COURSE TITLE **BASIC MATHEMATICS(BMT)**

COURSE CODE **6G101**

Diploma Programme in which this course is offered	Semester in which offered
Electrical Engineering	First Semester

1 RATIONALE

This course is classified under foundation level courses and intends to teach students basic facts, concepts and principles of mathematics, as a tool to analise engineering problems. Diploma engineers have to solve the problems in engineering.
Basic mathematics is an attempt to initiate the multi-dimensional logical thinking and reasoning capabilities of the students.

2 COMPETENCY

At the end of studying this course students will be able to
"**Solve engineering problems by using analytical and systematic approach.**"

3 COURSE OUTCOMES

Students will be able to

Apply rules of Logarithms in solving simple engineering problems
1. Solve simultaneous equations using concepts of Determinants and Matrices
2. Solve simple engineering problems using concepts of Partial Fractions
3. Solve simple engineering problems by applying formulae of trigonometry.
4. Solve simple engineering problem of function using the different definition of Function
5. Solve simple engineering problem of function using the rules of Limits.

4 TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PT	ESE	PA	
03	01	--	04	80	20	--	--	100
Exam Duration				03 Hrs.	01 Hr.			

Legends: L-Lecture; **T** – Tutorial/Teacher Guided Theory Practice(batch-wise); **P** - Practical; **C** – Credit, **ESE** - End Semester Examination; **PT** - Progressive Test; OR-Oral examination

5 COURSE DETAILS:-

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit I Revision	1a.To recall/know the basic concept of Logarithms and Determinant of order 2and3	1.1 Logarithms 1.2 Definition natural and common logarithms. 1.3 Laws of logarithm . 1.4 Definition of Determinant, Order of Determinant. 1.5 Expansion of Determinant of order 2 and 3. 1.6 Properties of Determinant.
Unit II Determinant And Matrices	2a.Students will be able to Solve simultaneous equations using concepts of Determinants and Matrices	2.1 Cramer's Rule. (solution of simultaneous equations in two and three unknowns) 2.1 Definition of matrix: Type of matrix: viz.- null, row, column, Square, diagonal, scalar, unit, Triangular. 2.2 Algebra of matrices –addition, subtraction and multiplication . 2.3 Transpose of a matrix. 2.4 adjoint of a matrix Relation. 2.5 Inverse of matrix by adjoint method. 2.6 Solution of simultaneous equations in two and three Unknowns using Inverse of matrix method .
Unit III Partial Fractions	3a.Students will be able to solve simple problems Using concepts of Partial Fractions	3.1 Definition of Partial fraction, proper and improper fractions, rational fractions. 3.2 To resolve given rational fraction into partial fractions. 3.3 Denominator containing non repeated linear factors. 3.4 Denominator containing repeated linear factors. 3.5 Denominator containing irreducible non-repeated quadratic factors.

		3.6 Different types of examples.
Unit IV Trigonometry	4a.Students will be able to Solve simple problems by applying using concepts of trigonometry.	4.1 Trigonometric ratios of allied, compound and multiple angles. 4.2 Trigonometric Ratios of allied angles. 4.3 Trigonometric Ratios of compound angles. 4.4 Trigonometric Ratios of multiple angle Product, sum and difference formulae. 4.5 Sub-multiple angles. 4.6 Definition of inverse trigonometric, ratios. 4.7 Principal value of inverse trigonometric ratios. Relation between inverse trigonometric ratios. 4.8 Examples on inverse circular functions.
Unit V Function	5a.Students will be able to Solve the problem of function using the concept of Function	5.1 Cartesian products of sets. 5.2 Definition of relation, definition of function, real value. Function, domain, co-domain of a function. 5.3 Types of Functions. 5.4 Value of the function at given point . 5.5 Composite function. 5.6 Different types of examples on functions .
Unit VI Limits	6a. Students will be able to Solve the problem of function using the concept of Limit	6.1Definition and concept of limit, limits of algebraic functions. 6.2 Limits of trigonometric functions. 6.3 Limits of exponential functions. 6.4 Limits of logarithmic functions.

6. SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Revision	02	0	0	0	0
2	Determinants and Matrices	12	04	08	12	24
3	Partial Fractions	06		04	04	08
4	Trigonometry	14	04	08	12	24
5	Function	04	02	02	04	08
6	Limits	10	04	04	08	16
	TOTAL	**48**	**14**	**26**	**40**	**80**

Legends: R = Remembrance; U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

7 SUGGESTED EXERCISES/PRACTICAL/TUTORIAL

1) The tutorial/practical/exercises should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills so that students are able to acquire the competencies.

2) Form a batch of 20 students and at least 10 problems should be given to get necessary exercise.

Sr. No.	**Title/Topic**	**Exercises/Tutorial**	Approx. hours
1	Determinants and Matrices	Solving problems on cramer's rule Examples on Matrix Addition/Subtraction and Product Co-factors, Ad joint and Inverse of Matrix Solution of Simultaneous Equation using 3X3 Matrix and its Applications	02 02 02

2	Partial Fractions	Examples related Definition and cases	02
3	Trigonometry	Practice Examples: Allied & Compound Angles. Examples related inverse trigonometric ratios	04
4	Function	Examples related Definition and Rules.	02
5	Limits	Examples related to different types of function.	02

8. SUGGESTED STUDENT ACTIVITIES

--------N.A.-----

9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

1 Chalk-board method.
2 Projector method.
3 Tutorial method.

10. SUGGESTED LEARNING RESOURCES

Sr. No.	**Title of Book**	**Author**	**Publication**
1	Mathematics for polytechnic students for first year	S.P.Deshpande	Pune vidhyarti gruh prakshan Pune
2	Mathematics for polytechnic students for first year	G.V.Kumbhojkar	Phadke prakashan Kholapur
3	Mathematics for polytechnics	TTTI Bhopal	TTTI Bhopal

11 Major Equipment/ Instrument with Broad Specifications

Sr.NO.	Name of the Equipment	Specification
	NA	

12. Software/Learning Websites

POs and PSOs assignment and its strength of assignment with each CO of the Course

CO. NO.	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS01	PSO2	PSO3
CO1	To able the basic concept of Logarithms and Determinant of order 2 and 3	1	1	0	0	0	0	0	0	0	0	-	-	-
CO2	Students will be able to Solve simultaneous equations using concepts of Determinants and Matrices	3	1	1	0	0	0	0	0	0	0	-	-	-
CO3	Students will be able to solve simple problems Using concepts of Partial Fractions	1	1	1	0	0	0	0	0	0	0	-	-	-
CO4	Students will be able to Solve simple problems by applying using concepts of trigonometry.	3	2	1	0	0	0	0	0	0	0	-	-	-
CO5	Students will be able to Solve the problem of function using the concept of Function	1	1	0	0	0	0	0	0	0	0	-	-	-
CO6	Students will be able to Solve the problem of function using the concept of Limits	1	3	0	0	0	0	0	0	0	0	-	-	-

13. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Sr. No	Name of the faculty member	Designation and Institute
1	Mr. M.A. Ali	Lecturer in Mathematics, Government Polytechnic Aurangabad
2	Mr. R.B. Borulkar	Lecturer in Mathematics, Government Polytechnic Aurangabad
3	Mrs. H.H. Bhumkar	Lecturer in Mathematics, Government Polytechnic Aurangabad

Member Secretary PBOS Chairman PBOS Co-coordinator science and Humanities

COURSE TITLE **ENGINEERING PHYSICS(EPH)**
COURSE CODE **6G103**

Diploma Programmes in which this course is offered	Semester in which offered
Electrical Engineering	First Semester

1. RATIONALE

Engineering Physics represents foundation level of courses. It is considered as the mother of all engineering programmes. The principles, laws, hypothesis, concepts, ideas which are acquired by students through this course help in reinforcing the knowledge of technology and solving engineering problems.

2. COMPETENCIES

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the following competencies…

I. Apply facts, concepts and principles of Physics for solving various Engineering Problems
II. Observe, describe, interpret and interact with physical and engineering world through concepts and principles of physics.

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			**Total Credits (L+T+P)**	**Examination Scheme**				
				Theory Marks		**Practical Marks**		**Total Marks**
L	T	P	C	ESE	PT	ESE	PA	**150**
3	0	2	5	80~	20~	25@	25	
Exam Duration				2 Hrs.	1 Hr.	2 Hrs.		

Legends: **L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** - Practical;
C – credit; **ESE** - End Semester Examination; **PA** - Progressive Assessment;
PT- Progressive Test**; ~** - Multiple choice Online Examination
@ Internal Examination

4. COURSE OUTCOMES:

Students will able to

1. Determine relevant physical properties of a given material.
2. Analyze thermal, optical and acoustical system using properties of heat, light and sound.
3. Apply fundamentals electrical laws.
4. Select different type of semiconductors, x-ray and optical fibre application.

5. COURSE DETAILS:-

Unit	Major Learning Outcomes	Topics and Sub-topics
UNIT-I Genral Propertis of Matter	1a. Measure Strength parameter. 1b. Measure automization and lubricity of given liquid.	**Elasticity:** 1.1 Definitions of deforming force, restoring force, elasticity, plasticity, Factors affecting elasticity.· 1.2 Stress Tensile, Compressive, Volumetric and Shear stress, Strain: Tensile, Volumetric and Shear strain. 1.3 Elastic limit, Hooke's law. Elastic co-efficient- Young's modulus, bulk modulus, modulus of rigidity and relation between them **Viscosity** 1.4 Viscous force, definition of viscosity, velocity gradient, Newton's law of viscosity, coefficient of viscosity and its SI unit. 1.5 Streamline and turbulent flow with examples, critical velocity, Reynold's number and its significance. **Surface tension** 1.6 Cohesive and adhesive force, Laplace's molecular theory of surface tension, Surface Tension: definition and unit, 1.7 effect of temperature and impurity on surface tension. Angle of contact, Capillarity and examples of capillary action 1.8 derivation of expression for surface tension by capillary rise method, applications of surface tension.

UNIT-II Heat Light And Sound	2a. Analyze thermal system. 2b. Analyze optical system. 2c. Analyze acoustic system.	**Heat** : 2.1 Three modes of transistor of heat , conduction convection Radiation , law of thermal conductivity 2.2 Coefficient of thermal conductivity , , expansion of solid and coefficient of linear , aerial and cubical expansion & relation between them **LIGHT** : 2.3 Introduction to reflection and refraction of light, Snell's Law, 2.4 Dispersion. Total internal reflection of light. Critical angle, Simple problems. **Properties of sound** : 2.5 Wave motion transverse & longitudinal wave 2.6 Free & forced vibration , Resonance formula calculate velocity of sound by resonance tube method
UNIT-III Electrostatics And Current Electricity	3a.Analyze electrical system.	3.1 Electric charge, Coulomb's Law of Charges, Unit charge, field, intensity of electric field, electric lines of forces (Properties) Electric Flux, Flux Density. 3.2 Concept of resistance, Specific resistance, Whetstone's network, meter bridge, balancing condition of meter bridge, measurement of unknown resistance using meter bridge. Problems. 3.3 Potential , Potential drop along the length of wire, Principle of Potentiometer, Potential gradient, E.M.F. Unit, Comparison of EMF using potentiometer

UNIT-IV Modern Physics	4a. Use modern materials 4b. Use X-ray	Semiconductor – 4.1 Classification of solids on the basis of band theory: forbidden energy gap, conductor, insulator semiconductor 4.2 intrinsic, extrinsic, semiconductor doping , P and n type semiconductor electrical conduction through p and n semiconductor .P-N junction diode semiconductor metal and insulator. 4.3 Optical fibre: principle, structure of optical fibre, propagation of light wave through optical fibre, derivation of numerical aperture and acceptance angle **X-rays:** 4.4 Origin of X-rays, production of X-rays using Coolidge's X-ray tube 4.5. Minimum wavelength of X-ray derivation, properties of X-rays, applications of X- rays: engineering, medical and scientific

6. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
1	GENERAL PROPERTIES OF MATTER	12	6	7	7	20
2	HEAT LIGHT AND SOUND	12	6	7	7	20
3	ELECTRICITY	12	6	7	7	20
4	MODERN PHYSICS	12	6	7	7	20
	TOTAL	48	24	28	28	80

Legends:
R = Remembrance; U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

7. SUGGESTED LIST OF EXERCISES/PRACTICAL/EXPERIMENTS

The exercises/practical/experiments should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the competency. Following is the list of exercises/practical/experiments for guidance.

