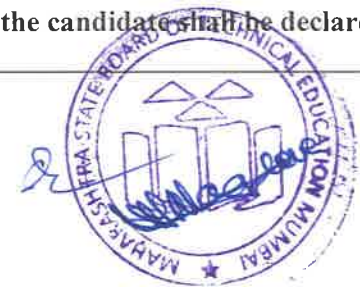
 <b>Maharashtra State Board of Technical Education, Mumbai</b> <b>Teaching And Examination Scheme For Post S.S.C. Diploma Courses</b>																						
<b>Program Name : Diploma in Industrial Electronics</b>												<b>With Effect From Academic Year: 2017 - 18</b>										
<b>Program Code : IE</b>												<b>Duration : 16 Weeks</b>										
<b>Duration of Program : 6 Semesters</b>												<b>Scheme : I</b>										
<b>Semester : Second</b>																						
S. N.	Course Title	Course Abbreviation	Course Code	Teaching Scheme			Credit (L+T+P)	Examination Scheme														Grand Total
				L	T	P		Theory						Practical								
								Exam Duration in Hrs.	ESE		PA		Total		ESE		PA		Total			
Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks							
1	Applied Mathematics	AME	22210	4	2	-	6	3	70	28	30*	00	100	40	--	--	--	--	--	--	100	
2	Applied Science	ASE	22211	2	-	2	6	90 Min	70*#	28	15*	00	100	40	25@	10	25	10	50	20	200	
				2							15*	00			25@	10	25	10	50	20		
3	Elements of Electrical Engineering	EEC	22215	4	-	2	6	3	70	28	30*	00	100	40	25#	10	25	10	50	20	150	
4	Basic Electronics	BEL	22216	4	-	4	8	3	70	28	30*	00	100	40	50#	20	50	20	100	40	200	
5	Business Communication Using Computers	BCC	22009	-	-	2	2	--	--	--	--	--	--	--	35@^	14	15~	06	50	20	50	
6	Programming in 'C'	PIC	22020	2	-	2	4	--	--	--	--	--	--	--	25@	10	25~	10	50	20	50	
<b>Total</b>				<b>18</b>	<b>2</b>	<b>12</b>	<b>32</b>	<b>--</b>	<b>280</b>	<b>--</b>	<b>120</b>	<b>--</b>	<b>400</b>	<b>--</b>	<b>185</b>	<b>--</b>	<b>165</b>	<b>--</b>	<b>350</b>	<b>--</b>	<b>750</b>	

Student Contact Hours Per Week: **32 Hrs.** Medium of Instruction: **English**  
**Theory and practical periods of 60 minutes each.** Total Marks : **750**  
Abbreviations: ESE- End Semester Exam, PA- Progressive Assessment, L - Lectures, T - Tutorial, P - Practical  
@ Internal Assessment, # External Assessment, \*# On Line Examination, ^ Computer Based Assessment  
\* Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment (5 marks each for Physics and Chemistry) to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain LOs required for the attainment of the COs.  
~ For the courses having ONLY Practical Examination, the PA marks Practical Part - with 60% weightage and Micro-Project Part with 40% weightage

- It is mandatory for the candidate to appear for practical (ESE) of both the part of Applied Science (Physics & Chemistry). Candidate remaining absent in exam of any one part, will be considered as absent for the head ESE (PR) of Applied Science.
- If Candidate not securing minimum marks for passing in the "PA" part of practical of any course of any semester then the candidate shall be declared as "Detained" for that semester.



**Program Name** : Electrical Engineering Program Group & Electronics Engineering Program Group  
**Program Code** : DE/EE/EJ/IE/IS/MU  
**Semester** : Second  
**Course Title** : Applied Mathematics  
**Course Code** : 22210

**1. RATIONALE**

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

**2. COMPETENCY**

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

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

**3. COURSE OUTCOMES (COs)**

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

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

**4. TEACHING AND EXAMINATION SCHEME**

Teaching Scheme			Credit (L+T+P)	Examination Scheme											
L	T	P		Theory						Practical					
				ESE		PA		Total		ESE		PA		Total	
Paper Hrs.		Max	Min	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.

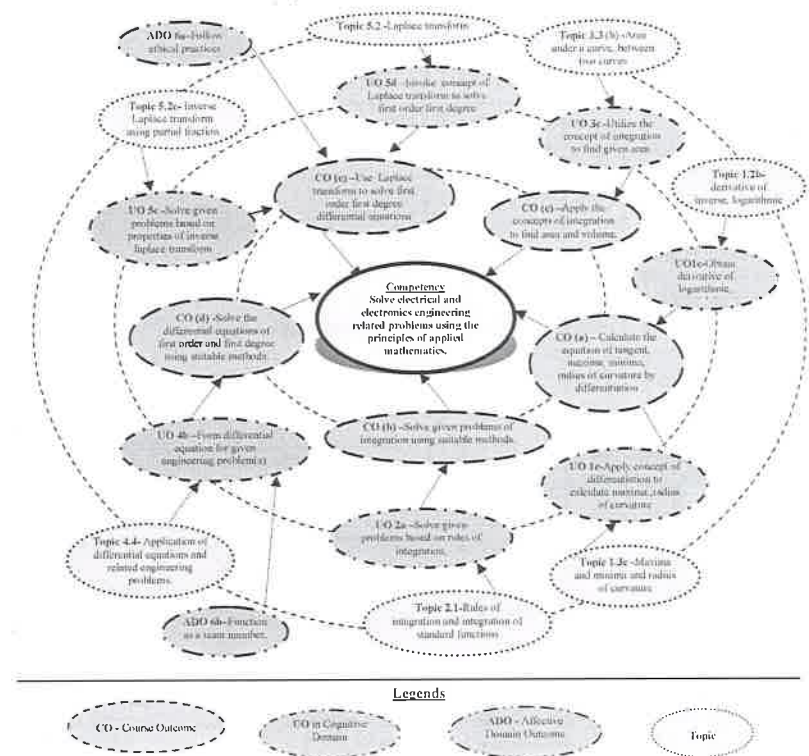


Figure 1 - Course Map

**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	Solve problems based on finding maxima, minima of function and radius of curvature at a given point.	I	2
6	Solve the problems based on standard formulae of integration.	II	2
7	Solve problems based on methods of integration, substitution, partial fractions.	II	2
8	Solve problems based on integration by parts.	II	2
9	Solve practice problems based on properties of definite integration.	III	2
10	Solve practice problems based on finding area under curve, area between two curves and volume of revolutions.	III	2
11	Solve the problems based on formation, order and degree of differential equations.	IV	2
12	Develop a model using variable separable method to related engineering problem.	IV	2
13	Develop a model using the concept of linear differential equation to related engineering problem.	IV	2
14	Solve problems based on algebra of complex numbers.	V	2
15	Find Laplace transform and inverse Laplace transform using related properties.	V	2
16	Make use of concept of Laplace transform to solve first order first degree differential equation.	V	2
			<b>32</b>

