener voltage regulator circuit. 5d Calculate load and line regulation of the given transistorized regulator	5.1 Basic block diagram of DC regulated power supply 5.2 Load and Line regulation 5.3 Zener diode voltage regulator 5.4 Transistorized series and shunt regulator - circuit diagram and working

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Semiconductor Diode	12	3	4	7	14
II	Applications of diodes	14	3	6	7	16
III	Bipolar Junction Transistor	16	3	7	8	18
IV	Field Effect Transistor	12	3	4	5	12
V	Regulators and power supply	10	2	3	5	10
Total		**64**	**14**	**24**	**32**	**70**

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

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

10. SUGGESTED STUDENT ACTIVITIES

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

a. Prepare journals based on practical performed in laboratory.
b. Test different diodes using CRO.
c. Give seminar on any relevant topic.
d. Library survey regarding different data books and manuals.
e. Prepare power point presentation for wave shaping circuits.
f. Undertake a market survey of different semiconductor components.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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

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

12. SUGGESTED MICRO-PROJECTS

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

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

a. **Diode**: Build a circuit on general purpose PCB to clip a positive half cycle at 1.5 v a waveform with input signal 5Vpp., and prepare the report.

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

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Electronic Devices and Circuit: An Introduction	Mottershead, Allen	PHI Learning, New Delhi, ISBN 9788120301245
2	Electronic Devices and Circuit Theory	Boylestead Robert, Louis Neshelsky	Pearson Education, 10th edition, New Delhi,2009, ISBN: 978-8131727003
3	The Art of Electronics	Paul Horowitz Winfield Hill	Cambridge University Press, New Delhi 2015 ISBN: 9780521689175
4	Electronics Principles	Malvino, Albert Paul, David	McGraw Hill Eduction, New Delhi, ISBN: 978-0070634244
5	Principles of Electronics	Mehta, V K Mehta, Rohit	S Chand and Company, Ram Nagar New Delhi-110 055, 2014, ISBN: 9788121924504
6	Basic Electronic Engineering	Baru V., Kaduskar R ,Gaikwad S.T	Dreamtech Press, New Delhi, 2015 ISBN: 9789350040126
7	Fundamentals of Electronic Devices and Circuits	Bell, David	Oxford University Press, International edition, USA, 2015, ISBN : 9780195425239
8	A text book of Applied Electronics	Sedha, R S	S.Chand ,New Delhi, 2008, ISBN: 978-8121927833

14. SOFTWARE/LEARNING WEBSITES

a. www.nptel.iitm.ac.in
b. www.datasheetcafe.com
c. www.williamson-labs.com
d. www.futurlec.com
e. www.bis.org.in
f. www.learnerstv.com
g. www.cadsoft.io
h. www.khanacademy.com

Program Name : **Diploma in Electronics and Telecommunication Engineering and Diploma in Digital Electronics**

Program Code : **EJ/DE/ET/EN/EX**

Semester : **Second**

Course Title : **Electronic Engineering Materials**

Course Code : **22217**

1. RATIONALE

'Electronic Engineering Materials' is the basic course for the Electronics and Communication engineering and Digital Electronics engineering student. Material science have undergone radical changes, especially due to requirement of electronic component in variety of application area.This subject will enable the student to know and apply facts, concepts and working principles for the selecting material and components for various electronics engineering applications.

2. COMPETENCY

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

- **Select electronic engineering materials for specified electronics application.**

3. COURSE OUTCOMES (COs)

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

a. Choose relevant metal on basis of conductivity property.
b. Interpret the properties of dielectric materials.
c. Select relevant magnetic materials for the specified electronics application.
d. Select relevant semiconductor device fabrication materials.
e. Select material for the relevant applications.