Sr. No.	Unit No.	Experiment /Practical Exercises	Approximate Hours
1	1	Know your Physics Laboratory and use of scientific calculator & interpretation of graph.	2
2	2	Measure the dimensions of given objects using vernier caliper.	2

3	3	. Determine Young's modulus of elasticity of metal wire by using Searle's apparatus	2
4	4	Measurement of unknown temperature using platinum resistance thermometer.	2
5	5	To determine critical angle using glass block	2
6	6	. Determine coefficient of viscosity of given liquid using Stoke's Method	2
7	7	To determine specific resistance of given wire using Ohm's Law	2
8	8	To verify the Law of Resistance in series by Meter bridge.	2
9	9	To study the forward characteristics of P-N junction diode	2
10	10	To understand the concept of resonance and determine the velocity of sound in air.	2
11	11	Comparison of EMF of two cells using Potentiometer	2
Micro Project (Any one of following will be opted by a group of 5-6 students)			
1	Survey of different diodes, resistances and capacitance		
2	Prepare current and voltage rating of home appliances		
3	To make the telescope using lenses		
4	Analyse the different toys and watch on the basis of property of Elasticity		
5	Analyse the different liquidator on the basis of property of surface tension		
6	To collect the information from internet regarding distribution of sound at Gowalkonda fort		
7	To collect the information from internet regarding distribution of sound at Golghumut at Vaijapur		

8. SUGGESTED LIST OF PROPOSED STUDENT ACTIVITIES

Following is the list of proposed student activities

a. Calculate acoustics of given class room.
b. Prepare a chart of applications of optical fibre in different fields.
c. Demonstrate different types of capacitors.
d. Seminar by student on any relevant topic.

9. SPECIAL INSTRUCTIONAL STRATEGIES

a. Search various sites to teach various topics/sub topics.
b. Instead of the traditional lecture method, use different types of teaching methods such as improved lecture method, question answer method, laboratory method to attained specific outcome.
c. Some topics are relatively simpler in nature is to be given to the students for self-learning by seminar or by classroom presentations
d. Teachers provide theme to create multiple choice questions.
e. Provide super visionary assistance for completion of micro-projects.

10. Hours distribution for Physics Experiments :

Sr. No.	Description	Hours
1	An introduction to Physics laboratory and its experiments (for the set of first four experiments)	02
2	Set of first four experiments	08
3	An introduction to experiments (for the set of next four experiments)	02
4	Set of next four experiments	08
5	An introduction to experiments (for the set of next three experiments)	02
6	Set of next three experiments	06

11. SUGGESTED LEARNING RESOURCES LIST OF BOOKS

Sr No.	**Title of Books**	**Author**	**Publication**
1	Basic Science Physics	Pawar and Sutar	Nirali Publication
2	Applied Physics	B.G. Bhandarkar	Vrunda Publication
3	Engineering Physics	R.K. Gupta and S.L Gupta	Dhanpat Rai Publication
4	Applied Physics	Pawar, Umrani and Joshi	Nirali Publication
5	Basic Physics	B.G. Bhandarkar, S.N. Jumde	Vrunda Publication
6	Physics Text Book Part -1 for Class - 12	NCERT	NCERT; 2014 edition **ISBN-13:** 978-8174506313
7	Physics Text Book Part -2 for Class - 12	NCERT	NCERT; 2014 edition **ISBN-13:** 978-8174506719
8	A text book of applied physics		S Chand Publication

12. List of Major Equipment/ Instrument

1. Platinum resistance thermometer
2. Thermocouple
3. Meter bridge
4. Potentiometer

13. E-learning resources

1. www.physicsclassroom.com for unit II and unit III
2. www.fearofphysics.com for unit III
3. www.sciencejoywagon.com/physicszone for unit III and IV
4. www.science.howstuffworks.com
5. https://phet.colorado.edu/en/simulations/category/physics for unit I, II, III and IV

POs and PSOs assignment and its strength of assignment with each CO of the Course

CO. NO.	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	**Student will able to calculate young's modulus ,surface tension and viscosity of different material**	3	3	3	2	0	1	0	0	0	2	-	-	-
CO2	**Student will able to demonstrate different properties of heat ,light and sound**	3	3	2	2	0	2	0	0	0	1	-	-	-
CO3	**Student will able to demonstrate different laws of electric field, charge resistance and capacitance**	3	3	3	3	0	2	1	0	0	1	-	-	-
CO4	**Student will able to demonstrate different type of semiconductors, x-ray and optical fiber knowledge and application**	3	3	3	3	0	3	0	0	0	0	-	-	-

14. Name and Designation of Course Designer

Sr. No	Name of the faculty member	Designation and Institute
1	Mr. V.S Deshmukh	Lecturer in Physics, Government Polytechnic Aurangabad
2	Mrs. S.B.Kale	Lecturer in Physics, Government Polytechnic Aurangabad
3	Mrs. Z.F.Siddiqui	Lecturer in Physics, Government Polytechnic Aurangabad

Member Secretary PBOS Chairman PBOS Co-coordinator science and Humanities

COURSETITLE : ENGINEERING GRAPHICS (EGR)

COURSE CODE : 6G201

DIPLOMA PROGRAMME IN WHICH THIS COURSE IS OFFERED	SEMESTER
Electrical Engineering	First

1. RATIONALE:

Engineering Drawing is the language of engineers and technicians. Always the engineers come across different types of drawings. It is therefore very important to understand the fundamentals and basic concepts involved in drawing.

It describes the scientific facts, concepts, principles and techniques of drawings in any engineering field to express the ideas, conveying the instructions, which are used to carry out jobs in engineering fields. The course aim for building foundation for the further course in drawing and other allied subjects.

It covers knowledge & application of drawing instruments & also familiarizes the learner about Bureau of Indian standards. The curriculum aims at developing the ability to draw and read various drawings, curves and projections.

2. COMPETENCY:

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the following competencies:

"Prepare engineering drawings manually with given geometrical dimensions using prevailing drawing standards and drafting instruments."

"Draw orthographic views and isometric views."

3. TEACHING AND EXAMINATION SCHEME:

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PT	ESE (PR)	PA	100
2	--	2	4	--	--	50@	50	
Exam duration						02 hrs		

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

4. COURSE OUTCOMEs (COs):

1. Draw geometrical figures and scales.
2. Drawing of various engineering curves.
3. Draw orthographic views of given component.
4. Draw isometric view of given component.

5. Use various drawing codes, conventions and symbols as per IS SP-46 in engineering drawing.

5. COURSE DETAILS.

Unit	**Major Learning Outcomes** (in cognitive domain)	**Topics and Sub-topics (Containing POs and PSOs assignment in each Sub-topic)**
Unit – I **Introduction**	1 Use drawing equipments and instruments effectively. 2 Draw and prepare simple drawings. 3 Follow and apply standard practice as per bureau of I.S. for planning and layout. 4 Choose appropriate scale factor for the drawing.	1.1 Drawing Instruments and their uses 1.2 Letters and numbers (single stroke vertical) for main title, sub-title and normal use. 1.3 Different types of lines, Convention of lines and their applications. 1.4 Scale (reduced, enlarged & full size), Plain scale and Diagonal scale. 1.5 Sheet sizes and layout, Geometrical Constructions. 1.6 Dimensioning, its methods, parallel and chain dimensioning, radius and diameter dimensioning, leader and its use, dimension with text.
Unit – II **Simple Drawing Practices**	1 Select line types and divide given line, circle into equal number of parts. 2 Draw different regular polygons and circle.	2.1 Drawing of different circles with thin, thick, center line use, dividing circle into number of equal parts, dividing line into equal parts. 2.2 Drawing pentagon, hexagon and rhombus, drawing correct arrows to dimension lines, drawing tangent to circle from given point
Unit – III **Engineering Curves**	1 Draw engineering curves with proficiency and speed as per given dimensions. 2 Draw curves with uniform thickness and darkness, dimensioning as per IS.	3.1 To draw ellipse by – • Arcs of circle method • Concentric circle method • Oblong method 3.2 To draw parabola by – • Directrix focus method • Rectangle method 3.3 To draw hyperbola by – • Transverse axis & focus method. • Passing through a given

		point. (Rectangular hyperbola) 3.4 To draw involute of square, pentagon hexagon and circle. 3.5 To draw cycloid, epicycloid, hypocycloid.
Unit – IV **Orthographic Projections**	1Draw the orthographic views of object. 2 Interpret given orthographic views and imagine the actual shape of the component.	4.1 Converting pictorial view into orthographic views. (pictorial view of components with holes, cylinders, ribs, plates, slots) 4.2 Sectional orthographic projection of simple objects. (Use First angle method of Projection).
Unit – V **Isometric Projections**	1 Draw isometric view of given object. 2 Draw isometric scale.	5.1 Isometric projection of simple objects 5.2 Isometric projection of objects having circular holes, slots on sloping surface.

6. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (End semester examination)

Unit	Unit Title	Teaching Hours	Distribution of practical examination marks			
			R Level	U Level	A Level	Total Marks
I	Introduction	4	2	2	2	6
II	Simple Drawing Practices	4	2	2	2	6
III	Engineering Curves	8	4	4	6	14
IV	Orthographic Projections	8	2	4	8	14
V	Isometric Projections	8	2	4	4	10
	Total	32	12	16	22	50

Legends: R = Remembrance; U = Understanding; A = Application and above levels

7. LIST OF EXERCISES/PRACTICALS.

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills **(outcomes in psychomotor and affective domain)** so that students are able to acquire the competencies/ programme outcomes.
A3 size sketch book should be used by the students. It is necessary to draw all the sheet problems in sketch book first and then redrawn on the sheets

S. No.	Unit Number	Practical Exercises	Hrs. required
1	I	1. Drawing of lines of different types, lettering and numbers. 2. Drawing of plain and diagonal scale. 3. Redraw any 2D drawing with circles, slots and curves. Show dimensions on it. (Drawing on sketchbook.)	2 2 2
2	II	1. Drawing of regular pentagon, hexagon with standard procedure. Measure internal and external angles. 2. Divide line, circle, and angles in equal number of parts. (Drawing on sketchbook.)	2
2	III	Sheet 1: Drawing of engineering curves. (3 problems) each on ellipse, parabola and hyperbola. Sheet 2: Drawing of Engineering curves. (3 problems) each on scale, involute and cycloid.)	4 4
3	IV	Drawing of Orthographic views from given pictorial view. (Minimum 2 objects on sketchbook) Sheet 3: Drawing orthographic views from pictorial view. (2 objects) Use of first angle method only	4 4
4	V	Drawing of Isometric views of simple Objects. (Minimum 2 objects on sketch book). Sheet 4: Drawing of Isometric views of simple objects (any 2 objects).	4 4
		Total	32

Notes:

a: Use one side of sheet.

b: Theory & practice should be in first angle projections and IS codes should be followed wherever applicable.

c: The dimensions of line, distances, angle, side of polygon, diameter, etc. may be different for different batches.

d: The sketchbook has to contain data of all problems, solutions of all problems and student activities performed. Students activities are compulsory to be performed.

e: A hand out containing applicable standards from IS codes including title block as per IS standard should be given to each student by concerned teacher.

f: For ESE Practical examination, students are to be assessed for competencies

achieved. Students are to be given data for practical ESE to prepare drawings.

g: At the end of term practical examination of 50 marks of 2 Hours duration is compulsory to all students. External and Internal Examiners should set and assess the Question paper jointly as per following guidelines

- Engineering curves and geometric construction (three problems) 24 marks
- Simple Orthographic projection (One Problem) 16 marks
- Isometric projection with slots and holes (One Problem) 10 marks

8. LIST OF STUDENT ACTIVITIES.

Sr. No.	Activities
1	Sketch the combinations of set squares to draw angles in step of 15 degrees. (15^0 , 30^0 , 45^0 , 60^0 , 75^0 , 90^0 , 105^0 , 120^0 , 135^0 , 150^0 , 165^0 , 180^0).
2	List the shapes you are observing around you in real life with place/item. (For ellipse, parabola and hyperbola).
3	Draw free hand isometric and orthographic views of any components
4	Observe and draw the locus/path of a point on circumference of a rolling wheel.
5	Prepare cuttings of circle and polygons using cardboard/drawing sheet.

9. SPECIAL INSTRUCTIONAL STRATEGIES.

Sr. no.	Unit no	Unit name	Strategy
1	I	**Introduction**	Conventional black board method, Use of models. Use of software.
2	II	**Simple Drawing Practices**	Conventional black board method, Use of models.
3	III	**Engineering Curves**	Planes made of sheet, cardboard.
4	IV	**Orthographic Projections**	Models, Use of software.
5	V	**Isometric Projections**	Models and cut section.

10. LEARNING RESOURCES:

Sr. No	Title of Book	Author and Publication
1	Elementary Engineering Drawing	N.D.Bhatt , Charotar Publishing House
2	Engineering Drawing	Mali , Chaudhari, Vrinda Publication
3	Engineering Drawing	Sidheswar Shastri , Tata McGraw Hill
4	Engineering Graphics	Arunodaykumar, Techmax publications, Pune

5	Engineering Drawing for schools and colleges	IS CODE SP- 46

11. LIST OF MAJOR EQUIPMENT/ INSTRUMENT WITH BROAD SPECIFICATIONS

Sr. No.	Major equipment/ Instrument with Broad Specification	Quantity
1	Models- full and cut. (wooden and acrylic)	12
2	Drawing equipments and instruments for class room teaching-large size.	1
3	Drawing board-half imperial size.	100
4	T-square or drafter (Drafting Machine).	1

12. MAJOR EQUIPMENT/ INSTRUMENT WITH BROAD SPECIFICATIONS

Sr. NO.	Name of the Equipment	Specification
1	Various models of standard solids such as pyramid, prism, cone, cylinder etc.	
2.	Different objects or machine elements.	