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
<b>Unit – I Differential Calculus</b>	1a. Solve the given simple problems based on functions. 1b. Solve the given simple problems based on rules of differentiation. 1c. Obtain the derivatives of	1.1 Functions and Limits : a) Concept of function and simple examples b) Concept of limits without examples. 1.2 Derivatives : a) Rules of derivatives such as sum.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	logarithmic, exponential functions. 1d. Apply the concept of differentiation to find equation of tangent and normal. 1e. Apply the concept of differentiation to calculate maxima and minima and radius of curvature of given problem.	product, quotient of functions. b) Derivative of composite functions (chain Rule), implicit and parametric functions. c) Derivatives of inverse, logarithmic and exponential functions. 1.3 Applications of derivative : a) Second order derivative without examples. b) Equation of tangent and normal c) Maxima and minima d) Radius of curvature
<b>Unit– II Integral Calculus</b>	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.
<b>Unit– III Applications of Definite Integration</b>	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.
<b>Unit-IV First Order First Degree Differential Equations</b>	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
<b>Unit –V Complex Numbers and Laplace transform.</b>	5a. Solve given problems based on algebra of complex numbers. 5b. Solve the given problems based on properties of Laplace transform 5c. Solve the given problems based on properties of inverse Laplace transform. 5d. Invoke the concept of Laplace transform to solve first order first degree differential equations.	5.1 Complex numbers: a. Cartesian, polar and exponential form of a complex number. b. Algebra of complex numbers. 5.2 Laplace transform: a. Laplace transform of standard functions (without proof). b. Properties of Laplace transform such as linearity, first and second shifting properties (without proof). c. Inverse Laplace transform using partial fraction method, linearity and first shifting property. d. Laplace transform of derivatives and solution of first order first degree differential equations.

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

#### 9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

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

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

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

#### 10. SUGGESTED STUDENT ACTIVITIES

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

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

- Identify problems based on applications of differential equations and solve these problems.
- Prepare models to explain different concepts of applied mathematics.
- Prepare a seminar on any relevant topic based on applications of integration.
- Prepare a seminar on any relevant topic based on applications of Laplace transform to related engineering problems.

#### 11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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

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

#### 12. SUGGESTED MICRO-PROJECTS

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

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

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



- j. Prepare models using the concept of Laplace transform to solve initial value problem of first order and first degree.
- k. Prepare charts displaying various algebraic operations of complex numbers in complex plane

### 13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Higher Engineering Mathematics	Grewal, B.S.	Khanna publications, New Delhi , 2013 ISBN- 8174091955
2	Advanced Engineering Mathematics	Krezig, Ervin	Wiley Publications, New Delhi, 2016 ISBN:978-81-265-5423-2.
3	Advanced Engineering Mathematics	Das, H.K.	S. Chand Publications, New Delhi, 2008, ISBN-9788121903455
4	Engineering Mathematics, Volume 1 (4 <sup>th</sup> 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/](http://www.scilab.org/) - SCI Lab
- b. [www.mathworks.com/products/matlab/](http://www.mathworks.com/products/matlab/) - MATLAB
- c. Spreadsheet applications
- d. [www.dplot.com/](http://www.dplot.com/) - DPlot
- e. [www.allmathcad.com/](http://www.allmathcad.com/) - MathCAD
- f. [www.wolfram.com/mathematica/](http://www.wolfram.com/mathematica/) - Mathematica
- g. <http://fossee.in/>
- h. <https://www.khanacademy.org/math?gclid=CNqHuabCys4CFdOJaAoddHoPig>
- i. [www.easycalculation.com](http://www.easycalculation.com)
- j. [www.math-magic.com](http://www.math-magic.com)



**Program Name** : Electrical Engineering Program Group  
**Program Code** : EE/EP/EU/IE/IS  
**Semester** : Second  
**Course Title** : Applied Science (Physics & Chemistry)  
**Course Code** : 22211

**1. RATIONALE**

Diploma engineers (also called technologists) have to deal with various materials and machines. The study of concepts and principles of science like capacitance and current electricity, electromagnetic induction and alternating current, photo-sensors and LASER, water treatment and analysis, electrochemistry and batteries, metals, alloys, insulators and others will help them in understanding the engineering courses where emphasis is laid on the applications. This course is developed in the way by which fundamental information will help the diploma engineers to apply the concepts and principles of advanced science in various engineering applications to solve broad based problems.

**2. COMPETENCY**

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

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

**3. COURSE OUTCOMES (COs)**

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

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

**4. TEACHING AND EXAMINATION SCHEME**

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE Max	ESE Min	PA Max	PA Min	Total Max	Total Min	ESE Max	ESE Min	PA Max	PA Min	Total Max	Total Min
2	-	2	6	90	70*	28	15*	00	100	40	25@	10	25	10	50	20
2	-	2	6	90	70*	28	15*	00	100	40	25@	10	25	10	50	20

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



**Legends:** L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment  
**Note:** Practical of Chemistry and Physics will be conducted in alternate weeks for each batch.