4. TEACHING AND EXAMINATION SCHEME

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

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

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

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

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

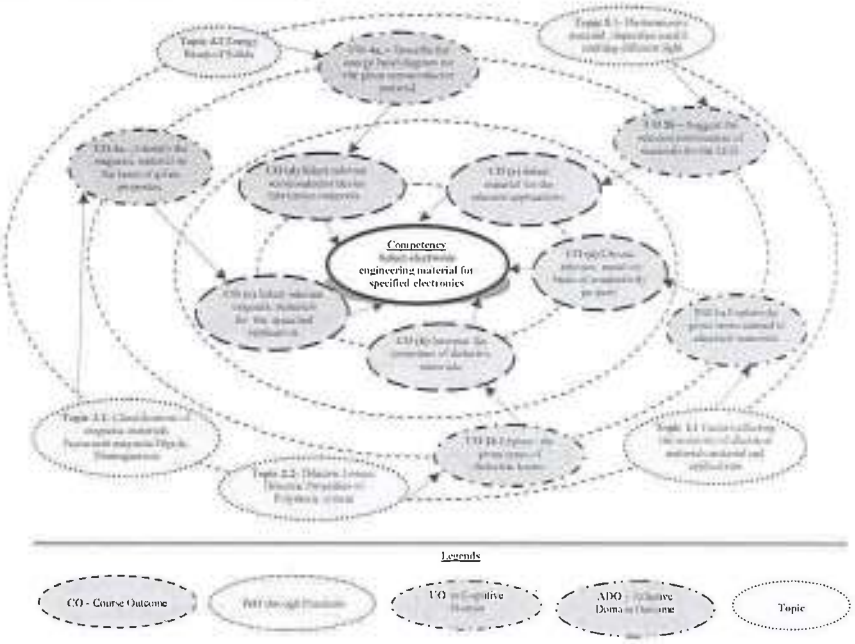

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

- Not applicable –

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

Not applicable –

8. UNDERPINNING THEORY COMPONENTS

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

Unit	Unit Outcomes(UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Conductivity of Materials	1a. Explain the given terms related to electrical materials. 1b. Describe the effect on conductivity of metal on the basis of the given factor (s)	1.1 Terms and factors affecting the resistvity of electrical materials 1.2 Electron mobility, energy level diagram of a materials 1.3 Emission of electrons from metals

Unit	Unit Outcomes(UOs) (in cognitive domain)	Topics and Sub-topics
	1c. Expain the given mode(s) of electron emission from metals 1d. Explain the effect of change in temperature on the conductivity of the given metal	modes of emission – therminoic emission , photo electric emission , field emission , secondary emission , concept, material and applications 1.4 Effect of temperature on conductivity of metals, superconductivity , electrial and thermal conductivity of metals 1.5 Thermoelectric effect concept , material and applications
Unit-II Dielectric Materials	2a. Describe the effect on the capacitance on the given dielectric material on the basis of the given factor(s). 2b. Explain the given types of dielectric losses. 2c. Explain the concept of the given phenomenon of dilectric material.. 2d. Select the dielectric material for the given application	2.1 Effect of dielectric on the behavior of capacitor , frequency dependence of electronic polarisability, frequency dependence of permittivity 2.2 Dilectric losses, dilectric properties of polymeric material 2.3 Insulating materials - breakdown in gaseous , liquid and solid delectric materials, requirements of good insulating materials 2.4 Dielectric materials –mica, porecilan , polythene , bakelite , polyvinylcarboide (PVC),rubber ,cotton and silk ,glass ,paper and Boards, wood, enamel covering, transformer oil, polymers properties and applications . 2.5 Ferroelectricity and piezoelectity concept , materials and applications
Unit– III Magnetic Properties of Materials	3a. Identify the magnetic material on the basis of given magnetic properties 3b. Describe the given Hysterisis loop identifying the material 3c. Describe the effect on permeability of the material due to the given factor (s). 3d. Explain the concept anti ferromagnetism	3.1 Classifications of magnetic materials Permanent magnetic dipole, diamagnetism, paramagnetism, ferromagnetism ferromagntic domain 3.2 Magnetisation curve hysterisis loop magnetosteiction effect– application for ultrasonic generation, permeability and affecting factors 3.3 Magnetic material– iron and silicon iron alloy, nickel iron alloy, 3.4 Anti-ferromagnetism and ferrimagnetism
Unit– IV Semi Conductor Materials	4a. Describe the energy band diagram for the given semiconductor material 4b. Select the material for given type of impurity add in semiconductor 4c. Explain the given effect of	4.1 Energy bands of solids: conductors, semiconductors,nonconductors 4.2 Types of semiconductors, intrinsic material, impurity type and material for various impurities 4.3 Diffusion, hall effect,thermal and electrical conductivity of semi conductor