13. E-LEARNING RECOURSES:

List of Software/Learning Websites.

- http://www.slideshare.net/sahilsahil992/conic-section-1819818
- http://www.technologystudent.com/designpro/drawdex.htm
- http://www.engineeringdrawing.org/engg_curves/problem-3-8-engineering-curves/490/
- http://web.iitd.ac.in/~hirani/mel110-part3.pdf
- http://www.studyvilla.com/ed.aspx
- http://www.youtube.com/watch?v=a703_xNeDao
- E-learning package from KOROS.
- E-learning package from Cognifront.

POs and PSOs assignment and its strength of assignment with each CO of the course.

CO. NO.	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	No. of hours allocated in curriculum
CO1	Draw geometrical figures and scales.	3	3	2	3	-	-	-	-	3	2	2	2	3	6
CO2	Drawing of various engineering curves.	3	3	2	3	-	-	-	-	3	2	2	2	3	8
CO3	Draw orthographic views of given components.	3	3	2	3	-	-	-	-	3	2	2	2	3	8
CO4	Draw isometric views of given component.	3	3	2	3	-	-	-	-	3	2	2	-	3	8
CO5	Use various drawing codes, conventions and symbols as per IS SP-46 in engineering drawing.	3	3	2	3	-	-	-	-	3	2	2	-	3	2

Name and Designation of Course Designer:-

1 Prof. Aher S M

2 Prof. Dhirbassi G D

HOD CDIC coordinator

COURSE TITLE- **BASICS OF COMPUTER SYSTEM(BCS)**

COURSE CODE **6G203**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Electrical Engineering	First Semester

1. RATIONALE

This course pertains to basic technology level. It aims to developing fundamentals of Computer and its Applications in students of various programs. This will enable students in using application software's such as word processor, spreadsheets, and power point presentations in their professional fields. Further it will enable students to be lifelong learner.

2. COMPETENCY

"Use of computer and software application proficiently".

3. TEACHING AND EXAMNATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (PR)	PA (TW)	50
-	-	2	2	--	--	25@	25	
Duration of the Examination (Hrs)				--	--	--	--	

Legends : L-Lecture**; T**-Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, OR – Oral Examination, TW - Term Work, # External, @ Internal

4. COURSE OUTCOMES

On successful completion of the course, the students will be able to:

1. Connect and operationalize computer system with its peripheral devices.
2. Create and Format documents in Microsoft Word.
3. Create spreadsheets in Microsoft Excel by using formulae.
4. Create and edit basic power point presentations in Microsoft PowerPoint.

5. Use internet for creating email-id, receive and send email with attachment & search information on internet.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (Cognitive Domain Only)	Topics And Sub-Topics
Unit- 1 Basics of Computer System	1a.Describe computer hardware and software 1b.Identify & use of I/O devices 1c. Describe functioning of CU ALU and memory unit 1d Differentiate various types of printers 1e. Explain use of OS 1f. Demonstrate various file handling operations	1.1 Concept of Hardware and Software 1.2 Computer block diagram and its component like CPU, Control Unit, Arithmetic logic Unit (ALU) & Memory Unit 1.3 Input Output Devices: Keyboard, Mouse, Scanner, Monitor, Printers: Dot matrix, Laser, Inkjet, Plotters. 1.4 System software and Application Software 1.5 Operating system concepts, purpose and functions 1.6 Operations of Windows OS. 1.7 Creating and naming of file and folders 1.8 Copying file, renaming and deleting of files and folders, 1.9 Searching files and folders, installation application, creating shortcut of application on the desktop 1.10 Overview of control Panel, Taskbar.
Unit-2 Word Processor	2a. Create, edit and save word document using basic text formatting features, page setup options & print options. 2b.Apply spell check & grammatical check in the created document. 2c. Insert graphics/clipart/ smart art/shapes/charts in the document. 2d. Create tables, insert, delete rows and columns and apply different table properties.	2.1 Overview of Word processor 2.2 Basics of Font type, size, colour 2.3 Effects like Bold, italic , underline, Subscript and superscript, 2.4 Case changing options, 2.5 Inserting, deleting, undo and redo, Copy and Moving (cutting) text within a document, 2.6 Formatting Paragraphs and Lists 2.7 Setting line spacing; single, multiple 2.8 Page settings and margins including header and footer 2.9 Spelling and Grammatical checks 2.10 Table and its options, Inserting rows or columns, merging and splitting cells. 2.11 Insert Picture, Clipart, shapes, smart art & charts.

Unit	Major Learning Outcomes (Cognitive Domain Only)	Topics And Sub-Topics
		2.12 Working with pictures, Inserting Pictures from Files, Wrapping it with image. 2.13 Finding & replacing text. 2.14 Using Drawings and WordArt; Lines and Shapes, Modifying Drawn Objects. 2.15 Printing: print preview, select printer & appropriate print options.
Unit- 3 Excel (Spreadsheets)	3a. Create, open, save and print worksheet with page setup and print options. 3b. Enter data and insert, delete and format cells, rows and columns. Use formula and functions 3c. Insert formulas, functions and named ranges in worksheet. 3d. Create chart of different types.	3.1 Introduction to Excel, 3.2 Introduction to data, Cell address, Excel Data Types, Concept of hyperlink 3.3 Introduction to formatting number, text and date. 3.4 Concept of worksheet and workbook. 3.5 Understanding formulas, Operators in Excel, Operators Precedence, Understanding Functions, Common Excel Functions such as sum, average, min, max, date, sqrt, power, upper, lower, count, countif, roundup, sin, cos. 3.6 Introduction to charts, overview of different types of charts available with Excel. 3.7 Hide, unhide rows and columns. 3.8 Concept of print area, margins, header, footer and other page setup options.
Unit- 4 Power Point Presentation	4a. Create a simple text slide using formatting, selecting a slide layout and insert pictures & backgrounds. 4b.Use different design templates for creating slides. 4c. Apply slide transitions and slide timings and animation effect for slide show. 4d. Insert hyperlink in the created slides.	4.1 Outline of an effective presentations 4.2 Starting a New Presentation Files, Saving work, 4.3 Creating new Slides, Working with textboxes. 4.4 Changing a slides Layout, Applying a theme, Changing Colours, fonts and effects, Creating and managing custom Colour & font theme, Changing the background. 4.5 Use of design template and auto content wizard. 4.6 Apply animation and transition to slides with timing effect. 4.7 Slideshow: from beginning slideshow, from current slideshow, custom slideshow.

Unit	Major Learning Outcomes (Cognitive Domain Only)	Topics And Sub-Topics
		4.8 Creating hyperlinks**,** Using action buttons
Unit- 5 Introduction to Internet	5a. Know different terms related to internet and browsers. 5b. Understand need & duty of ISP & List out different ISP in city. 5c. Use internet for searching information and create, receive & send email with attachment.	5.1 What is the Internet? 5.2 Web pages, Home Pages. 5.3 Use of web sites 5.4 ISP: need & duties of ISP, different ISP in city 5.5 Browsers 5.6 Universal resource locators (URL) 5.7 Browsing or surfing the web 5.8 Search engines 5.9 E-mail and Creation of E-mail ID. Sending & Receiving email with attachment. 5.10 Chatting & Video Conferencing tools: Skype and GTalk 5.11 Applications of the Internet

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Practical Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL
1	Basics of Computer System	08				NA
2	Word Processing	08				NA
3	Spreadsheet	06				NA
4	Presentation	06				NA
5	Introduction to Internet	04				NA
6						NA

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	1	Connect the peripherals to a computer system. Get the information about the manufacturers and prices of various components of a PC and laptop.	2
2	1	Start and shutdown of windows, starting different applications. Use of accessories like calculator, paint, notepad & WordPad, Use of system tools like Disk Cleaner, Disk defragmenter, System Information, System Restore & Control panel.	4
3	1	Perform file management operations such as copying, deleting, renaming, creating folders, renaming folders using My computer, Windows Explorer, searching files and folders.	2
4	1	Change windows format such as wall paper, date &time, installing printer, installing and removing programs by using add/remove programs.	2
5	2	Prepare a sample doc files such as resume, application, time table etc. using all word processor tools from menu bar.	6
6	3	Prepare sample spreadsheets such as sample result sheet, salary sheet of employees using all MS-Excel tools from menu bar. (applying excel formulae/functions)	6
7	4	Prepare sample power point presentation by applying MS-Power Point tools such as design template, background, transition and animation effect to slides.	6
8	5	Search information on internet .Use Internet to create email account, send email with attachment, receive email and management of email account.	2
9	5	Use of E-commerce sites, Mobile apps for various online transactions.	2
			32

8. SUGGESTED STUDENTS ACTIVITIES

Following is the list of proposed student activities like: assignments based on MS-Office, teacher guided self learning activities and lab based mini-projects on MS-Word, MS-Excel and MS-PowerPoint. These could be individual or group-based.

a. Visit institute website.
b. Manage files and folder using Windows.
c. Prepare letter and project report using word processor
d. Create result sheet by inserting student marks and show it in chart form on the same worksheet using Excel spreadsheet.
e. Develop effective presentation of project report using PowerPoint Presentation.
f. Use open source software like openoffice.org (latest version).

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Group based.
b. Q & A technique.
c. Individual based.
d. Activity based learning
e. Self Line learning.

10. SUGGESTED LEARNING RESOURCE

S.No.	Name of Book	Author	Publication
1.	Fundamentals of computers	P.K.Sinha	BPB Publication
2.	Computer course	R.Taxali	TMGH Publication
3.	MS-Office for Dummies	Wallace Wang	Wiley India, New Delhi
4.	Basic Computer Engineering	Dr. Shailendra Singh, Pawan Thakur, Anurag Jain	Satya Prakashan, New Delhi, India.
5.	Microsoft Office	Ron Mansfield	BPB Publication
6.	Fundamentals of computers	P.K.Sinha	BPB Publication

11. **LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED** :

S. No.	Name of equipment	Brief specification
1.	Computer System with latest configuration along with Windows Operating System and latest MS-Office.	Desktop Computer/Personal Computer (Windows OS Prof. Edition/Academic edition) with preloaded operating systems windows 7/windows 8 (academic Lic)
2.	PROJECTOR	Multimedia Projector with wireless connectivity between PC and Projector
3.	PRINTER	HP 1022n laser printer
4.	SCANNER	HP scanner ,Color Scan Method: Color, Flatbed, Mirror Moving Scanner Optical Resolution: 800 x 1600 dpi Maximum Scanning Area 304.8 x 431.8 mm (12x17 inch)
5.	Computer System with latest configuration along with Windows Operating System and latest MS-Office.	Desktop Computer/Personal Computer (Windows OS Prof. Edition/Academic edition) with preloaded operating systems windows 7/windows 8 (academic Lic)
6.	PROJECTOR	Multimedia Projector with wireless connectivity between PC and Projector

12. LEARNING WEBSITE & SOFTWARE

(Please mention complete URL of the E- resource CO wise)

a. https://www.youtube.com/watch?v=cXBVMyKQ3ZY
b. http://www.gcflearnfree.org/computerbasics/
c. http://www.homeandlearn.co.uk/word2007_2010/Word-2007-2010.html
d. http://www.homeandlearn.co.uk/excel2007/Excel2007.html
e. https://support.office.com/

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

SNo	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Connect and operationalize computer system with its peripheral devices.	2	2	2	0	0	0	0	0	0	2	0	0
2	Create and Format documents in Microsoft Word.	3	0	3	3	0	0	0	0	0	3	0	0
3	Create spreadsheets in Microsoft Excel by using formulae.	3	0	3	3	0	0	0	0	0	3	0	0
4	Create and edit basic power point presentations in Microsoft PowerPoint.	3	0	3	3	0	0	0	0	0	3	0	0
5	Use internet for creating email-id, receive and send email with attachment & search information on internet.	1	1	1	1	0	0	0	0	0	1	0	0

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	R.T.Aghao	Sr.Lecturer in APM Dept. , Govt. Polytechnic, Aurangabad
2	O.R.Varma	Lecturer in IT Dept., Govt. Polytechnic,Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE ENGLISH(ENG)
COURSE CODE 6G301

Diploma Programme in which this course is offered	Semester in which offered
Common to all programmes	First

1. RATIONALE

English language has become a supreme necessity to pick up a solid core of knowledge. It has a power of linking us with the outside world. Competency in English is also important in business matters like transactions including e-mails, memos, reports and contracts in writingnot only for Indian industry, but also worldwide. Students having proficiency in reading, writing and speaking English has become a prospect of employment in the industry. Hence, this course is designed to help the students to communicate in English effectively.

2. COMPETENCY

At the end of studying this course students will be able to

"Communicate in English language in spoken and written form."

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PT	ESE	PA	
2	-	2	4	80	20	-	25*	125
Exam Duration				3 Hrs	1 Hr	-	-	-

(*): *Out of 25 marks, 05 marks -micro-project assessment; 20 marks-progressive assessment.*

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

4. COURSE OUTCOMES

1. Interpret the meaning of new words from the text.
2. Formulate grammatically correct sentences using new words.
3. Prepare resume in proper format.
4. Use relevant vocabulary to construct sentences.