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

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

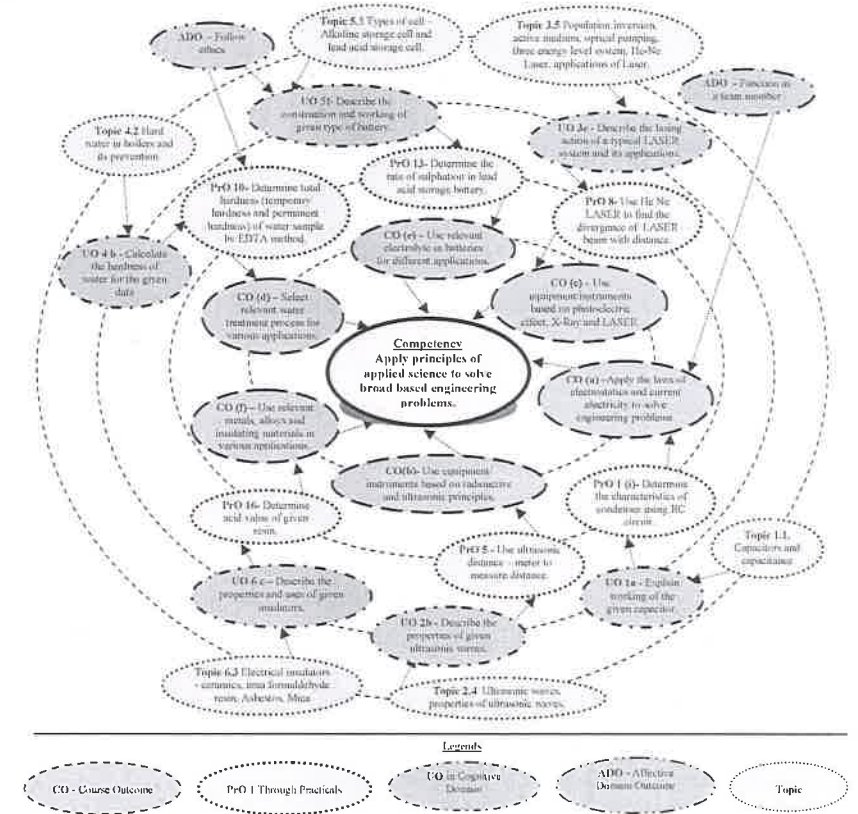


Figure 1 - Course Map

**6. SUGGESTED PRACTICALS / EXERCISES**

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

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

**Note**

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

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

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



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

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

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

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

- 'Valuing Level' in 1<sup>st</sup> year
- 'Organising Level' in 2<sup>nd</sup> year
- 'Characterising Level' in 3<sup>rd</sup> 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	Digital multimeter : 3½ digit display, 9999 counts digital multimeter measures: $V_{ac}$ , $V_{dc}$ (1000V max), $A_{dc}$ , $A_{ac}$ (10 amp max), Hz, Resistance (0 - 100 M $\Omega$ ), capacitance and Temperature	1,2,3,6,7
2	Micrometer screw gauge : Range : 0-25mm, Resolution: 0.01mm Accuracy: $\pm 0.02$ mm or better	2
3	Resistance Box: 4 decade ranges from 1 ohm to 1K $\Omega$ , accuracy:0.1%-1%	1,2,3,6,7
4	Battery eliminator : 0-12 V, 2A	1,2,3,6,7
5	Meter bridge, Galvanometer and Jockey	2
6	Potentiometer	3
7	Ultrasonic distance meter	5
8	Resonance tube, tuning fork	4
9	Daniel cell and Leclanche cell	2
10	LASER kit	8
11	Conductivity meter; conductivity range – 0.01 uS/cm to 200 mS/cm, Cell constant – digital 0.1 to 2.00; Temp. range – 0 to 100°C	11,12
12	Electronic balance, with the scale range of 0.001gm to 500gm pan size	All

S. No.	Equipment Name with Broad Specifications	Exp. S. No.
13	100 mm; response time 3-5 sec.; power requirement 90-250V, 10 watt Simple distillation unit	15

### 8. UNDERPINNING THEORY COMPONENTS

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

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
<b>Physics</b>		
<b>Unit – I Electricity and Capacitance</b>	1a. Explain working of the given capacitor. 1b. Calculate the equivalent capacity and energy stored in the given combination of capacitors 1c. Calculate the voltage in various components of the given electric circuit. 1d. Calculate the value of the given resistance using the principle of Wheatstone's bridge. 1e. Calculate the emf of the given cell using potentiometer.	1.1 Capacitors and capacitance. 1.2 Parallel plate capacitor, effect of dielectric on capacitance 1.3 Combination of capacitors, energy stored in a capacitor. 1.4 Cells, emf of cell, internal resistance of cell, Kirchhoff's laws, Wheatstone's bridge. 1.5 Potential gradient, potentiometer.
<b>Unit– II Radioactivity and Ultrasonic Waves</b>	2a. Describe the phenomenon of radioactivity for the given system. 2b. Calculate half-life period of given radioactive substance. 2c. Calculate the value of the period, frequency and velocity of the given type of wave. 2d. Describe the properties of given ultrasonic waves. 2e. Describe the properties of the given Piezo-electric material. 2f. Explain the production of ultrasonic waves using the given equipment. 2g. Describe the Doppler effect for the given application.	2.1 Radioactivity, $\alpha$ , $\beta$ and $\gamma$ particles/ rays and their properties. 2.2 Radioactive decay law, half-life period. 2.3 Sound waves, amplitude, frequency, time - period wave-length and velocity of wave, relation between velocity, frequency and time - period of wave. 2.4 Ultrasonic waves, properties of ultrasonic waves. 2.5 Piezo-electric effect. Piezo materials; Natural: Quartz, Synthetic: Gallium orthophosphate 2.6 Generation of ultrasonic waves using Piezo electric effect. 2.7 Applications of ultrasonic waves. 2.8 Doppler Effect and its applications.
<b>Unit– III Photo electricity,</b>	3a. Explain concept of photoelectric effect for the given materials. 3b. Explain the working of the given	3.1 Planck's hypothesis, properties of photons, photoelectric effect: threshold frequency, threshold

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
<b>X-Rays and LASERS</b>	photoelectric cell and LDR.  3c. Explain the production of X-Rays from given material with its properties and applications. 3d. Differentiate between LASER and given colour of light. 3e. Describe the lasing action of a typical LASER system and its applications.	wavelength, stopping potential, Work function, characteristics of photoelectric effect, Einstein's photoelectric equation. 3.2 Photoelectric cell and LDR: principle, working and applications. 3.3 Production of X-rays by Modern Coolidge tube, properties and applications of X-rays. 3.4 Laser, properties of laser, absorption, spontaneous and stimulated emission, 3.5 Population inversion, active medium, optical pumping, three energy level system, He-Ne Laser, applications of Laser.
<b>Chemistry</b>		
<b>Unit-IV Water treatment and analysis</b>	4a. Describe the hardness in given water source. 4b. Calculate the hardness of water for the given data. 4c. Describe the effects of hard water in the given boilers. 4d. Explain the given type of water softening process. 4e. Describe the purification of municipal water for the given process. 4f. Describe the reverse osmosis process for the given type of water. 4g. Describe the given process of desalination of water.	4.1 Hardness: Types of hardness, soap solution method, EDTA method. 4.2 Effect of hard water in boilers and prevention: Boiler corrosion, caustic embrittlement, priming and foaming, scales and sludges 4.3 Water softening: Lime soda process (hot lime soda and cold lime soda process), zeolite process, ion exchange process (cation exchange and anion exchange). 4.4 Municipal water treatment: Sedimentation, coagulation, filtration and sterilization. 4.5 Waste water: Characteristics, BOD and COD, Sewage treatment, recycling of waste water. 4.6 De-salination process by reverse osmosis.
<b>Unit–V Electroche mistry and Batteries</b>	5a. Differentiate the electrical conductance in given metals and electrolytes. 5b. Identify factors affecting conductivity of the given solution. 5c. Describe construction of given	5.1 Electrical conductance in metals and electrolytes, specific conductance, equivalent conductance, cell constant. 5.2 Conductance: Nature of solute, nature of solvent, temperature, concentration or dilution.





Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	electrodes. 5d. Describe the process for calculation of the strength of given acid and base. 5e. Calculate specific and equivalent conductance of given electrolyte. 5f. Describe construction and working of given type of battery.	5.3 Electrodes: Hydrogen electrode, calomel electrode and glass electrode 5.4 Conductometric Titration: 5.5 Batteries- Dry cell, alkaline battery, lead Acid storage cell and Ni-Cd battery, H <sub>2</sub> -O <sub>2</sub> fuel cell, Lithium ion battery.
<b>Unit-VI Metals, Alloys and Insulators</b>	6a. Describe the properties of the given metal. 6b. Select relevant thermocouple alloy for given application. 6c. Describe the properties and uses of the given insulators. 6d. Select relevant insulator for given system. 6e. Describe given techniques of unit operation.	6.1 Properties of metals like copper, Aluminium, tungsten, platinum nickel. 6.2 Thermocouple alloy: Composition and characteristics of nickel alloy, platinum/rhodium, tungsten/rhenium, chromel-gold/iron. 6.3 Electrical insulators: Classification, Solid - ceramics, mica, asbestos, urea formaldehyde resin and glass. Liquid-silicon fluid, Gaseous-inert gases, hydrogen and nitrogen gas. 6.4 Types of rubber : Natural and, synthetic, processing of natural rubber. Synthetic rubber : Properties and applications of Buna-N, Thiokol, Neoprene. 6.5 Process industry unit operations: Evaporation, condensation, Distillation, Energy balance and mass balance for above processes. 6.6 Nanomaterials: Applications of Fullerenes, Graphene

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'.