Unit	Unit Outcomes(UOs) (in cognitive domain)	Topics and Sub-topics
	semiconductor material and its application 4d. Select the relevant material for the given semicoductor device fabrication with justification	materials 4.4 Materials for fabrication of semiconductor devices – passive materials and process materials, substrate, metal, capacitance material, Junction coating , device pooting, Packaging
Unit –V Micro-electronic components and special materials	5a. Explain with sketches the working of the given type of LASER. 5b. Suggest the relevant combination of materials for the LED of the given wavelength 5c. Suggest the relevant material for the given type of antenna. 5d. Identify the relevant micro-device for the given application and the material of which it is made of.	5.1 Photoemissive material, impurities used to emit different colours of light/ wavelengh; electroluminiscence and junction LASERS 5.2 Material for flexible and wearable antenas 5.3 Photovoltaic material 5.4 Materials used and application micro motors, micro relay and micro switches

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Conductivity of Materials	10	06	06	06	18
II	Dielectric Materials	10	04	06	06	16
III	Magnetic Properties of Materials	10	04	06	06	16
IV	Semi Conductor Materials	10	04	04	04	12
V	Microc electronic components and special materials	08	02	02	04	08
	Total	**48**	**20**	**24**	**26**	**70**

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

10. SUGGESTED STUDENT ACTIVITIES

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

a. Library / Internet survey of electrical /electronic material
b. Prepare power point presentation or animation for understanding different material behavior.
c. Access national digital Library for survey .

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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

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

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a group of 3-4 student assigned to them in the beginning of the semester. They ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than ***16 (sixteen) student engagement hours*** **during the course.**

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

a. Prepare the chart of conducting materials
b. Prepare the chart of dielectric materials
c. Collect different samples of insulating material and prepare chart of their applications
d. Collect different samples of conducting material and prepare chart of their applications
e. Collect data for bifuel project erction
f. Make survey for PV cell as per efficiency and pricing.
g. Prepare chart for application of nanomateil
h. Demostrate effect of various modes of magnetism.

13. SUGGESTED LEARNING RESOURCES

S. No	Title of Book	Author	Publication
1	An Introduction to	C S Indulkar and S.	S Chand Publishing New Delhi

S. No	Title of Book	Author	Publication
	Electrical Materials by	Thiruvengadam S	ISBN 9788121906661
2	A course in Electrical engineering Materials	S.P. Seth and P.V Gupta	Dhanpat Rai and Sons
3	Material Science and Engg	William D. Callister	WILLEY India 2/e Edition ISBN 9788126541607

14. SOFTWARE/LEARNING WEBSITES

a. https://www.youtube.com/watch?v=ooLJ_bGKmH
b. https://www.youtube.com/watch?v=emCqQdrSo3o
c. http://www.engineeringtoolbox.com/thermal-conductivity-metals-d_858.html


MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION MUMBAI

Program Name : **Electronics and Telecommunication and Digital Electronics**
Program Code : **EJ/DE/ET/EN/EX**
Semester : **Second**
Course Title : **'C' Programming Language**
Course Code : **22218**

1. RATIONALE

Automation Industry needs to build Microcontroller based applications which are being developed using 'C'. This course deals with concepts of programming to enhance programming skills of diploma students. This course will enable the students to inculcate programming concepts and methodology to solve engineering problems.

2. COMPETENCY

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

- **Develop 'C' programs to solve broad-based electronic engineering related problems.**

3. COURSE OUTCOMES (COs)

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

a. Interpret the basic code of 'C'
b. Implement decision making in 'C' programming
c. Use Arrays and string in 'C' programming
d. Use functions in 'C' programs for modular programming approach
e. Use pointers to increase efficiency of programs
f. Implement basic concept of structure in 'C'

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme											
				Theory						Practical					
				Paper	ESE		PA		Total		ESE		PA		Total	
L	T	P		Hrs.	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
4	-	4	8	3	70	28	30*	00	100	40	50@	20	50	20	100	40

(*):Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.
Legends: **L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** - Practical; **C** – Credit, **ESE** - End Semester Examination; **PA** - Progressive Assessment, **'#':** No Theory Examination