5. COURSE DETAILS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
UNIT-I Comprehension	1a. Understanding meaning of new words from the text.	**Text from the book & Vocabulary Building** 1.1.Man Versus Machine—

	1b.Write summary of the text 1c. Responding to the questions from the text 1d. Express ideas and views on learned topics	M..K..Gandhi 1.2. Say No to Plastic Bags 1.3. Interview of Dr.A.P.J.AbdulKalam 1.4. Dare to Dream- N.R.Narayan Murthy 1.5. The History Maker—MaltiHola
UNIT-II Functional Grammar	2a. Apply correct verbs in given sentences 2b. Use of correct structures in writing 2c. Identify different types of sentences 2d. Apply correct auxiliaries 2e. Use appropriate connectors in the given sentences 2f. Use appropriate prepositions in the given sentences 2g. Apply correct and exact rules and structures to transform the sentences 2h. Use of correct punctuations in writing	**Functional Grammar** 2.1.Tenses & Time 2.2. Sentence Patterns 2.3. Types of Sentences 2.4. Modal Auxiliaries 2.5. Connectors 2. 6. Prepositions 2.7. Voice, Degree and Reported Speech 2.8. Punctuation Marks
UNIT-III Craft of writing	3a. Writing a paragraph effectively 3b. Writing e-mail in proper formats 3c. Prepare resume in suitable format	3.1.Paragraph Writing 3.2.E-mail writing 3.3. Resume Writing
UNIT-IV Listening & Speaking Skills	4a. Formulate sentences using new words 4b. Enrich vocabulary through reading and listening 4c. Follow correct pronunciations, intonations & accents in communication	4.1. Importance of effective listening 4.2.Barriers in listening and how to overcome them 4.3Problems in speaking English faced by Indian Students

6. SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Text from the book & Vocabulary Building	12	08	12	10	30
II	Functional Grammar	12	05	08	13	26
III	Craft of Writing	06	04	04	08	16
IV	Listening & Speaking Skills	02	02	02	04	08
	Total	**32**	**19**	**26**	**35**	**80**

Legends: R = Remembrance; U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from the above table.

7. SUGGESTED EXERCISES/PRACTICALS

The tutorial/practical/exercises should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the competencies.

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1.	I	Make Sentences Using Correct Collocations	04
2.	II	Frame Sentences Using Appropriate Preposition/Conjunction	04
3.	III	Make Sentences Using Correct Tenses	04
4.	IV	Make Sentences Using Seven Basic Sentence Patterns	04
5.	V	Transform Sentences in Reported Speech	04
6.	VI	Prepare an Effective Resume in a Proper Format	04
7.	VII	Draft Formal E-mails	04
8.	VIII	Listen a Paragraph/Speech/Story and Make a Summary	04
Total			**32**

8. SUGGESTED STUDENT ACTIVITIES

Following is the list of proposed student activities like:

a. Read newspapers daily.
b. Solve exercises on lexical items.

c. Use apps for practice.
d. Use pocket dictionary to increase vocabulary.
e. Listen the news bulletin on radio.
f. Play different word games to improve vocabulary.
g. Write different articles & posts.
h. Practice role-playing.
i. Write a story of own experiences.
j. Practice listening comprehension.
k. Collect articles from newspapers & make a collection.
l. Practice paragraph writing.
m. Collect different business letters.

9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

a. Arrange different competitions to solve various grammatical items.
b. Motivate students to listen, speak, read and write English in their day-to-day life.
c. Student centered methods and techniques of teaching and learning e.g. group discussion, role-play, individual and group assignments should be used so as to make the students actively participate in the teaching-learning process.

10. SUGGESTED TITLES FOR MICRO-PROJECTS

A micro-project is planned to be undertaken by a student. He/she ought to submit it by the end of the semester to develop the industry oriented COs. The micro-project could be industry application-based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty**:**

a. The use of English language in the user manual of electronic appliances used at home.
b. Prepare an advertisement for five daily used products using contextual vocabulary.
c. Observe environmental problems in your locality and frame at least ten slogans to createan awareness.
d. Take an interview of any successful person in your locality in context with his life journey, inspiration, social contribution, role model and keys to success.
e. Prepare a leaflet giving information about your institute.
f. Write a review of your favourite movie/drama/novel.
g. Find out the difficulties in speaking English faced by the students from rural areas.

11. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	English Grammar & Composition	R. C. Jain	Macmillan
2	Business Letters & E-mails	JyotiNandedkar	Saket Pub.
3	Business Correspondence and Report writing	R. C. Sharma & Krishna Mohan	Tata McGraw Hill
4	Contemporary English Grammar	David Green	Macmillan
5	A Communicative Grammar of English	Geofray Leech &Jansvartvik	Pearson Education
6	*Spectrum- A Text Book on English	-	MSBTE
7	* A Text Book on English	-	MSBTE

12. Major Equipments/ Instruments with Broad Specifications

Sr.No.	Name of the Equipment	Specification
1	Digital English Language Laboratory	
2	Computers and Headphones	
3	Magazines,Articles,Journals in Lab.	

13. E-learning resourses

(Please mention complete URL of the E- resourses CO wise)

1	https://www.nptel.ac.in/courses
2	https://www.k12reader.com
3	https://www.eduaction.com
4	https://www.k5learning.com
5	https://www.english4u.com

POs and PSOs assignment and its strength of assignment with each CO of the Course

CO. NO.	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	Interpret the meaning of new words from the text.	3	1	1	1	1	1	1	1	3	1	-	-	-
CO2	Formulate grammatically correct sentences using new words.	3	1	1	1	1	1	1	1	3	1	-	-	-
CO3	Prepare resume in proper format.	1	1	2	1	3	3	2	3	3	3	-	-	-
CO4	Use relevant vocabulary to construct sentences.	1	1	1	1	1	1	1	1	2	1	-	-	-

Sr. No	Name of the faculty member	Designation and Institute
1	Mrs. P.Y. Kamble	Lecturer in English, Government Polytechnic, Aurangabad
2	Mrs. M.S. Ban	Lecturer in English, Government Polytechnic, Aurangabad
3	Mr. P.V. Deshmukh	Lecturer in English, Government Polytechnic, Aurangabad
4	Mr. R.L. Korde	Lecturer in English, Government Polytechnic, Aurangabad
5	Mr. D.D. Gangthade	Lecturer in English, Government Polytechnic, Aurangabad
6	Mr. A.P. Jagtap	Lecturer in English, Government Polytechnic, Osmanabad

Member Secretary PBOS | Chairman PBOS | Co-coordinator science and Humanities

COURSE TITLE: DEVELOPMENT OF LIFE SKILLS

COURSE CODE: 6G303

Diploma Programme in which this course is offered	Semester in which course is offered
Electrical Engineering	First Semester

1 RATIONALE

The generic skills are lifelong skills which need to be developed continuously. These skills are necessary for diploma engineers for their professional career.

This course aims to develop interpersonal skills, problem solving, decision making, Professionalism with etiquettes, ethics and value system.

This course also aims at developing an engineer as a team leader, effective member of the team and to become sound personality. It will develop the abilities and skills to perform at highest degree of quality as an individual.

2 COMPETENCY

"Develop life skills to enhance personal effectiveness, professionalism and optimal use of resources."

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PT	ESE (OR)	PA	
--	--	2	2	--	--	25@	25	50

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

4. COURSE OUTCOMES (COs)

1. Develop interpersonal skills.
2. Exhibit corporate etiquettes and professionalism.
3. Enhance personal effectiveness and body language
4. Practice time management and goal setting technique
5. Develop presentation skills.
6. Manage Stress at workplaces

5 COURSE DETAILS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit –I Self Analysis	1a. Identify Strengths and weaknesses of an individual 1b.Identify opportunities, threats in different situations. 1c. Describe principle of Need Base Theory	**Self-Analysis** 1.1 Strength, weaknesses, opportunities and threats 1.2 Techniques of self-control 1.3 Understanding Need base Theory — Attitude, aptitude, assertiveness, self-esteem, Confidence 1.4 Understanding Self
Unit– II Communication Skills& Presentation Skills	2a. Identify techniques of communications. 2b. Describe Body language techniques 2c. Understand the principle Eye contact and facial expression. 2d. Develop appropriate presentation Skills. 2e. Use multimedia tools and technology for effective presentation. 2f. Conduct Group discussion and Interviews.	**Communication Skills& Presentation Skills** 2.1 Techniques of communication skills, 2.2 Body language, Dress like the audience, Posture, Gestures, Eye contact and facial expression. 2.3 Presentation Skill –Stage fright, Voice and language – Volume, Pitch, Inflection, Speed, Pause Pronunciation, Articulation, Language, Practice of speech. 2.4 Group discussion and Interview technique, Use of aids –OHP, LCD projector, white board
Unit III Interpersonal communication and Corporate and Etiquettes	3a. exhibit/apply inter personal skills in different situations. 3b. Practice manners and Etiquettes.	**Interpersonal communication and Corporate and Etiquettes** 3.1 Interpersonal communication. Through Self Development and

		change. 3.2 Polished personal habits 3.3 Ethics & Etiquettes: a way of life, what are ethics, how ethics help to ensure positive interpersonal relations, 3.4 Personal value system, Personal Attire & Grooming 3.5 Cell phone manners
Unit IV **Time Management and goal setting.**	4a. Understand importance of time management. 4b. Apply time management skills. 4c. Set the goals for career growth.	**Time management and Goal Setting** 4.1 Time management skills in groups for completion of project 4.2 Factors that lead to time loss and how they can be avoided 4.3 Time matrix & urgent versus, Important jobs 4.4 Importance of goal setting 4.5 How to set SMART goals.
Unit V **Health and Stress Management**	4a. Manage health for personal efficiency. 4b. Describe Stress Management, 4c. Use strategies to overcome stress 4d Understand emotions	**Health and Stress Management** 5.1 Importance of health management, 5.2 Relevance of it, 5.3 Tips to maintain good health 5.4 Strategies to overcome stress, understanding importance of good health to avoid stress. 5.5 Stresses in groups,

		understand and identify emotions, how to control emotions, emotional intelligence.
Unit VI **Problem Solving Techniques and Creativity**	6a. participate in technical Quizzes and puzzles. 6b.Use problem solving techniques 6c. Describe factors enhancing creativity	**Problem Solving Techniques and Creativity** 6.1 definition of problem, types 6.2 solving Puzzles and technical quizzes. 6.3 Reducing conflict by preventing problems in the classroom. 6.4 Creativity concept, Tips and ways to increase creativity, importance of creativity.

6 SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Self-Analysis	4	NA	NA	NA	NA
II	Communication Skills & Presentation Skills	6	NA	NA	NA	NA
III	Interpersonal communication and Corporate and Etiquettes	6	NA	NA	NA	NA
IV	Time management and Goal Setting	6	NA	NA	NA	NA
V	Health and Stress Management	6	NA	NA	NA	NA

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
VI	Problem Solving Techniques and Creativity	4	NA	NA	NA	NA

Legends: R = Remembrance; U= Understanding; A= Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

7. SUGGESTED EXERCISES/PRACTICALS

The tutorial/practical/exercises should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the competencies.

Note*: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of* ***Programme Outcomes/Course Outcomes in affective domain*** *as given in a common list at the beginning of curriculum document for this programme. Faculty should refer to that common list and should ensure that students also acquire those Programme Outcomes/Course Outcomes related to affective domain.*

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	I	1) Analyze self with SWOT techniques.	04
2	II	2) Present a topic (related to technical advancement should be given to a group of five to six students. Group should search the necessary information from various sources and prepare a systematic power point presentation. All such presentations should be delivered in front of class by groups. Presentations are to be evaluated by teacher).	04

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
3	II	3) Deliver extempore (Topic will be given to the individual for a speech of 5 to 8 minutes. Here the individual speeches of students will be conducted and evaluated by group of students.)	04
4	II	4) Participate in Group Discussion (Teacher should form group of six to eight students and give topics for group discussion. Group discussions should be carried out and evaluated by teacher)	04
5	III	5) Exhibit Etiquettes in different situations (Visit to any one place like office/firm/development sites etc. and observe the communication and etiquettes.)	04
6	IV	6) Prepare your individual time table for a week - a) List down your daily activities. b) Decide priorities to be given according to the urgency and importance of the activities. c) Find out your time wasters and mention the corrective measures. d) Set short term and long term goal for PT/TEE/Gymkhana -sport/gathering event etc.	04
7	V	7) Demonstrate simple Yoga postures and other stress relieving techniques by professional persons and narrate his/her experiences.	04
8	VI	8) Participate in Quizzes, puzzle- solving and educational games and narrate his/her experiences.	04
Total			**32**

8. SUGGESTED STUDENT ACTIVITIES

Following is the list of proposed student activities like:

- Following activities will be undertaken as per their convenience. students are advice to submit their report about participation in activities.
- 1. Case studies to be discussed in a group and presentation of the same by group /group leader.