#### 10. 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
<b>Physics</b>						
I	Capacitance and current electricity	8	02	03	04	09
II	Radioactivity and ultrasonic waves	12	03	04	07	14
III	Photo-electricity, X-rays and LASER	12	03	04	05	12
<b>Chemistry</b>						
IV	Water treatment and analysis	12	02	04	06	12



Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
V	Electrochemistry and Batteries.	12	03	05	06	14
VI	Metals, Alloys, Insulators.	08	02	02	05	09
<b>Total</b>		<b>64</b>	<b>15</b>	<b>22</b>	<b>33</b>	<b>70</b>

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.

#### 11. SUGGESTED STUDENT ACTIVITIES

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

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

#### 12. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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

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

#### 13. 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:

- Capacitors:** Prepare the models of various types of capacitors.

- b. **Current electricity:** Make one circuit with bulbs/ LED/ connected in parallel or series.
- c. **Photosensors:** Prepare working model of simple photosensor using LED.
- d. **LASER:** Prepare the presentation on the industrial application of LASER.
- e. **Water analysis:** Collect water samples from different water sources and determine the acidity, conductivity, dissolved solids, suspended particles in the sample.
- f. **Water treatment:** Collect 3 to 5 water samples from borewell and determine the dosage of bleaching powder required for its sterilization.
- g. **Water analysis:** Determine the soap foaming capacity of bore water on addition of soda ash.
- h. **Energy sources:** Prepare chart showing different types of energy sources with their advantages.
- i. **Electrolytic Cells:** Collect fruit and vegetable and prepare working model of cell.
- j. **Electric Insulators:** Collect the samples of different insulators and list their industrial applications.
- k. **Thermocouple:** Prepare chart showing different types of thermocouples with their characteristics used in electronic and electrical industry.

- b. <http://nptel.ac.in/course.php?disciplineId=104>
- c. <http://hyperphysics.phy-astr.gsu.edu/hbase/hph.html>
- d. [www.physicsclassroom.com](http://www.physicsclassroom.com)
- e. [www.physics.org](http://www.physics.org)
- f. [www.fearofphysics.com](http://www.fearofphysics.com)
- g. [www.sciencejoywagon.com/physicszone](http://www.sciencejoywagon.com/physicszone)
- h. [www.chemistryteaching.com](http://www.chemistryteaching.com)
- i. [www.visionlearning.com](http://www.visionlearning.com)
- j. [www.chem1.com](http://www.chem1.com)
- k. [www.onlinelibrary.wiley.com](http://www.onlinelibrary.wiley.com)
- l. [www.rsc.org](http://www.rsc.org)
- m. [www.chemcollective.org](http://www.chemcollective.org)
- n. [www.wqa.org](http://www.wqa.org)
- o. [www.cm-ca.org](http://www.cm-ca.org)

#### 14. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Physics Textbook Part I - Class XI	Narlikar, J. V.; Joshi, A. W.; Mathur, Anuradha; <i>et al</i>	National Council of Education Research and Training, New Delhi, 2010. ISBN : 8174505083
2	Physics Textbook Part II - Class XI	Narlikar, J. V.; Joshi, A. W.; Mathur, Anuradha; <i>et al</i>	National Council of Education Research and Training, New Delhi, 2015. ISBN : 8174505660
3	Physics Textbook Part I - Class XII	Narlikar, J.V.; Joshi, A. W.; <i>et al</i>	National Council of Education Research and Training, New Delhi, 2013. ISBN : 8174506314
4	Physics Textbook Part II - Class XII	Narlikar, J.V.; Joshi, A. W.; <i>et al</i>	National Council of Education Research and Training, New Delhi, 2013. ISBN : 8174506713
5	Engineering Chemistry	Agarwal, Shikha	Cambridge university press ; New Delhi, 2015 ISBN : 9781107476417
6	Engineering Chemistry	Dara, S. S.	S.Chand. Publication, New Delhi, 2013, ISBN: 8121997658
7	Engineering Chemistry	Jain & Jain	Dhanpat Rai and sons; New Delhi, 2015, ISBN : 9352160002
8	Engineering Chemistry	Dr. Vairam, S.	Wiley India Pvt.Ltd. New Delhi, 2013 ISBN: 9788126543342
9	Chemistry for engineers	Agnihotri, Rajesh	Wiley India Pvt.Ltd. New Delhi, 2014 ISBN: 9788126550784

#### 15. SOFTWARE/LEARNING WEBSITES

- a. <http://nptel.ac.in/course.php?disciplineId=115>





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

### 1. RATIONALE

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

### 2. COMPETENCY

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

- Use electrical equipment in industrial applications.