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

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

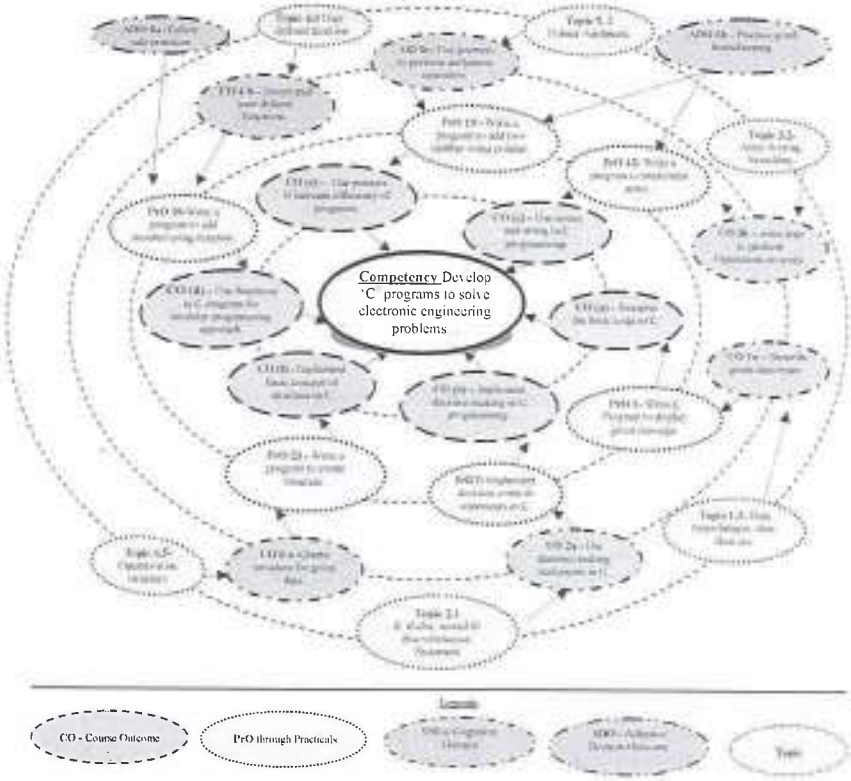

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

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

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	a) Write a 'C'program to display hexadecimal, decimal, octal format of entered number using %d, %c, %i, %f, %g, %u, %o, %s, %x b) Write algorithm and draw flow chart for following problems: i. Addition of two numbers ii. Exchange value of two variable	I	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
2	Write a program to perform following operations: (a) Display the message "Hello World", name, address, date of birth and email_id using printf ( ) function (b) Logical operations: & (AND) , | (OR) for given values , Bitwise operations :<< (LEFT SHIFT), >> (RIGHT OPERATOR) for given values.	I	02
3	(a) Write a program to display current time and date using **time.h** header file. (b) Write a program to display addition of value of resister R, Where, i R series =R1 + R2+R3 and ii R parallel =1/ R1 + 1/ R2+1/R3 *Note. Use math.h header file*	I	02*
4	(a) Write a program to calculate inductive resistance (F_L) with the help of given formula $F_L = 2 * \pi * f L$. Where π, f, L are given data. (b) Write a program to calculate capacitive resistance (F_C) with the help of given formula $F_C = 1/(2 * \pi * f C)$. Where π, f, C are given data ***Note** Develop above programs using local variables, global variables and arithmetic operators.*	I	02
5	Implement decision control statements in C using 'if' (a) Write a program to find whether given number is even or odd. (b) Write a program to find whether given number is Positive, negative or zero.	II	02*
6	(a) Write a program to find the largest among n numbers using 'if-else'. (b) Write a program to determine leap year using 'if-else'	II	02
7	Implement decision control statements in 'C' using 'nested if-else' (a) Determine whether a string is palindrome. (b) Find the greatest of the three numbers using conditional operators	II	02
8	Write a program to perform addition, subtraction; multiplication and division according to user's choice using switch case statement for given data	II	02
9	Implement loop control statements in 'C' using 'for' loop (a) Write a program to print the table for given no. in one column. (b) Write a program to count the number of digit in a given number.	II	02
10	Implement loop control statements in 'C' (a) Find Fibonacci series for given number (b) Write a program to produce the following output: 1 2 3 4 5 6 7 8 9 10	II	02
11	(a) Print the Result sheet: Conditions given are: marks >=40%	II	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	pass, marks <40 % fail, marks 60>=first class, marks above 75 % distinction, marks >100 and marks < 0 not valid		
12	(a) Write a program to declare, modify and print elements of a given data array (b) Write a program to find highest marks in a class of n students using array.	III	02*
13	(a) Write a program to copy of one array into second array for given data elements (b) Write a program to create an array by reversing the elements of the given array.	III	02
14	(a) Write a program to sort numbers in ascending and descending in a given array. (b) Write a program to add two matrices of size 3*3 store additions in third matrix for given data elements.	III	02
15	(a) Write a program that accept a string from user and print that string (b) Write a program that accept a string and compare it with existing string	III	02*
16	(a) Write a program to accept and concatenate two strings. (b) Write a program to find length of a string.	III	02
17	**Library Functions:** Develop Program to demonstrate: (a). Use of all String handling functions. (b). Use of few Mathematical functions	IV	02*
18	(a) Write a program to add two numbers using function (b) Write a program to perform addition, subtraction, multiplication and division using switch case statement and user defined function for given data	IV	02*
19	(a) Write a program to use address operator (&) and pointer operator (*) for given data (b) Write a program to add two integer numbers using pointer	V	02*
20	(a) Write a program to calculate the sum of elements of given array using pointer (b) Write a program to access the array elements using pointer.	V	02
21	(a) Write a program to interchange given values of two variables using call by value mechanism. (b) Write a program to interchange given values of two variables using call by reference mechanism	V	02*
22	Write a program to exchange given values of two variables using pointer	V	02
23	Create structure DATE using 'C' having members' day, month, year and assign initial values to that structure	VI	02
24	Write a program to create a structure for student having data members like Roll No , Name, Class, marks in three subjects and calculate the % of marks	VI	02
	Total		**48**