- Carry out Field exercises and prepare reports. (e.g. interact with supplier/trader and discuss about techno commercial specifications of product)
- Role play by individual/group leader.
- Sharing of self -experiences in a group.
- Brain storming sessions in a group
- Questionnaire -filling & discussing results of the same in a group.

9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

i. Motivate students to use internet and collect information about various generic skills

ii. Arrange expert lecture on various topics on (two/three) SWOT analysis/Time management/Etiquettes / stress management/health management.etc.

10. SUGGESTED LEARNING RESOURCES

A) Books

S. No.	Title of Book	Author	Publication
1	Pearson Education Asia	Organizational Behavior	Tata McGraw Hill
2	Marshall Cooks	Adams Time management	Viva Books
3	Bishop , Sue	Develop Your Assertiveness	Kogan Page India
4	Allen Pease	Body Language	Sudha Publications Pvt. Ltd.
5	Lowe and Phil	Creativity and problem solving	Kogan Page (I) P Ltd
6	You can win	Mr. Shiv Khera	Macmillan ,India Ltd.
7	Wings of Fire	Mr .Abdul Kalam	Universities Press
8	Prabhavi Vyaktimatwa	SEEMA GUPTA	SAKET PUBLICATION
9	Yoga Dipika	Mr. Iyyengar	Rohan prakashan
10	Tan Tanavache Niyojan (Marathi)	Dr. Anand Nadkarni	Majestic Publishing House

S. No.	Title of Book	Author	Publication
11	Tandrust Raha ,Mast Jaga.(Marathi)	Dr. Rajiv Sharangpani	Continental Prakashan

B) Software/Learning Websites:
Websites related to soft skills.

POs and PSOs assignment and its strength of assignment with each CO of the Course

CO. NO.	Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2
CO1	Develop interpersonal communication				2				2	3			
CO2	Display corporate etiquettes and professionalism		2			2			2				
CO3	Improve personality and body language			2							2		
CO4	Practice time management and goal setting technique	2		2					2	2			
CO5	Develop presentation and group discussion technique		2		2			2					
CO6	Acquire Stress removing and Problem solving technique		2			2					2		

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	Dr.Uday V. Pise	Head of Department , Mechanical Engg. Govt. Polytechnic, Aurangabad
2	Prof. R. T. Aghao	Lecturer in Applied Mechanics., Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE : ENVIRONMENTAL SCIENCE
COURSE CODE : 6G304

DIPLOMA PROGRAMME IN WHICH THIS COURSE IS OFFERED	SEMESTER
Electrical Engineering	First Semester

1. RATIONALE :

The present plight of the world as a victim to a number of environmental setbacks ranging from global warming, ozone layer depletion, acid rains led to alarmingly increase in world pollution levels. This has led to the dangerous situation threatening existence of biosphere on the earth. Diploma engineers also get confronted with this issue in their professional life.. Diploma engineers need to be aware of environment and associated issues so that he can help in protection and preservation of environment.

2. COMPETENCY :

"Contribute in overall preservation of eco system of organization."

3. TEACHING AND EXAMINATION SCHEME :

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PT	ESE (PR)	PA	
0	--	2	2	--	--	--	50	50
Exam duration			--	--	--	--	--	

Legends : **L**-Lecture; **T**-Tutorial/Teacher Guided Theory Practice ; **P**- Practical; **C**- Credits; **ESE**- End Semester Examination; **PT** – Progressive Test, **PA**- Progressive Assessment, PR- Practical Examination, OR – Oral Examination, TW - Term Work, # External, @ Internal examination , ~ Online Examination.

4. COURSE OUTCOMES :

At the end of this course, students would be able to -

1. Analyze and assess the impact of biodiversity and its loss on environment
2. Identify causes of pollution in working system and apply control measures for prevention.
3. Apply provisions of various environmental protection acts in practice.
4. Appreciate correlation between Human population and its effect on environment.
5. Read, analyze and apply various laws and regulations concerning environmental issues.

5. COURSE DETAILS :

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit –I **Environment and studies**	1a. Write genesis of environmental concerns 1b. Identify the various types of environmental issues.	1.1 Definition , Scope and importance of Environmental studies 1.2 Meaning of environment, , Environment and its components, Segments of environment, scientific aspects 1.3 Global environment crisis and factors affecting it. Deforestation. aquatic life and tsunami effects ,Population, Carbon dioxide emissions, pollution, Extinction of species etc. Ecological Foot print
Unit– II **Environmental** **Natural Resources**	2a. Classify different resources 2b. Outline issues associated with different resources. 2c. Develop strategies to conserve of natural resources.	2.1. Renewable and Nonrenewable natural resources and associated issues as under, a. Forest resources b. Water resources c. Energy resources d. Land resources e. Food resources f. Energy resources 2.2. Role of individual in conservation of natural resources
Unit– III **Ecosystems**	3a. Outline ecosystem. 3b. Categorize various ecosystems .	3.1 Concept of Ecosystem 3.2 Structure and function of ecosystem 3.3 Structure and functions of following ecosystems, a. Forest Ecosystem b. Grassland Ecosystem c. Desert Ecosystem d. Aquatic ecosystem

Unit– IV **Biodiversity and Conservation**	4a. Outline Biographical classification of India 4b. Assess Biodiversity loss and its impact.	4.1 Introduction, Values of the Biodiversity, Biographical classification of India 4.2 Biodiversity loss and its impact 4.3 Conservation of Biodiversity, Efforts made in India.
Unit - V **Environmental Pollution**	5a. Describe pollution and its typs 5b. Describe cause, effect relationship. 5c. Conduct Survey on Environmental Pollution	5.1 Definition of pollution and its types 5.2 Causes, effects and control measures of following types of pollutions a. Air Pollution b. Water Pollution c. Soil Pollution d. Marine Pollution e. Thermal Pollution f. Nuclear hazards and pollution 5.3 Pollution norms, rules and bye laws 5.4 Solid waste management: Causes, Effects and control measures of urban and industrial waste.
Unit – VI **Social Issues and Environment**	6a. Identify social issues related to environment 6b. Suggest control measures to counter the issues, .	6.1 Urban problems related to Energy, Measures of water conservation including Rain water harvesting, Watershed Management 6.2 Climatic changes, Global Warming, Acid rain, Ozone layer depletion issue, Nuclear accidents and holocaust. Kyoto Protocol, Climate justice 6.3 Introduction to Environment (protection) act(prevention and control of pollution),Wildlife protection act, Forest protection act Air (Prevention and control of pollution) Act, Water related Environment laws ,issues in enforcement of environmental legislation, public awareness.
Unit – VII **Human population**	7a. Use of ICT in environment and human health areas.	7.1Concepts of Population Growth, Environment and human health, Role of information technology in

and environment		environment and human health

6. SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS (THEORY) :

Unit	Unit Title	Teaching Hours	Distribution of practical examination marks			
			R Level	U Level	A Level	Total Marks
I	Environment and studies	4	NA	NA	NA	NA
II	Environmental Natural resources	4	NA	NA	NA	NA
III	Ecosystems	4	NA	NA	NA	NA
IV	Biodiversity and conservation	4	NA	NA	NA	NA
V	Environmental Pollution	8	NA	NA	NA	NA
VI	Social issues and environment	4	NA	NA	NA	NA
VII	Human population and environment	4	NA	NA	NA	NA
Total		32	NA	NA	NA	NA

Legends: R = Remembrance; U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

7. SUGGESTED EXERCISES/PRACTICALS :

The tutorial/practical/exercises should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the competencies.

Here all the practical exercises are to be completed by students in a group. The group size should be 10 to 12. The groups should be formed by concerned teacher in consultation with students Every group should be assigned a group leader. All groups will complete the practical assignments in spare time and during Sundays and holidays. No separate time slots will be allotted to these practical exercises. Teacher will guide and give necessary inputs for modus operand of exercises.

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	I	Prepare report on environmental issues of your institute / Selected Premises	04
2	II	Collect information related to natural resources of India and methods adopted for conservation of these resources	02
3	I, II	Prepare "Energy Audit Report" of a small home. And give suggestions for conservation of energy.	02
4	III, IV	Examine water usage of a small community/locality in city/Apartment /Your Institute and prepare a Report on actions that could be taken to conserve the water fron following point of view: How much water is consumed How much wastage of water occurs How can demand of water be reduced How can ecological footprint of water they get can be reduced What other environment friendly ways of getting water can one implement What is the quality of water and how can it be improved How reuse and recycling of water can be done How users can be educated for proper use of water	02
5	I,II,III, VI	Visit, "Roof water harvesting" system installed in nearby area and prepare a detailed report. Include local bodies legislation as regards roof water harvesting	02
6	I,II,III	Undertake "Tree plantation project" and plant at least 03 trees per student in your Institute. Prepare detailed report on tree plantation.	02
7	I,II,III	Visit ,study and analyze a "Solar systems" installed in nearby area and prepare a detailed report. Include following types of systems, a.Household Solar water heating systems b. Solar P-V Systems c.Solar roof top Net metering systems	02
8	IV	Preparation of Biodiversity Report: Select a small park or garden in your area.Prepare a Biodiversity register: list all the species found in place ,find their scientific names with the help of a botanist. Interview long term users of the place and find out about loss of biodiversity. Write a report describing your observations and your recommendations for conservation of biodiversity.	04
9	V	Prepare a report on water pollution scenario in your institute and make a detailed report. Following activities can be undertaken with permission, Locating and studying water consumption locations in institute like Water coolers , R.O units, Filters, taps. Taking and checking drinking water samples periodically from testing authorities and keeping records. Preparing and executing schedule for cleaning water tanks, water filters, RO units etc.	06
10	V	Prepare report Vehicular pollution checking in your institute:	02

		Here sample check the two wheelers, four wheeler vehicles of employees, students with the help of Exhaust gas analyzer / Smokemeter periodically and check the levels of pollution.	
11	V	Prepare report of Noise and Air pollution levels at a crowded square of city using Deciblemeter and Air sampling device	02
12	VI	Collect information on Global Warming,Acid rain, Ozone layer depletion issue,Nuclear accidents and holocaust. Kyoto Protocol, Climate justice, Environment protection laws and regulations.	02
Total			32

8. SUGGESTED STUDENT ACTIVITIES :

Following is the list of proposed student activities like:

1 Search different journals on Environment
2 Collect info of Environmental laws and regulations from websites.
3 Collect various news paper cuttings on the issues of environment
4 Observe and celebrate following important days on environment,
- 22 April- Earth Day
- 1 – 7 July – Vanamahotsava Week
- 11 International Mountain day
- 2 February –Worlds wetland day
- 5 April – National Maritime day
- 8 June – World Oceans day
- 22 May – international Day of Biological diversity
- 22 March – World Water day.
- 21 March – World Forestry Day
- 16 October –Worlds food day
- 22 September –Car free day
- 29 October-National disaster reduction day
- 21 July – Worlds Population day
- 8 March – Womans day

5 Prepare charts, banners, posters on environment and its protection and display in class, notice boards.
6 Participate in social campaigns concerning environment and its preservation.
7

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATEGIES :

1. Q & A Techniques.
2. Field Visits
3. Expert Lectures.

10. SUGGESTED LEARNING RESOURCES :

S. No.	Title of Book	Author	Publication
1	Environmental Studies	R.Rajgopalan	OXFORD university press
2	Environmental Studies	Anindata Basak	Pearson education
3	Air Pollution	M.N. Rao	Tata Macgrawhill

4	Elements of Environmental Science and Engineering	P. Meenakshi	Prentice Hall
5	Introduction to Environmental Engineering	P.AarneVesilind and Susan Morgan	Thomson

11. Major Equipment/ Instrument with Broad Specifications :

Sr. No.	Major equipment/ Instrument with Broad Specification	Quantity
1	Biological Microscope	01
2	Air sample testing setup	01
3	Water sample testing setup	01
4	Exhaust gas Analyzer	01
5	Smoke meter	01
6	PC with Net connectivity	01
7	LCD Projector	01 et

12. E-learning resources :

(Please mention complete URL of the E- recourse CO wise)

1. www.unep.org
2. www.ipcc.ch
3. www.grida.no
4. www.wildlifeinindia.com
5. www.fsi.nic.in/sfr_2009.htm
6. www.unesco.org
7. www.chilika.com
8. www.foodfirst.org/media/opeds/2000/4-greenrev.html
9. www.cites.org
10. http://projecttiger.nic.in/
11. www.iwmi.cgiar.org/
12. www.worldwater.org
13. www.indiaenergyportal.org
14. http://www.lifeaftertheoilcrash.net/
15. www.mmpindia.org/
16. www.pcri.com
17. http://www.unwater.org/statistics_pollu.html

List of Films

1. The 11th hour
2. The many faces of madness
3. Planet Earth-BBC documentary
4. The childrens of Amazon
5. The Blue Planet-BBC documentary
6. End of Line

7. The State of planet – BBC Documentary
8. The truth about Tigers
9. Bringing home rain- A film by SushamaVeerappa.
10. Drinking the sky – BBC documentary
11. A Crude Awakening :The OIL Crash – A documentary by Basil Gelpke
12. Poison on a platter – Documentary by Mahesh Bhatt
13. The story of bottled water – A documentary by Annie Leonard on packaged water industry.(Download from www.storyofstuff.org)

13. POs and PSOs assignment and its strength of assignment with each CO of the Course :

CO. NO.	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	Analyze and assess the impact of biodiversity and its loss on environment.	2				2	2						
CO2	Identify causes of pollution in working system and apply control measures for prevention.					2	2						
CO3	Apply provisions of various environmental protection acts in practice.	2				3	3			3			
CO4	Appreciate correlation between Human population and its effect on environment.	2				2	2			3			
CO5	Read, analyze and apply various laws and regulations concerning environmental issues.	2				3	3						

Course Curriculum Design Committee :

Sr No	Name of the faculty members	Designation and Institute
1	Prof.S.P.Shiralkar	Lecturer in Mechanical Engineering Department
2	Prof. A.B. Deshpande	Lecturer in Mechanical Engineering Department

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **ENGINEERING MATHEMATICS(EMT)**

COURSE CODE **6G102**

Diploma program in which course is offered	Semester in which course is offered
Electrical Engineering	Second Semester

1. RATIONALE:

Engineering Mathematics forms foundation to understand basic principles of Engineering Mathematics to solve engineering problems. This subject is an extension of Basic Mathematics which deals with calculus, differentiation, integration, differential equations etc. which have applications in several engineering courses of various programmes. This course aims at multi-dimensional logical thinking and reasoning capabilities of the students.