### 3. COURSE OUTCOMES (COs)

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

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

### 4. TEACHING AND EXAMINATION SCHEME

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

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

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

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

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

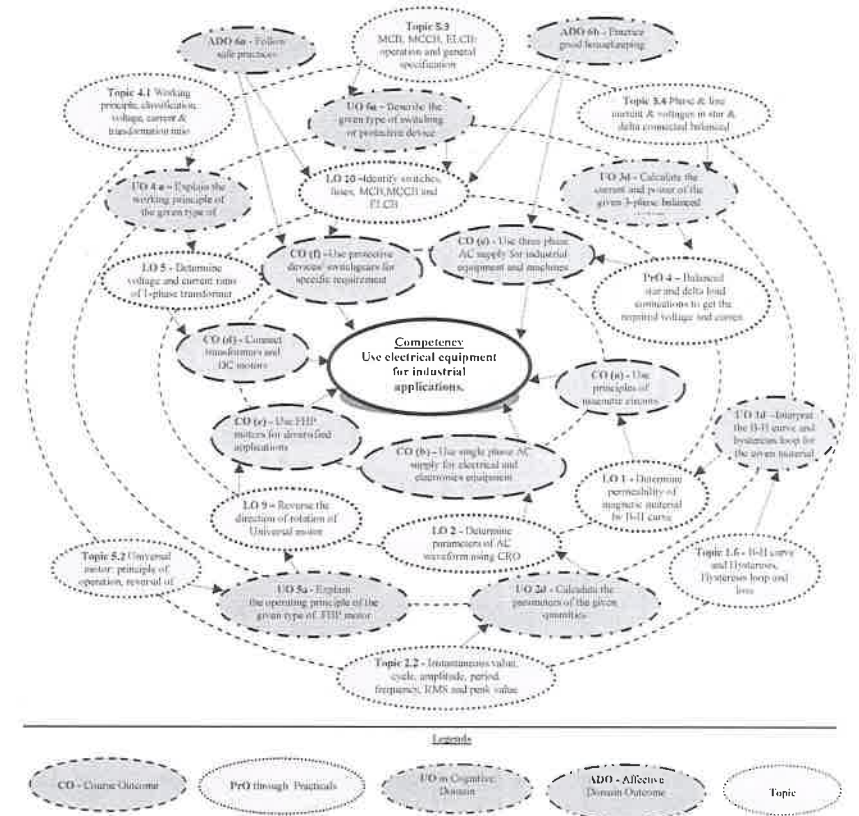


Figure 1 - Course Map

### 6. SUGGESTED PRACTICALS/ EXERCISES

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

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



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

**Note**

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

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



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

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

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

- 'Valuing Level' in 1<sup>st</sup> year.
- 'Organising Level' in 2<sup>nd</sup> year.
- 'Characterising Level' in 3<sup>rd</sup> year.

**7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED**

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

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

**8. UNDERPINNING THEORY COMPONENTS**

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

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
<b>Unit – I Magnetic Circuits</b>	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.
<b>Unit– II AC Fundamentals</b>	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
<b>Unit– III Polyphase AC Circuits</b>	3a. Describe the salient features of the given type of AC power supply. 3b. Explain the concept of symmetrical system and phase sequence of the given AC supply. 3c. Distinguish the characteristics of the given type(s) of star (or delta) connections with sketches. 3d. Calculate the current and power of the given three phase	3.1 3 phase system over 1 phase system 3.2 3-phase emf generation and its wave form 3.3 Phase sequence and balanced and unbalanced load 3.4 Phase and line current, phase and line voltage in star connected and delta connected balanced system 3.5 Current, power, power factor in a 3 phase balanced system 3.6 Star and delta connections

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	balanced system.	
<b>Unit-IV Transformer and DC Motors</b>	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
<b>Unit –V Fractional Horse Power (FHP) Motors</b>	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
<b>Unit-VI Protective Devices and Switchgear</b>	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
<b>Total</b>		<b>64</b>	<b>16</b>	<b>24</b>	<b>30</b>	<b>70</b>

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

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

## 10. SUGGESTED STUDENT ACTIVITIES

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

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

## 11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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

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

## 12. SUGGESTED MICRO-PROJECTS

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

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

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



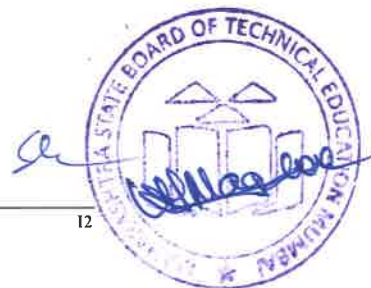
- iii. Different protective and safety devices used
  - iv. Maintenance
- h. Each batch will select any one electrical device/equipment which is not included in the curriculum and prepare a short power point presentation for the class based on the following points: construction, working, salient features,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

### 13. SUGGESTED LEARNING RESOURCES

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

### 14. SOFTWARE/LEARNING WEBSITES

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







**Program Name** : Diploma in Electronics Program Group  
**Program Code** : DE/EE/EJ/IE/IS/MU  
**Semester** : Second  
**Course Title** : Basic Electronics  
**Course Code** : 22216

**1. RATIONALE**

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

**2. COMPETENCY**

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

- Maintain electronic circuits comprising of discrete electronic components.

**3. COURSE OUTCOMES (COs)**

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

- Use relevant diode in different electronics circuits,
- Maintain rectifiers comprising of diodes,
- Use BJT in electronics circuits.
- Use FET in electronics circuits.
- Maintain DC regulated power supply.

**4. TEACHING AND EXAMINATION SCHEME**

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				ESE		PA		Total		ESE		PA		Total		
				Paper 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 cognitive domain UOs required for the attainment of the COs.

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

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

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

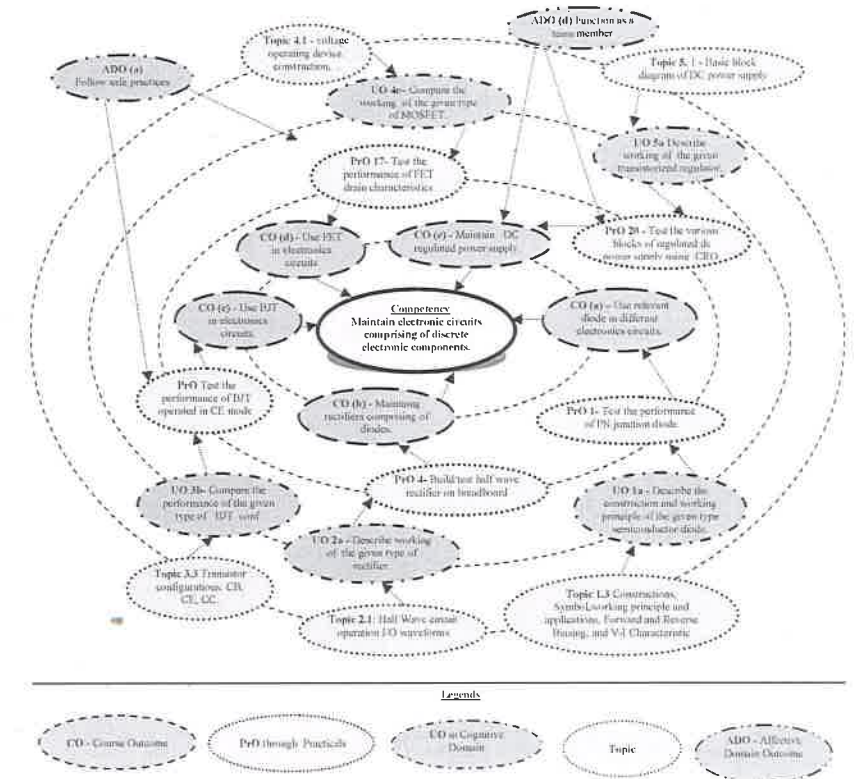
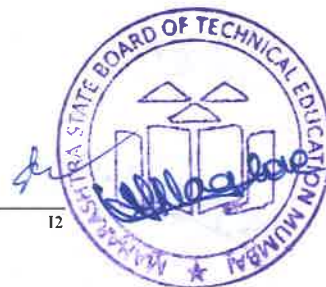


Figure 1 - Course Map

**6. SUGGESTED PRACTICALS/ EXERCISES**

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

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



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

**Note**

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

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

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

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

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

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

- 'Valuing Level' in 1<sup>st</sup> year.
- 'Organising Level' in 2<sup>nd</sup> year.
- 'Characterising Level' in 3<sup>rd</sup> year.