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 %
1	Write algorithm and draw flow chart.	20
2	Use 'C' software tool for programming to create, edit, compile the 'C' programs/applications	40
3	Debug, test and execute the programs/applications	20
4	Able to answer oral questions	10
5	Submission of report in time	10
	Total	**100**

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

a. Handle command prompt environment.
b. Experiment with C / C++ environment.
c. Plan, construct, compile, debug and test C programs.
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.

1. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

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

S. No.	Equipment Name with Broad Specifications	Expt. S. No.
1	Hardware: Personal computer, (i3-i5 preferable), RAM minimum 2 GB onwards.	For all Experiments
2	Operating system: Windows XP/Windows 7/LINUX onwards	
3	Software: Turbo C , or Microsoft Visual Studio 2005 onwards (Optional).	

2. UNDERPINNING THEORY COMPONENTS

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

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Overview of C Programming	1a. Describe the given data type. 1b. Construct algorithm, flow chart for the given problem. 1c. Use pre-increment and post-increment operators in the given situation. 1d. Use bitwise operators in the given situation.	1.1 Structure of 'C' program, Assembler, Linker, Compiler, Interpreter. 1.2 'C' character set-keywords, identifiers, types of constants (Integer, single character, string, and real) variables, scope of variables, concept of ASCII. 1.3 Data types: integer- unsigned, signed, long, float- float, double, character- char, string, octal, hexadecimal. 1.4 Algorithm and flow chart. 1.5 Formatted input and output statements Input and output function. 1.6 Operators and expressions: a. Operators in 'C'- arithmetic, logical, assignment, relational, increment and decrement, conditional, bit wise, special operators. b. Expressions. c. Precedence and associatively.
Unit– II Decision control and Loop control	2a. Write a 'C' program using the given decision making structure for two-way branching. 2b. Write a 'C' program using the decision making structure for multi-way branching. 2c. Write a 'C' program using loop statements to solve the given iterative problem. 2d. Use related statements to alter the program flow in the given loop.	2.1 Decision making if statement (if, if-else, nested if-else), switch –case statement. 2.2 Repetition in 'C' (loop control statement) while, do-while and for loop, break and continue statement, nested loops.
Unit– III Array and Strings	3a. Write steps to access elements of the given array. 3b. Write steps to perform operation on the given array.	3.1 Introduction to Array and its types. 3.2 Declaration, initialization of array, accessing elements of an array, adding, deleting, sorting & searching.
	3c. Write steps to initialization and declaration of the given string in 'C' program. 3d. Apply relevant control statement on the given strings to manipulate its elements.	3.3 Introduction to string Initializing, declaring and display of string. 3.4 String handling functions from standard library (strlen (), strcpy (), strcat (), strcmp(), strlwr(),strupr()):