2.COMPETENCY STATEMENT:

At the end of studying this course students will be able to

"Solve engineering problems using the principles of applied mathematics."

3. COURSE OUTCOMES

Students will be able to

1. Differentiate the various function using different rules
2. Apply rules of derivatives to solve engineering problems.
3. Apply rules of integration to solve engineering problems.
4. Solve the various types of differential equations.
5. Apply principles of central tendencies for quality assurance in engineering field

4. TEACHING AND EXAMINATION SCHEME

Teaching scheme (In hours)			**Total credits (L+T+P)**	**Examination scheme**				
				Theory Marks		**Practical marks**		**Total Marks**
L	**T**	**P**	**C**	**ESE**	**PT**	**ESE**	**PA**	
03	01	00	04	80	20	--	--	100
Exam Duration				3 Hrs	1 Hr.			

Legends:

L-Lecture; **T** – Tutorial/Teacher Guided Theory Practice(batch-wise); **P** Practical;

C – Credit; **ESE** -End Semester Examination; **PT** - Progressive Test.

5. CORSE DETAIL.

Unit	Major Learning Outcomes	Topics and Sub-topics
UNIT I Derivatives	1a.Differentiate various engineering functions	1.1 Definition of derivative, notation. 1.2 Derivative of standard functions. 1.3 Rules of Differentiation (without proof) such as sum, difference, product and quotient. 1.4 Derivative of composite functions. 1.5 Derivative of inverse trigonometric functions. 1.6 Derivative of implicit functions. 1.7 Derivative of parametric functions. 1.8 Logarithmic differentiation. 1.9 Second order derivatives.
UNIT II Applications of derivative	2a.Apply derivatives to find Velocity, Acceleration and Maxima & Minima	2.1 Tangent & normal. 2.2 Maxima & minima. 2.3 Radius of curvature.
UNIT III Integration	3a.Integrate various Functions using appropriate methods.	3.1 Definition of integration. 3.2 Integration of standard function. 3.3 Rules of Integration: sum, difference & multiplication. 3.4 Methods of Integration 3.4.1 Integration by substitution. 3.4.2 Integration by partial fraction. 3.4.3 Integration by parts. 3.5 Definition of Definite integral. 3.6 Simple problems on definite integral
UNIT IV Differential Equations	4a.Solve various types of differential equations.	4.1 Definition of differential equation, order &degree. 4.2 Formation of differential equation. 4.3 Solution of Diff. equation. 4.4.1 variable separable. 4.4.2 Homogeneous equation. 4.4.3 Exact diff. equation. 4.4.4 Linear diff. equation.
UNIT V Statistics	5a.Measure Central Tendencies 5b. Measure Dispersion for given data.	5.1 Graphical representation: Histogram & o-give curve to find Mode and median. 5.2 Measures of dispersion : Range, mean deviation and Standard deviation.

6. SUGGESTED SPRCIFICATION TABLE WITH HOURS AND MARKS (THEORY)

Sr,no	Title/Topic	Teaching Hours	Distribution of Theory Marks			
			Remembrance levels	Understanding levels	Application levels	Total
1	Derivative	12	2	08	08	18
2	Applications of derivative	04	00	04	08	12
3	Integration	16	06	08	12	26
4	Differential Equations	10	04	04	08	16
5	Statistics	06	02	02	04	08
TOTAL		48	14	26	36	80

7. SUGGESTED LIST OF TUTORIAL

1) The exercises should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the competency
2) Form a batch of 20 students and at least **ten** problems should be given to get necessary exercise.
3) Course faculty will provide programme related problems.

Sr. No.	**Title/Topic**	**Exercises/Tutorial**	**Approx. hours**
1	Derivative	Solve problems related to various methods/techniques of differentiations	03
2	Applications of derivative	Calculate Engineering Applications of Tangent, normal, maxima, minima and Radius of curvature from respective programmes.	03
3	Integration	Solve problems Related to Various Methods/Techniques of integration	04
4	Differential Equations	Solve problems Related to Various Methods/Techniques of Differential equation.	04
5	Statistics	Solve examples of Comparative data. Plot different types of graph.	02

8. SUGGESTED STUDENT ACTIVITIES

Following is the list of proposed student activities like:

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

a. Collect the mathematical derivation based on curriculum from respective programme.
b. Identify mathematical problems related to respective programme and get them solved.
c. Find graphical software using internet and list them.
d. Identify problems based on applications of differential equations and solve these problems.

e. Prepare a seminar on any relevant topic based on curriculum.

9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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

a. Use open resources available on internet to teach Engineering Mathematics.
b. Apply the mathematical concepts learnt in this course to branch specific problems.
c. Use different instructional strategies in classroom teaching.

10. SUGGESTED LEARNING RESOURCES

Sr. No.	Title	Author	Publication
1.	Mathematics for polytechnic students for second Year	S. P. Deshpande	Pune vidhyarti gruh prakshan Pune
2.	Applied Mathematics	By Patel & Rawal	Nirali prakashan Mumbai
3	Mathematics for polytechnic students for second year	G.V.Kumbhojkar	Phadke prakashan Kholapur

11. Major Equipment/ Instrument with Broad Specifications

Sr. No.	Name of the Equipment	Specification
1	NA	

12. Software/Learning Websites

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13. POs and PSOs assignment and its strength of assignment with each CO of the Course

CO. No.	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	Students will be able to differentiate the various function using different rules	2	3	1	-	-	-	-	-	-	-	-	-	-
CO2	Students will be able to apply the differentiation to Velocity, Acceleration and Maxima & Minima	-	-	1	-	1	-	-	-	-	-	-	-	-
CO3	Students will be able to so Integrate the various Function using different methods	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	Students will be able to solve the various types of differential equation using different methods.	1	1	3	-	-	-	-	-	-	-	-	-	-
CO5	Students will be able to Measure Central tendency and Measure Dispersion in given data	-	1	1	-	1	-	-	-	-	-	-	-	-

13. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Sr. No.	Name of the faculty member	Designation and Institute
1	Mr. M.A. Ali	Lecturer in Mathematics, Government Polytechnic, Aurangabad
2	Mr. R.B. Borulkar	Lecturer in Mathematics, Government Polytechnic, Aurangabad
3	Mrs. H.H. Bhumkar	Lecturer in Mathematics, Government Polytechnic, Aurangabad

Member Secretary PBOS	Chairman PBOS	Co-ordinator science and Humanities

COURSE TITLE ENGINEERING CHEMISTRY (ECH)

COURSE CODE 6G104

Diploma Programme in which this course is offered	**Semester in which offered**
ME/CE/EE//ET/CO/IT/AE	First/ Second Semester

1 RATIONALE:

Chemistry is a basic science subject which is essential to all engineering courses. It gives knowledge of engineering materials, their properties, related applications and selection of materials for specific engineering applications/work/job.

Due to technological progress, there are hazardous effects of chemicals, waste water and sewage water on environment & human life. The core knowledge of environmental effects will bring awareness; generate curiosity in students about the precautions & preventions to be taken to carry out further development resultantly to reduce the ill effects.

2. COMPETENCY:

At the end of studying this course students will be able to

"**Apply basic knowledge and principles of chemistry to solve different industrial problems."**

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme					
				Theory Marks		Practical Marks		Term work	Total Marks
L	T	P	C	ESE	PT	ESE	PA	ESE	TOTAL MARKS
3	0	2	5	80~	20~	25@	--	25	150
Examination Duration				2Hrs	1/2Hr.	2Hrs.	--	--	--

Legends: L-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** - Practical; **C** – Credit, **ESE** - End Semester Examination; **PT** - Progressive Test; OR-Oral examination; **PA** - Progressive Assessment(PR); ~Online Multiple choice examination. @ Internal Examination

3. COURSE OUTCOMES:

After providing classroom teaching and laboratory experiences related to this course, students will be able to

1. Draw the orbital configuration of different elements.
2. Represent the formation of molecules schematically.
3. Compare and use different types of cells.
4. Identify the properties of metals & alloys related to engineering applications.

5. Identify the properties of nonmetallic materials, related to engineering applications.
6. Select a proper material for specific purpose.
7. Select and use the lubricants at proper/ specific conditions of machines.

4. COURSE DETAILS:

Unit	Major Learning Outcomes	Topics and Sub-topics
UNIT-I Electronic Theory Of Valency & Molecule Formation	1a.Identification of structure and nature of atom, element and molecule.	1.1 Atomic no, atomic mass no. numerical problems on it , orbit & orbitals. 1.2 Electronic configuration, electronic configuration of first 30 elements. 1.3 Molecule formation: Valency, types of valency, electrovalency and covalency with suitable examples. Study of Formation of Electrovalent compounds e.g. NaCl, $CaCl_2$ & $MgCl_2$ and formation of Covalent Compounds examples H_2O, Cl_2, CO_2, N_2
UNIT-II Electrochemistry	2a.Verify Principle, construction, working and applications of different cells.	2.1 Arrhenius Theory of Ionization, Degree of ionization. 2.2 Basic concepts of Conductors, Insulators, Dielectrics, Electrolyte, Non Electrolyte 2.3 Electrolysis, Electrolytic Cell, Electrodes. 2.4 Electrolysis of $CuSO_4$ Solution by using Cu Electrode & Platinum Electrode 2.5 Faraday's first law of Electrolysis & numerical problems on it Application of Electrolysis such as Electroplating. 2.6 Electrochemical Cells & Batteries Types of cell Primary & secondary cell construction And Working of Dry cell & Lead – Acid Storage.

UNIT III Metals and Alloys	3a.Identify different mechanical properties and extraction methods of pure metal, Correlate properties, composition and applications of alloys with metal.	3.1 Definition of Metallurgy, Mineral, Ore, Gangue, Flux & Slag, Occurrence of Metals. 3.2 Mechanical Properties of metals such as hardness, Toughness, ductility, malleability, tensile strength. 3.3 Stages of Extraction of Metals from its Ores in detail i.e. its flow sheet Crushing, Concentration, methods of concentration (physical and chemical). 3.4 Reduction of iron in blast furnace with chemical reactions, Reactions in zone of reduction. **Alloys** 3.5 Definition of Alloy, Purposes of Making alloy. 3.6 Methods of Preparation of alloy such as fusion method & compression method 3.7 Classification of Alloys, Ferrous alloys & Non Ferrous alloys, their examples. 3.8 Composition, Properties & Applications of some common alloys such as Alnico, Duralumin, Wood's Metal
UNIT-IV Corrosion of Metals And its Application	4a. Classify corrosion from action of surrounding environment and its protection methods.	4.1 Definition of corrosion 4.2 Atmospheric corrosion or dry Corrosion, corrosion due to oxygen , different types of film formation. 4.3 Electrochemical Corrosion Hydrogen evolution mechanism. 4.4 Appling protective Coatings like metal coating by galvanising, tinning
UNIT-V Water	5a. Recognize ill effect of hard water and methods for purification of water.	5.1 Hard water & soft water, types of hardness, causes of hardness 5.2 Effects of hard water in different industries (such as paper , sugar , dying and textile industries) and domestic purposes. 5.3 Softening of hard water by Permutit process and ion exchange process,. 5.4 Potable water & its condition for pot-ability. Different methods of purification of water for drinking purposes chlorination and ozonation 5.5 pH – value of water its applications Numericals on pH values.