**7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED**

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

S. No.	Equipment Name with Broad Specifications	Exp. S. No.
1	Variable DC power supply 0- 30V, 2A, SC protection, display for voltage and current.	1,2,3,9,10, 12,13,15, 16,17,18, 19,20,21
2	Cathode Ray Oscilloscope Dual Trace 20Mhz, 1Mega $\Omega$ Input Impedance	4,5,6,7,8,9,10,11,12, 13,14, 22
	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
	Digital Multimeter : 3 1/2 digit display, 9999 coun:s digital	All

S. No.	Equipment Name with Broad Specifications	Exp. S. No.
	multimeter measures: $V_{ac}$ , $V_{dc}$ (1000V max), $A_{dc}$ , $A_{ac}$ (10 amp max), Resistance (0 - 100 M $\Omega$ ), 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
<b>Unit – I Semiconductor Diode</b>	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
<b>Unit– II Applications of diodes</b>	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 $\pi$ filter, bleeder resistor 2.4 Clipper and Clamper circuits
<b>Unit– III Bipolar Junction Transistor</b>	3a. Describe the working principle of the given type of transistor. 3b. Compare the performance of the given type of transistor configurations. 3c. Justify the biasing method for the given circuit.	3.1 Current operating device 3.2 Different types of transistors: PNP, NPN 3.3 Transistor configurations: CB, CE, CC. Transistor characteristics (input, output,) in different transistor configurations

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	3d. Describe the procedure to minimize the thermal runaway effect for the given type of transistor biasing circuit.	3.4 BJT biasing: DC load line, operating point, stabilization, thermal runaway, types of biasing, fixed biasing, base bias with emitter feedback, voltage divider
<b>Unit– IV Field Effect Transistor</b>	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
<b>Unit– V Regulators and power supply</b>	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
<b>Total</b>		<b>64</b>	<b>14</b>	<b>24</b>	<b>32</b>	<b>70</b>

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



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

### 10. SUGGESTED STUDENT ACTIVITIES

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

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

### 11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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

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

### 12. SUGGESTED MICRO-PROJECTS

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

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

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

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

### 13. SUGGESTED LEARNING RESOURCES

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

### 14. SOFTWARE/LEARNING WEBSITES

- [www.nptel.iitm.ac.in](http://www.nptel.iitm.ac.in)
- [www.datasheetcafe.com](http://www.datasheetcafe.com)
- [www.williamson-labs.com](http://www.williamson-labs.com)
- [www.futurlec.com](http://www.futurlec.com)
- [www.bis.org.in](http://www.bis.org.in)
- [www.learnerstv.com](http://www.learnerstv.com)
- [www.cadsoft.io](http://www.cadsoft.io)
- [www.khanacademy.com](http://www.khanacademy.com)



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

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

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

**Semester :** Second

**Course Title :** Business Communication Using Computers

**Course Code :** 22009

**1. RATIONALE**

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

**2. COMPETENCY**

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

- Communicate effectively and skillfully at workplace.

**3. COURSE OUTCOMES (COs)**

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

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

**4. TEACHING AND EXAMINATION SCHEME**

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

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

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

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

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

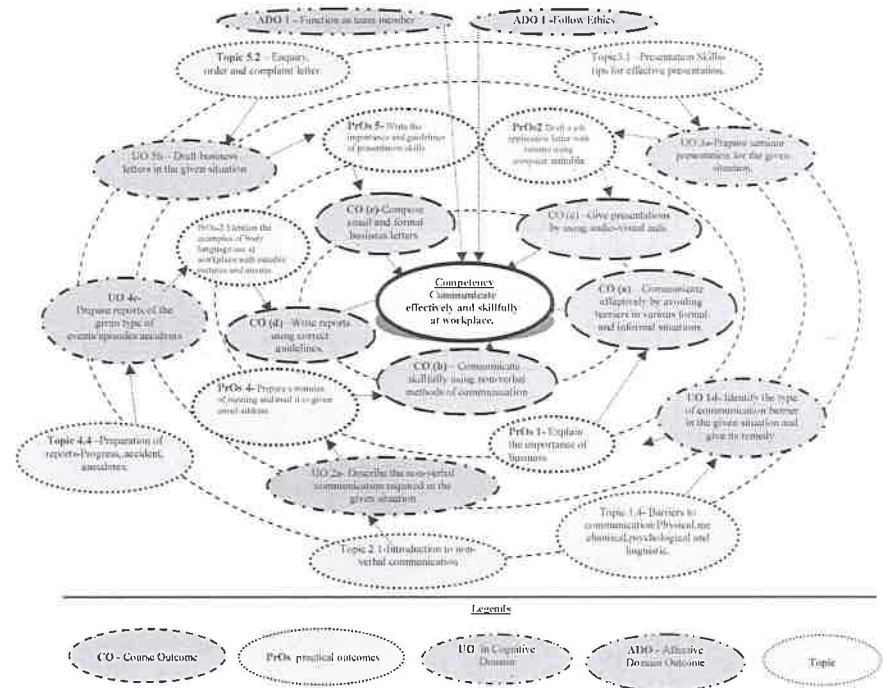


Figure 1 - Course Map

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

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

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



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

**Note**

- i. A suggestive list of practical LOs is given in the above table, more such practical LOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical LOs/tutorials need to be performed, out of which, the practicals marked as '\*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry. The size of batch for the practical should not exceed more than 21 students strictly for the maximum attainment of COs and PrOs.
- ii. Hence, the 'Process' and 'Product' related skills associated with each LO of the laboratory/workshop/field work are to be assessed according to a suggested sample given below:

**7. MAJOR EQUIPMENTS / INSTRUMENTS REQUIRED**

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

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

**8. UNDERPINNING THEORY COMPONENTS**

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

Unit	Unit Outcomes (UOs) (in cognitive domain)		Topics and Sub-topics
	Writing Skills	Speaking Skills	
<b>Unit – I Introducti on to Business Communication</b>	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.
<b>Unit– II Non- Verbal Communic ation</b>	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.
<b>Unit– III Presentatio n skills</b>	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	
<b>Unit-IV Office Drafting</b>	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.
<b>Unit-V Business Correspondence</b>	5a. Respond to given job advertisements by writing your CV/ Resume. 5b. Draft business letters in the given situations. 5c. Draft complaint letters for the given situations. 5d. Compose E- mails with relevant for the given situation.		5.1 Business correspondence. 5.2 Enquiry, order and complaint letters. 5.3 E-mails- netiquettes. 5.4 Difference –Curriculum Vitae, Bio-data and Resume. 5.5 Job application and resume writing

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

**9. SUGGESTED SPECIFICATION TABLE FOR INTERNAL END SEMESTER EXAMINATION**

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

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

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

Weightage (20 Marks)	Weightage (15 Marks)	Total
<b>A</b>	<b>B</b>	
<b>Assessment based on PrOs, practicals conducted during semester Based on computer and written skill. (Minimum four questions each five marks)</b> <b>Sample questions:</b> <b>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)</b>  <b>Eg. II Write job application with resume. ( written )</b>	<b>Oral examination based on UOs Topics mentioned in syllabus. (Minimum five questions each two marks to be asked )</b> <b>Eg. I Explain the importance of communication in professional life.</b> <b>II. State any four guidelines of presentation skills.</b>	<b>(35 Marks)</b> <b>A+B</b>  <b>Duration: 2 hours</b>