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit-IV Functions	4a Use inbuilt functions for the given problem 4b Develop relevant user defined functions for the given problem 4c Write 'C' codes to Pass function parameters using the given approach 4d Write recursive function for the given problem	4.1 Concept and need of functions 4.2 Library functions: Math functions, String handling functions, other miscellaneous functions 4.3 Writing User defined functions, scope of variables 4.4 Parameter passing: call by value, call by reference 4.5 Recursive functions
Unit –V Pointers	5a Use pointer for address access to manipulate the given data. 5b Use pointers to access memory locations to solve the given problem. 5c Use pointers for performing the given arithmetic operation 5d. Develop a program to access array elements using the given pointers	5.1 Concept of pointer and pointer variables, initialization of pointer, call-by-reference 5.2 Pointer arithmetic 5.3 Handling arrays using pointers 5.4 Handling functions using pointers
Unit-VI Structures	6a Create a structure for the given data. 6b Develop a program to access elements of structure using pointers. 6c Use the structure for solving the given problem. 6d Use of enumerated data type in structure to solve the given program.	6.1 Introduction and Features and Syntax of structure 6.2 Declaration and Initialization of Structures 6.3 Initializing, assessing structure members using pointers 6.4 Type def, Enumerated Data Type, using structures in C Program 6.5 Operations on structure

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Overview of C Programming	08	02	04	04	10
II	Decision control and Loop control	12	04	04	04	12
III	Array and Strings	14	04	06	06	16
IV	Functions	12	02	04	06	12
V	Pointers	10	02	04	04	10
VI	Structures	08	02	04	04	10
Total		**64**	**16**	**26**	**28**	**70**

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

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

10. SUGGESTED STUDENT ACTIVITIES

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

a. Prepare journals based on practical performed in laboratory.
b. Give seminar on relevant topic.
c. Library/E-Book survey regarding 'C' used in electronics industries.
d. Prepare power point presentation or animation for showing different types of 'C' applications.
e. Find and Utilize android applications related to 'C'.
f. Undertake a market survey of different 'C' application and compare with the following points.
   i. Available applications.
   ii. Application profile.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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

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

12. SUGGESTED MICRO-PROJECTS

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

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

a. **Modern Periodic Table using 'C'** - Each group will prepare a periodic table using functions 'Void add()' and 'Void show()'
b. **Simple Calculator** - Each batch will prepare a menu driven program to perform any five mathematical operations.
c. **Employee Record System** - Each batch will prepare a menu driven program to perform following operations :
   i. Add record
   ii. List record
d. **Digital clock using 'C'**
e. **String Manipulation project** - Each batch will prepare a menu driven program to perform following operations (any five) :
   i. Substrings
   ii. Palindromes
   iii. Comparison
   iv. Reverse string
   v. String to integer
   vi. Sort a string
f. **Matrix Operations** - Each batch will prepare a menu driven program to perform following operations:
   i. Matrix addition
   ii. Matrix multiplication
   iii. Matrix transpose
   iv. Sum of diagonal of a matrix
g. **Basic mathematic functions** - Each batch will prepare a menu driven program to perform following operations:
   i. Pascal triangle
   ii. Armstrong No.
   iii. Floyd's triangle
   iv. HCF and LCM.
h. **Patterns** - Each batch will prepare a menu driven program to obtain following patterns (any three):

```
1          1          *          1
121        12         **         2 2
12321      123        ***        3 3 3
1234321    1234       **         4 4 4 4
                      *
```

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Programming in 'C'	Balguruswamy, E.	Tata McGraw Hill May 2012, New Delhi ISBN:978-1-25-900461-2
2	Let us 'C'	Kanetkar, Yashwant	BPB Publication July 2016, New Delhi ISBN : 9788183331630,
3	Basic computation and programming with 'C'	Saha, Subrata ; Mukherjee, Subhodip	Cambridge 2016,New Delhi. ISBN: 978-1-316-60185-3

14. SOFTWARE/LEARNING WEBSITES

a. Turbo C Editor
b. Dosbox
c. www.tutorialspoint.com/cprogramming
d. www.cprogramming.com
e. www.sourcecodesworld.com/source/LanguageHome.asp?LangId=1
f. http://fresh2refresh.com/c-programming/c-basic-program/
g. http://www.c4learn.com/c-programs/
h. http://computer.howstuffworks.com/c2.htm
i. http://www.programiz.com/c-programming/examples
j. www.indiastudycenter.com/studyguides/cs/default.asp
k. Android application resources for 'C'programming from Google Play store.


MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION

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

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

Semester : Second

Course Title : Business Communication Using Computers

Course Code : 22009

1. RATIONALE

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

2. COMPETENCY

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

- **Communicate effectively and skillfully at workplace.**

3. COURSE OUTCOMES (COs)

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

a Communicate effectively by avoiding barriers in various formal and informal situations

b Communicate skillfully using non-verbal methods of communication

c Give presentations by using audio- visual aids

d Write reports using correct guidelines

e Compose e-mail and formal business letters

4. TEACHING AND EXAMINATION SCHEME

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

(~[1]): For only practical courses, the PA (15 marks) has two components under practical marks i.e. the assessment of practical has a weightage of 60% (i.e.09 marks) and micro-project assessment has a weightage of 40% (i.e.06 marks). This is designed to facilitate attainment of COs holistically, as there is no theory ESE.

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

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

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

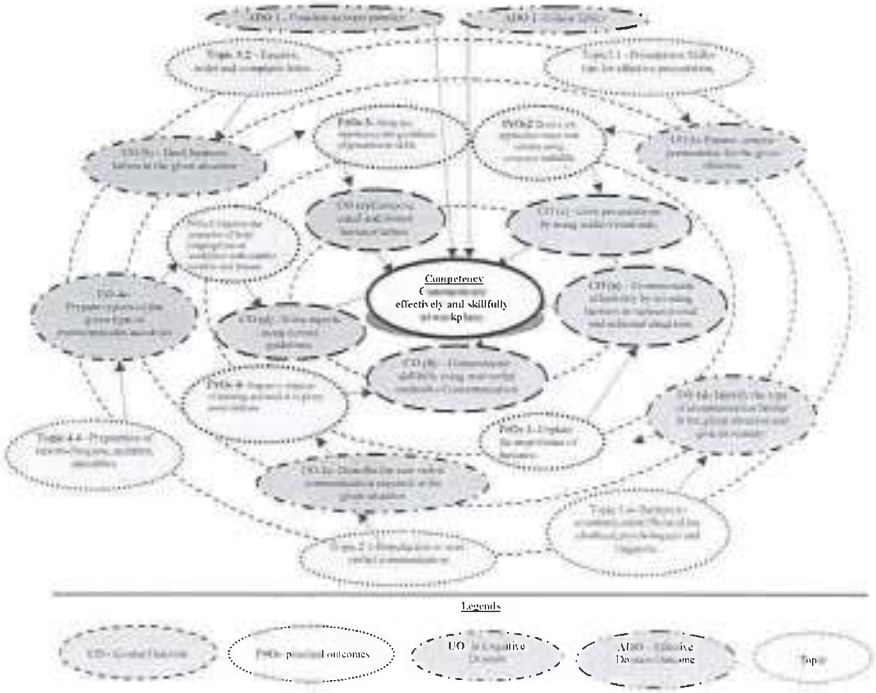

Figure 1 - Course Map

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

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

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

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

Note

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

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

7 MAJOR EQUIPMENTS / INSTRUMENTS REQUIRED

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

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

8. UNDERPINNING THEORY COMPONENTS

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

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

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

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

9. SUGGESTED SPECIFICATION TABLE FOR INTERNAL END SEMISTER EXAMINATION

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

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

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

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

SUGGESTED STUDENT ACTIVITIES

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

a. Collect good articles from newspapers and magazines and read them with correct intonation.
b. Listen to Business news on TV and radio.
c. Watch videos of effective presentations on television and open learning sources for presentation skills and body language.
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 CrAs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than *16 (sixteen) student engagement* hours during the course.

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

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

13. SUGGESTED LEARNING RESOURCES

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

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

14. SOFTWARE/LEARNING WEBSITES

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