UNIT-VI Non Metallic Materials	6a. Identification of types , preparation, properties and applications of plastic, rubber and thermal insulating material.	6.1 Plastics Definition of Plastic, Formation of Plastic by Addition Polymerisation with examples Polyethylene & PVC. 6.2 Formation of Plastic by Condensation Polymerisation with suitable example as Nylon 6, 6; Bakelite plastic. 6.3 Types of Plastics, Thermo softening & Thermosetting Plastic & difference between them. 6.4. Engineering properties of plastic and its related uses. **RUBBER** 6.5 Natural rubber its extraction from latex, drawbacks of natural rubber. Synthetic Rubber its examples 6.6 Vulcanisation of rubber with chemical reaction. 6.7 Properties of rubber such as elasticity, tack, resistant to abrasion, rebound capacity. 6.8 Engineering Applications of rubber based on its properties. 6.9 Thermal insulating materials Definition & characteristics of ideal thermal insulator. **Glass wool** preparation, properties & applications. **Thermocole** properties and its applications.
Unit-VII Lubricants	7a. Select proper lubricant for different types of machineries.	7.1 Definition of lubricant and Lubrication. 7.2 Functions of lubricants. 7.3 Classification of lubricants with examples, 7.4 Mechanism of Lubrication by Fluid Film, Boundary & Extreme Pressure, 7.5 Physical Characteristics of Lubricants Such as Viscosity, Viscosity Index, Oiliness, Volatility, Flash & Fire Point, Cloud & Pour Point. 7.6 Selection of proper Lubricants for Various types of machines.

5. SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Electronic Theory of Valency and Molecular Formatin	8	2	6	4	12
II	Electrochemistry	6	2	8	2	12
III	Metals and Alloys	8	2	8	4	14
IV	Corrosion of Metals and it's Applications	6	2	4	2	8
V	Water	7	2	2	6	10
VI	Non Metallic Materials	7	4	8	4	16
VII	Lubricants	6	2	4	2	8
Total		**48**	**16**	**40**	**24**	**80**

Legends: R = Remembrance; U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6. SUGGESTED EXERCISES/PRACTICALS

The tutorial/practical/exercises should be properly designed and implemented with an attempt to develop different types of cognitive and psychomotor skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the competencies.

(Any TEN from following)

Sr. No.	Unit No.	Practical Exercises	Approx. Hrs. required
1	1	Write Orbital electronic configuration of different elements (First 30 elements)	2
2	2	Verify Faraday's first Law of electrolysis.	2
3	7	Find the normality & strength in grams per liter of the given solution (NaOH) with the help of standard hydrochloric acid.	2
4	5	Determine pH value of given solutions, water samples, by using, universal indicator and pH meter.	2
5	7	Determine the normality & strength of given hydrochloric acid solution by titrating it against standard potassium hydroxide solution.	2
6	3	Determine percentage of iron from steel by titration method.	2
7	5	Determine the hardness of potable water and boiler feeding water.	2
8	5	Determine the chloride content potable water and boiler feeding water.	2
9	6	Prepare phenol formaldehyde resin.	2
10	7	Determine the acid value of oil sample by neutralization method.	2

11	2	Qualitative analysis of given salt solutions, i.e. to determine one acidic and one basic radical from given salt solution. (At least 05 salt solutions.)	For each salt solution 2
Micro Project (Any one of following will be opted by a group of 5-6 students)			
Sr. No.	**Unit No.**	**Practical Exercises**	
1	1	Prepare power point presentation to show/demonstrate covalent bond, ionic bond.	
2	4	Effect of acid or alkali on rate of corrosion for different metals.	
3	5	Study of hard and soft water of different samples of water	
4	2	Study of mechanism and working of different batteries.	
5	2	Preparation of small scale batteries/ Galvanic cells. Collect chemicals and material from lab and household and prepare working model of cell.	
6	6	Collect different polymers and prepare the chart on the basis of its type, properties and uses.	

7. SUGGESTED STUDENT ACTIVITIES

a. Verify the properties of different types of compounds used in day to day life.
b. Differentiate properties and uses of different metals.
c. Differentiate composition, properties and application of different alloys.
d. Co-relate the effect of acidic environment with neutral environment.
e. Library survey regarding engineering chemistry topics regarding curriculum.
f. Animated Power point presentation containing current research development related to topics mentioned in curriculum.

8. SPECIAL INSTRUCTIONAL STRATEGIES

a. Search various sites to teach various topics/sub topics.
b. Instead of the traditional lecture method, use different types of teaching methods such as improved lecture method, question answer method, laboratory method to attained specific outcome.
c. Some topics are relatively simpler in nature is to be given to the students for self-learning by seminar or by classroom presentations
d. Teachers provide theme to create multiple choice questions.
e. Provide super visionary assistance for completion of micro-projects.

9. SUGGESTED LEARNING RESOURCES

Sr.No.	Title of Book	Author	Publication
1	Engineering Chemistry	Jain & Jain	Dhanpat Rai and Sons Co. **ISBN 9789352160006**
2	Engineering Chemistry	S. S. Dara	S. Chand Publication **ISBN 8121903599**
3	Chemistry of Engineering Materials	S.N. Narkhede	Nirali Prakashan

10. MAJOR EQUIPMENTS/ INSTRUMENTS WITH BROAD SPECIFICATIONS

Sr. No.	Name of the Equipment	Specification
1	pH meter	Digital ,Range 0 to 14 with Sensitive Glass electrode
2	Distilled water plant	S.S. plant with 15 lit capacity with 2Kv heating coil
3	Kipps's Apparatus	Airtight three section apparatus
4	Electrolytic cell for verification of Faraday's first law	Battery 24V and 5 Ampere , Rheostat 1000 Ohm, Wire, Ammeter 0 to 5 Ampere, Copper plate 3" x 6 " inch

11. E-LEARNING RESOURCES

(Please mention complete URL of the E- resourse CO wise)

Sr. No.	Web Address
1	http://www.webelements.com
2	http://www.chemtutor.com
3	http://www.chem1.com
4	https://phet.colorado.edu
5	www.visionlearning.com
6	www.onlinelibrary.wiley.com
7	www.rsc.org
8	www.chemcollective.org

12. POs and PSOs assignment and its strength of assignment with each CO of the Course

CO. No.	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	Draw the orbital configuration of different elements.	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2	Represent the formation of molecules schematically.	3	2	2	1	-	-	-	-	-	-	-	-	-
CO3	Compare and use different types of cells.	3	3	-	1	-	-	-	-	-	-	-	-	-
CO4	Identify the properties of metals & alloys related to engineering applications.	3	3	2	1	-	-	-	-	-	-	-	-	-
CO5	Identify the properties of nonmetallic materials, related to engineering applications.	3	3	1	2	-	2	-	-	-	-	-	-	-
CO6	Select a proper material for specific purpose.	2	2	2	1	1	1	-	-	-	-	-	-	-

CO7	Select and use the lubricants at proper/ specific conditions of machines.	2	2	2	1	1	1	-	-	-	-	-	-	-

13. Name and Designation of Course Designer:

Sr. No	Name of the faculty member	Designation and Institute
1	Dr. H.R. Shaikh	Lecturer in Chemistry, Government Polytechnic, Aurangabad
2	Dr. Devdatta V. Saraf	Lecturer in Chemistry, Government Polytechnic, Aurangabad
3	Mrs. R.A. Nemade	Lecturer in Chemistry, Government Polytechnic, Aurangabad
4	Mr. P.K. Shewalkar	Lecturer in Chemistry, Government Polytechnic, Jalna

Member Secretary PBOS Chairman PBOS Co-coordinator science and Humanities

COURSE TITLE- WORKSHOP PRACTICE(WSP)

COURSE CODE:-6G202

Diploma Programme in which this course is offered	Semester in which offered
CE/ME/AE/EE/ET/IT/CO	First/Second

1. RATIONALE

Workshop Practice is a basic engineering course. Diploma Engineers while working at worksites / in industries, supervises various skilled man power during industrial / site related process. He is required to be conversant with various skills. These basic skills are imparted in basic shops like wood working, fitting, welding, plumbing and sheet metal shop is essential for technician to perform his/her duties in industries. Students are able to perform various operations using hand tool equipment and machineries in various shops. Working in workshop develops the attitude of group working and safety awareness. This course provides industrial environment in the educational institute.

2. COMPETENCY

"Prepare simple jobs on the shop floor of the engineering workshop."

3. TEACHING AND EXAMNATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
	T	P	C	ESE	PT	ESE (OR)	PA	
	--	03	03	--	--	--	50	50

Legends : L-Lecture**; T**-Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, OR – Oral Examination, TW - Term Work, # External, @ Internal

4. COURSE OUTCOMES-

At the end of this course, students would be able to –

1. Select tools and machinery according to job.
2. Use hand tools in different shops for performing different operation.
3. Operate equipment and machinery in different shops.
4. Prepare job according to drawing.
5. Maintain workshop related tools, equipment and machineries

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit – I **General Workshop Practice**	1a. Follow safety practices 1b. Explain the procedure for extinguishing fire 1c. Use firefighting equipment 1d. Locate various machines and equipment in workshop 1e. Follow good housekeeping.	1.1 Safety Practices, Causes of accidents, General safety rules, Safety signs and symbols. 1.2 First Aid 1.3 Fire, Causes of Fire, Basic ways of extinguishing the fire Classification of fire, Class A, B,C, D, Firefighting equipment, fire extinguishers, and their types . 1.4 Workshop Layout 1.5 Issue and return system of tools, equipment and consumables
Unit– II **Fitting**	2a. Identify fitting tools. 2b. Explain operation of fitting shop machines 2c. Use hand tools 2d. Operate machineries. 2e. Perform fitting operations 2f. Maintain tools, equipment and machineries.	2.1 Fitting hand tools bench vice, hammers, chisels, files, hacksaw, surface plate, punch, v block, angle plate, try square, marking block , steel rule, twist drills, reamers, tap set, die set and their Specifications 2.2 Operation of fitting shops machineries - Drilling machine, Power saw, grinder their specifications and maintenance. 2.3 Basic process chipping, filling, scraping, grinding, marking, sawing, drilling, tapping, dieing, reaming etc.
Unit– III **Plumbing**	3a. Identify plumbing tools. 3b. Explain operation of fitting shop machines 3c. Use hand tools 3d. Operate machineries.	3.1 Plumbing hand tools pipe vice, pipe bending equipment, pipe wrenches, dies and their Specifications 3.2 Pipe fittings- bends, elbows, tees,

	3e. Perform plumbing operations 3f. Maintain tools, equipment and machineries.	cross, coupler, socket, reducer, cap, plug, nipple and their Specifications 3.3 Operation of Machineries in plumbing shops- pipe bending machine their specifications and maintenance. 3.4 Basic process cutting, threading.
Unit– IV **Metal Joining**	4a. Identify metal joining tools. 4b. Explain gas and arc welding procedure 4c. Use hand tools. 4d. Perform welding, soldering, brazing operations 4e. Maintain tools, equipment and machineries.	4.1 Gas welding hand tools- welding torch, welding tip, pressure regulator, oxygen and acetylene cylinders, spark lighter and their Specifications 4.2 Arc welding hand tools- electrode holder, cable connector, cable lugs, chipping hammer, earthling clamp, wire brush and their Specifications 4.3 Operation of machineries in welding shops- arc welding transformer their specifications and maintenance. 4.4 Welding Electrode, filler rod, fluxes, and solders. 4.5 Basic process welding, brazing and soldering.
Unit– V **Furniture Making**	5a. Select wood working tools as per job/ requirement. 5b. Explain operation of wood working machines 5c. Use hand tools 5d. Operate machineries. 5e. Perform wood working operations 5f. Maintain tools, equipment and machineries.	5.1 Types of artificial woods such as plywood, block board, hardboard, laminated boards, Veneer, fiber Boards and their applications. 5.2 Wood working hand tools carpentry vice, marking and measuring tools, saws, claw hammer, mallet, chisels, plans, squares, and their specifications 5.3 Operation of wood working machineries - Wood turning lathe, circular saw, their specifications and maintenance. 5.4 Basic process- marking, sawing, planning, chiseling, turning, grooving, boring.
Unit–VI **Sheet Metal**	6a. Identify sheet metal tools. 6b. Explain operation of sheet metal machineries. 6c. Use hand tools 6d. Operate sheet metal machineries.	6.1 Sheet metal hand tools snip, shears sheet gauge, straight edge, L square, scriber, divider, trammel, punches, pliers, stakes, groovers, limit set and their Specifications

	6e. Perform bending operations 6f. Maintain tools, equipment and machineries.	6.2 Operation of machineries in sheet metal shops- sheet cutting and bending machine their specifications and maintenance. 6.3 Basic process-marking, bending, folding, edging, seaming, staking, riveting.

6. SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS (Practical)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	General Workshop Practice	03	01	01	03	05
II	Fitting	12	-	03	06	09
III	Plumbing	06	-	02	07	09
IV	Metal Joining	09	01	02	06	09
V	Furniture Making	09	-	02	07	09
VI	Sheet Metal	09	-	02	07	09
	Total	48	02	12	36	50

Legends: R = Remembrance; U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

7. SUGGESTED EXERCISES/PRACTICALS

The tutorial/practical/exercises should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the competencies.