**SUGGESTED STUDENT ACTIVITIES**

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

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

**11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)**

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

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





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

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

- <https://www.britishcouncil.in/english/learn-online>
- <http://learnenglish.britishcouncil.org/en/content>
- <http://www.talkenglish.com/>
- [language-labsystem.com](http://www.language-labsystem.com)
- [www.wordsworthelt.com](http://www.wordsworthelt.com)
- [www.notesdesk.com](http://www.notesdesk.com)
- <http://www.tutorialspoint.com>
- [www.studylecturenotes.com](http://www.studylecturenotes.com)
- [totalcommunicator.com](http://www.totalcommunicator.com)
- [www.speaking-tips.com](http://www.speaking-tips.com)



**Program Name** : Diploma in Industrial Electronics / Diploma in Medical Electronics  
**Program Code** : IE / MU  
**Semester** : Second  
**Course Title** : Programming in 'C'  
**Course Code** : 22020

**1. RATIONALE**

The electrical and electronics related specialised branches deal with microcontrollers and embedded systems, in many applications. To interface with such devices, knowledge of programming language is required. The 'C' language is very helpful to develop and enhance skills of programming. 'C' is used to develop device drivers, operating systems, system software and applications. This course will enable students to learn developing programming logic as well as debug, compile and execute 'C' program on different operating systems.

**2. COMPETENCY**

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

- Develop 'C' programs to solve engineering 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:

- Write simple 'C' programs using arithmetic expressions.
- Use control structures in 'C' program.
- Develop 'C' programs using array.
- Develop 'C' programs using functions for modular programming approach.
- Develop 'C' programs using structure and union.
- Create graphics employing 'C' functions.

**4. TEACHING AND EXAMINATION SCHEME**

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

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

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

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

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

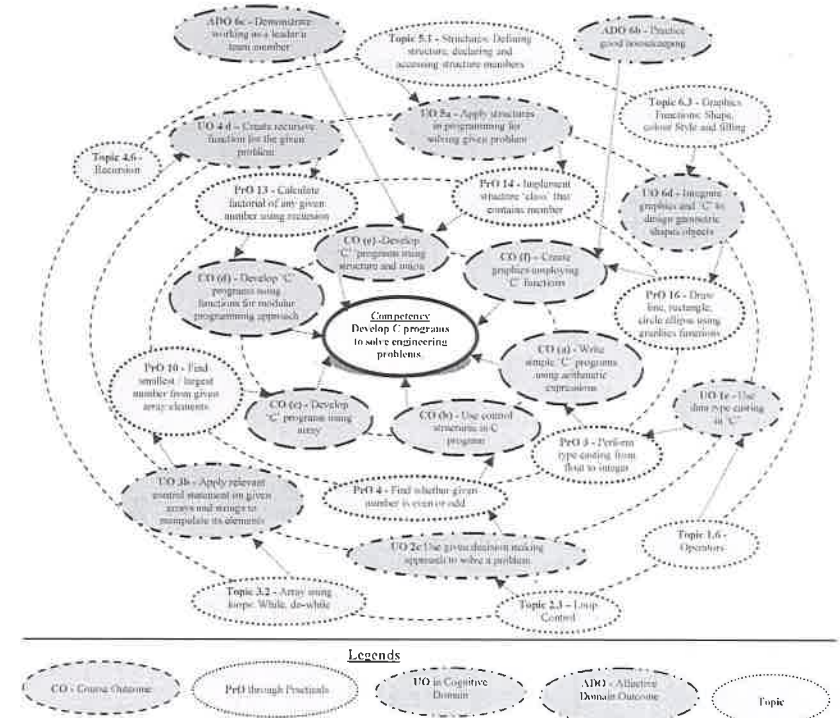


Figure 1 - Course Map

**6. SUGGESTED PRACTICALS/ EXERCISES**

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

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
Construct flowchart, algorithm and develop a 'C' program to do the following:			
1	a. Display "Hello World" on computer screen. b. Display your name, address and college name on screen.	1	02*
2	a. Display square, cube of given number on computer screen. b. Calculate area of triangle, square and circle	1	02
3	a. Perform type casting from float to integer. b. Demonstrate use of format specifiers.	1	02



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
4	a. Find whether given number is even or odd. b. Find greatest and smallest of 3 numbers.	II	02*
5	a. Convert a given decimal number to binary and hexadecimal number. b. Convert a binary number to decimal number.	II	02
6	Display pass class, second class, first class, distinction according to the marks entered using switch case.	II	02
7	Display menu to perform- <ul style="list-style-type: none"> <li>• Addition</li> <li>• Subtraction</li> <li>• Multiplication</li> <li>• Division and</li> </ul> Based on user's choice execute it using switch case.	II	02
8	a. Display Fibonacci series of length 5. b. Display following pattern 1 2 2 3 3 3 4 4 4 4	II	02
9	a. Print ASCII tables of alphabets (use continue statements). b. Print prime numbers from 1 to 100 (use break statement).	II	02
10	a. Find smallest / largest number from given array elements. b. Find sum of first 10 elements of array.	III	02*
11	a. Enter elements for 3X3 matrix and display them. b. Calculate addition and subtraction of 2 dimensional matrix.	III	02
12	a. Calculate length of String "Digital India". b. Replace word 'Digital' from above string with 'Incredible'. c. Concatenate "Incredible India" and "Campaign" as a one string d. Check if given string is palindrome or not.	III	02
13	a. Calculate area of circle, triangle and rectangle using function. b. Calculate factorial of any given number using recursion.	IV	02*
14	Implement a structure named 'class' that contains following member variables: Roll No, Name, Marks of three subjects Read the information from keyboard calculate percentage of total marks and print Roll No, Name, Marks of three subjects and percentage marks on screen.	V	02*
15	Implement union 'Book' that contains following member variables: Book title, Author's name, Book price Read the information from keyboard and print same on screen	V	02
16	Draw line, rectangle, circle and ellipse using graphics functions.	VI	02*
17	Draw a smiley using graphics functions.	VI	02
<b>Total</b>			<b>34</b>

**Note**

i. A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be



performed, out of which, the practicals marked as '\*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.  
ii. The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Ability to prepare flowchart	20
2	Ability to develop algorithm	20
3	Compile, debug and run 'C' programs	40
5	Answer to oral questions	10
6	Submission of program print-out in time	10
<b>Total</b>		<b>100</b>

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 1<sup>st</sup> year.
- 'Organizing Level' in 2<sup>nd</sup> year.
- 'Characterizing Level' in 3<sup>rd</sup> year.

**7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED**

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

S. No.	Equipment Name with Broad Specifications	Exp. S. No.
1	Desktop computer with optimum configuration	A.1
2	'C' compiler	

### 8. UNDERPINNING THEORY COMPONENTS

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

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
<b>Unit – I Fundamentals of 'C'</b>	1a. Interpret working of the given system software in the execution of 'C' program. 1b. Explain the feature of the given data types in 'C'. 1c. Explain use of the given operators in 'C' with example. 1d. Describe the given formatting procedure in 'C'. 1e. Describe the use of the given data type casting in 'C' with example.	1.1 Applications and functions of system software: Assembler, compiler, interpreter, debugger, linker 1.2 Basic concepts of 'C': Evolution, building components of C, Features, advantages, structure of 'C' program 1.3 Constants, variables and data types, character set, keywords, constants, variables, declaration initializations and assigning values of variables, data type and their size, formatting characters 1.4 Operators (arithmetic, Logical, assignment, relational, increment and decrement, conditional, bit wise, special operators), operator precedence, expressions, formatted input and output, type conversion
<b>Unit– II Loops in C- Decision Making</b>	2a. Describe the procedure to construct flowcharts for given problem. 2b. Describe the procedure to develop algorithm for the given problem. 2c. Use given decision making approach to solve a problem. 2d. Explain the procedure of using the given loop statement with examples.	2.1 Fundamentals of algorithm and flowcharts 2.2 Decision making and branching: If statement (if, if-else, if-else-if ladder, nested if-else), switch statement 2.3 Loop Control: Loop concepts, use of loops, pre test and post test loops, while, do-while and for loops, nested loops, break and continue statement
<b>Unit– III Arrays and Strings</b>	3a. Write statements to read, write the given array. 3b. Apply relevant control statement on the given arrays and strings to manipulate its elements. 3c. Explain use of numerical arrays in the given mathematical application with examples. 3d. Describe the procedure for string operations in 'C' for the given data.	3.1 Arrays: declaration, initialization of one dimensional, two dimensional arrays, size of array, memory allocation of array 3.2 Array operations using control structures: while, do-while and for 3.3 Multi dimensional array 3.4 Declaration and initialization of string variables.
<b>Unit-IV Functions</b>	4a. Use the given built-in C function. 4b. Develop relevant user defined functions for the given problem.	4.1 Concept of Functions, benefits of using functions, Built in functions from C library: Math.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	4c. Write program to pass the given function parameters using "call by value" and "call by reference" approach. 4d. Create recursive function for the given problem.	character/string, miscellaneous functions 4.2 User defined Function, Function declaration, definition and call 4.3 Return values and their types, function with return values 4.4 Internal and external variables, scope and lifetime of variables 4.5 Function call, passing arguments to functions (call by value, call by reference) 4.6 Recursion
<b>Unit –V Structure and Union</b>	5a. Apply structures in programming for solving the given problem. 5b. Differentiate the given structure and union with examples. 5c. Apply union to solve the given problem. 5d. Explain the memory utilization by member variables in the given structures/Union.	5.1 Structures: Defining structure, declaring and accessing structure members, initialization of structure 5.2 Arrays of structure 5.3 Union: Definition of union, declaring and accessing union members, difference between structure and union
<b>Unit-VI Graphics in C</b>	6a. Explain the given graphics component in 'C' with examples. 6b. Describe the use of the given graphics driver in C programming. 6c. Describe the use of the given in-built graphics functions in 'C'. 6d. Integrate graphics and 'C' to design the given geometric shapes/objects.	6.1 Computer graphics overview 6.2 Graphics drivers and graphics mode definition, declaration 6.3 Graphics functions: Shape, colour, style and filling

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

### 9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

-Not applicable -

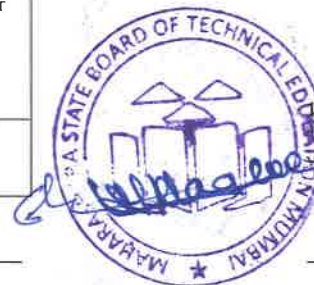
### 10. SUGGESTED STUDENT ACTIVITIES

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

- List any five major scientific and medical applications based on 'C' programming.
- List any five major commercial applications based on 'C' programming.
- Illustrate various languages based on the concepts of 'C'.

### SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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



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

## 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:

- Modern Periodic Table using 'C'** - Prepare a periodic table using functions: Void add() and Void show()
- Simple Calculator** - Prepare a menu driven program to perform any five mathematical operations.
- Employee Record System** - Prepare a menu driven program to perform following operations :
  - Add record
  - List record
- Digital clock using 'C'**
- String Manipulation project** - Prepare a menu driven program to perform following operations (any five) :
  - Substrings
  - Palindromes
  - Comparison
  - Reverse string
  - String to integer
  - Sort a string.
- Matrix Operations** - Prepare a menu driven program to perform following operations:

- Matrix addition
  - Matrix multiplication
  - Matrix transpose
  - Sum of diagonal of a matrix.
- g. **Basic mathematic functions** - Prepare a menu driven program to perform following operations:
- Pascal triangle
  - Armstrong No.
  - Floyd's triangle
  - HCF and LCM.
- h. **Patterns** - Prepare a menu driven program to obtain following patterns :

```

      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 Mc-Graw Hill, New Delhi 2008, ISBN: 978-0070648227
2	Let Us 'C'	Kanetkar, Yashwant P.	BPB Publications 13 <sup>th</sup> Edition. 2016, ISBN: 978-8183331630
3	Programming in 'C': A Practical Approach	Mittal, Ajay	Pearson Education India, New Delhi. 2010, ISBN: 978-8131729342
4	Programming with 'C' (Schaum's Outlines Series)	Gottfried, Byron; Chhabra Jitender	McGraw Hill Education, 2010, ISBN: 978-0070145900
5	'C' Programming Absolute Beginner's Guide	Perry Greg	Pearson Education, 1 <sup>st</sup> edition, 2014, ISBN: 978-9332539570
6	'C': The Complete Reference	Schildt, Herbert	Tata Mc-Graw Hill, New York 2000, ISBN: 978-00072121247

## 14. SOFTWARE/LEARNING WEBSITES

- Turbo C Editor
- Dosbox
- [www.tutorialspoint.com/cprogramming](http://www.tutorialspoint.com/cprogramming)
- [www.cprogramming.com](http://www.cprogramming.com)
- [www.programiz.com/c-programming](http://www.programiz.com/c-programming)
- [www.w3schools.in/c-tutorial](http://www.w3schools.in/c-tutorial)
- [www.fresh2refresh.com/c-programming](http://www.fresh2refresh.com/c-programming)
- [www.programming-techniques.com](http://www.programming-techniques.com)
- [www.learn-c.org](http://www.learn-c.org)
- [www.spoken-tutorial.org](http://www.spoken-tutorial.org)
- [www.cplusplus.com](http://www.cplusplus.com)
- [www.computer.howstuffworks.com/c.htm](http://www.computer.howstuffworks.com/c.htm)
- [www.indiastudycenter.com/studyguides/cs/default.asp](http://www.indiastudycenter.com/studyguides/cs/default.asp)