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	I	Perform mock drill session in group of minimum 10 students for extinguishing fire.	03
2	II	Prepare job involving marking, punching, sawing, chamfering, drilling, tapping operations as per given drawing. (simple job	09

		individually)	
3	III	Prepare plumbing job as per given drawing (individually)	06
4	III	Prepare black smithy job involving cutting, bending, drawing/ upsetting operations as per drawing (individually)	06
5	IV	Prepare lap joint/butt joint using arc welding as per given drawing (individually)	06
6	IV & V	Prepare utility job/ different working joints involving wood work as per given drawing (in group of 4 to 5 students)	12
7	VI	Prepare sheet cutting, bending, edging, end curling, lancing, soldering and riveting operations. (in group of 4 to 5 students)	06
Total			48

8. SUGGESTED STUDENT ACTIVITIES

Following is the list of proposed student activities like:

1. Prepare work diary based on practical performed in workshop. Work diary consist of job drawing, operations to be perform, required raw materials, tools, equipments, date of performance with teacher signature.
2. Prepare journals consist of free hand sketches of tools and equipments in each shop, detail specification and precautions to be observed while using tools and equipment.
3. Prepare/Download a specifications of followings:
    a) Various tools and equipment in various shops.
    b) Precision equipment in workshop
    c) Various machineries in workshop
4. Undertake a market survey of local dealers for procurement of workshop tools, equipment machineries and raw material.
5. Visit any fabrication/wood working/sheet metal workshop and prepare a report.

9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

1. Demonstration

10. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	Workshop Practice	Bawa, H.S.	McGraw Hill Education,Noida; ISBN-10: 0070671192 ISBN-13: 978-0070671195
2.	A Textbook of Manufacturing Process (Workshop Tech.)	Gupta, J.K.;Khurmi,R.S.	S.Chandand Co. New DelhiISBN:81-219-3092-8
3.	Workshop Practice Manual For Engineering Diploma & ITI Students	Hegde, R.K.	Sapna Book House, 2012, ISBN:13: 9798128005830
4.	Introduction to Basic Manufacturing Process & Workshop Technology	Singh, Rajender	New Age International, New Delhi; 2014, ISBN: 978-81-224-3070-7

11. **Major Equipment/ Instrument with Broad Specifications**

S. No.	Equipment Name with Broad Specifications	Experiment S.No.
1	Fire buckets with stand of medium size	I, II, III, IV,V, VI
2	Fire extinguisher A,B and C types	I, II, III, IV,V, VI
3	Wood Turning Lathe Machine, Height of Centre: 200mm, Distance between Centers: 1200mm, Spindle Bore: 20mm with Taper, Range of Speeds: 425 to 2800 with suitable Motor Drive. with all accessories	II
4	Circular Saw Machine, Diameter of saw blade 200 mm, Maximum Depth of Cut 50 mm, Table Size -350 x 450 mm, Table Tilting - 45^0	II
5	Wood working tools- marking and measuring tools, saws, claw hammer, mallet, chisels, plans, squares,	II
6	Carpentry Vice 200 mm	II
7	Work Benches- size:1800 x 900 x 750 mm	III

8	Bench Drilling machine (up to 13 mm drill cap.) with ½ H.P. Motor 1000 mm. Height.	III
9	Power Saw machine 350 mm mechanical with 1 HP Motor & all Accessories.	III
10	Bench Grinder 200 mm Grinding Disc diameter 200 mm. with 25 mm. bore 32 mm. with ½ HP/1HP Motor.	III
11	Vernier height Gauge 450 mm	III
12	Surface Plate 600 x 900 mm Grade I	III
13	Angle Plate 450 x 450 mm	III
14	Welding machine 20 KVA 400A welding current 300A at 50, 100, 200, 250, 300 with std. Accessories and Welding Cable 400 amp. ISI with holder	IV
15	Oxygen and acetylene gas welding and cutting kit with cylinders and regulators.	IV
16	Pipe Bending Machine	IV
17	Pipe Vice – 100 mm	IV
18	Pipe Cutter- 50 mm	IV
19	Bench Vice 100 mm	II,III,IV,V,VI
20	Portable Hammer Drill Machine 0-13 mm A.C. 230 V, 2.5Amp, Pistol type, having different types of bits	II, III, IV,V, VI
21	Sheet Bending Machine	VI
22	Sheet Cutting Machine	VI
23	Brazing Equipment	VI
24	Fitting tools - hammers, chisels, files, hacksaw, surface plate, punch, v block, angle plate, try square, marking block, steel rule, twist drills, reamers, tap set, die set.	III
25	Plumbing tools-pipe vice, pipe bending equipment, pipe wrenches dies.	IV
26	Gas welding hand tools- welding torch, welding tip, pressure regulator, oxygen and acetylene cylinders, spark lighter	V

27	Arc welding hand tools- electrode holder, cable connector, cable lugs, chipping hammer, earthing clamp, wire brush.	V
28	Sheet metal hand tools-snip, shears sheet gauge, straight edge, L square, scriber, divider, trammel, punches, pliers, stakes, groovers, limit set	VI

12. E-learning recourses

(Please mention complete URL of the E- recourse CO wise)

1. http://www.asnu.com.au
2. http://www.abmtools.com/downloads/Woodworking%20Carpentry%20Tools.pdf
3. http://www.weldingtechnology.org
4. http://www.newagepublishers.com/samplechapter/001469.pdf
5. http://www.youtube.com/watch?v=TeBX6cKKHWY
6. http://www.youtube.com/watch?v=QHF0sNHnttw&feature=related
7. http://www.youtube.com/watch?v=Kv1zo9CAxt4&feature=relmfu
8. http://www.piehtoolco.com
9. http://sourcing.indiamart.com/engineering/articles/materials-used-hand-tools/
10. https://www.youtube.com/watch?v=9_cnkaAbtCM

13. POs and PSOs assignment and its strength of assignment with each CO of the Course

CO. NO.	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO 1	Prepare simple jobs on the shop floor of the engineering workshop	1	2	3	3	1	-	1	2	2	2		3
CO 2	Select tools and machinery according to job	1	2	3	3	1	-	1	2	2	2	2	
CO 3	Use hand tools in different shop for performing different operation.	1	2	3	3	1	-	1	2	2	2		3
CO 4	Operate equipment and machinery in different shops	1	2	3	3	1	-	1	2	2	2	3	3
CO 5	Prepare job according to drawing	1	2	3	3	1	-	1	2	2	2		
CO 6	Maintain workshop related tools, equipment and machineries	1	2	3	3	1	-	1	2	2	2	3	

Sr No	Name of the faculty members	Designation and Institute
1	D.V.Tammewar	Workshop Superitendent
2	Dr.U.V.Pise	Head of Mechanical Engineering

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE- BASICS OF ELECTRICAL ENGINEERING(BEE)

COURSE CODE 6E201

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Electrical	Second

1. RATIONALE

Students of electrical engineering diploma need to possess a good understanding of concepts and principles of electrical engineering, which is essential to determine the Electrical Engineering parameters. Further, these concepts need to be assimilated by the students to understand concepts of advanced courses and develop skills that are needed by the industry. This will also be needed to analyze the different applications of electrical &electronics engineering circuits.

2. COMPETENCY

At the end of studying this course, students will be able to

"Use basic principles of electrical engineering in electrical system."

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (Hours/Credits)			Total Credits (L+T+P)	Examination Scheme(Marks)				
				Theory		Practical		Total Marks
L	T	P	C	ESE	PT	ESE(PR)	PA (TW)	150
04	--	02	06	80	20	25@	25	
Duration of the Examination (Hrs)				3	1	--	--	

Legends : L-Lecture**; T**-Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, **OR** –Oral Examination, **PR**- Practical Examination ; **TW** - Term Work, # External, @ Internal, ~ Online.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Determine electrical circuit parameters using basic laws.

2. Identify the different types of capacitors for different applications.
3. Select magnetic material for given application.
4. Apply the basic laws of electromagnetic induction.
5. Use different terms related to alternating voltage and current.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (Cognitive Domain Only)	Topics and Sub-topics
Unit-I Fundamentals	1a. Calculate resistance of material at different temperature. 1b. Use Ohms law to simplify series and parallel combination of resistive circuits. 1c. Calculate voltage and current in the given resistive circuits using KCL and KVL. 1d. Calculate electricity bill for simple domestic load.	1.1 Concept of Current, emf, Electric Potential, Potential difference, Resistance, Work, power, Energy. 1.2 Laws of resistance, resistivity, effect of temperature on resistance, Resistance temperature coefficient (simple numerical on 1.2) 1.3Types of resistance and their applications. 1.4 Ohms law: applications and limitations. 1.5 Series and parallel combination of resistance, current division rule, voltage division rule(simple numerical on 1.5) 1.6 Definitions of node, branch, loop, mesh. Kirchhoff's laws (simple numerical on 1.6). 1.7Specifications of commonly used domestic electrical appliances, calculation of electricity bill.(simple numerical on 1.7).
Unit– II Electrostatics & Capacitors	2a.Plot charging and discharging curve of capacitor. 2b.Select capacitors for different applications.	2.1 Electric charge, Electric field, Electro static induction, Electric flux, Flux Density, Electric field Intensity. 2.2 Capacitance, permittivity, Capacitors in series and parallel.(simple numerical on 2.2) 2.3 Energy stored in a Capacitor. 2.4 Charging and discharging of capacitors. 2.5 Types of capacitors and their

		applications.
Unit–III Magnetism	3a.Compare Electric and Magnetic circuits. 3b. Select a suitable magnetic material for given application. 3c.Solve numerical on series and parallel magnetic circuits.	3.1 Magnetic field, types of magnet, permanent and electromagnet, its applications. 3.2 Flux, flux density, magnetic field strength, mmf, reluctance, permeability. 3.3 Comparison between electric and magnetic circuits. 3.4 Magnetization curve, magnetic hysteresis, hysteresis loop, hysteresis loss and methods to minimize it. 3.5 Ohms law of magnetic circuits. 3.6 Concept of series and parallel magnetic circuits.(simple numerical on series magnetic circuit)
Unit–IV Electromagnetic Induction &Inductors	4a.Apply Faraday's law, Lenz's law, Fleming's right hand rule, Fleming's left hand rule in different applications. 4b.Differentiate between Statically and dynamically induced EMF, 4c. Select a suitable inductor for given application.	4.1 Faraday's laws of electromagnetic induction, Lenz's law, Fleming's right rule and left hand rule, Statically and dynamically induced emf. 4.2 Self and Mutual inductance. 4.3 Types of Inductor and their applications. 4.4 Energy stored in inductor.(Only Expression)
Unit–V AC Fundamentals	5a.Use different terms related to AC supply. 5b.Choose a suitable supply for given load.	5.1 Principle of generating an alternating voltage 5.2 Concept of AC and DC 5.3 Cycle, Time period, Frequency, Amplitude, Average value, R.M.S. value, Form factor, Peak Factor 5.4 Phase and Phase difference, (simple numerical on 5.2 &5.3)

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Teaching Hours	Distribution Of Theory Marks			
			R Level	U Level	A Level	TOTAL
1	Fundamentals	18	06	08	08	22
2	Electrostatics & Capacitors	12	04	04	06	14
3	Magnetism	14	06	04	08	18
4	Electromagnetic Induction &Inductors	13	06	04	06	16
5	AC Fundamentals	07	04	04	02	10
Total		64	26	24	30	80

Legends:*R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr.No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	1	A) Prepare a layout of electrical laboratory major and minor electrical equipments/instruments with their specification.	02
		B) Prepare charts of electrical safety, while handling equipments/instruments.	02
		C) Demonstrate for use of electrical tools (pliers, screw driver, insulation cutter, tester etc.)	02
2	1	Measure voltage and current for a given electrical circuit.	02
3	1	Determine equivalent resistance in parallel and series combination.	02
4	1	Use rheostat to regulate current and divide potential.	02
5	1	Use Ohm's Law to determine current in simple circuit.	02
6	1	Use Kirchhoff's current law to measure current in a particular branch of the given electrical circuit.	02
7	1	Use Kirchhoff's Voltage Law to measure voltage drop in a closed loop	02

		of the given electrical circuit.	
8	2	Plot charging and discharging curves for capacitors	02
9	3	Plot B-H curve for given magnetic material.	02
10	4	a)Use Faraday first law of electromagnetic induction to analyse behavior of statically induced emf in a given circuit.	02
		b)Use Faraday first law of electromagnetic induction to analyse behavior of dynamically induced emf in a given circuit	02
11	5	Use CRO to measure peak value, RMS value, Period and frequency of alternating quantity.	02
Total Hours			28

8. SUGGESTED STUDENTS ACTIVITIES

Following is the list of proposed student activities like:

a. Assignments on solving numerical
b. Identify and select various measuring instruments as per required range.
c. Identify and select resistors based on color code.
d. Identify and select capacitors based on color code
e. Calculate electricity bill for student's hostel
f. Write the specifications of appliances used at home.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

a. Demonstration
b. Activity based learning

10. SUGGESTED LEARNING RESOURCE

S.No.	Name of Book	Author	Publication
1	Electrical Technology Vol-1	Theraja, B. L.	S. Chand& Co. Ltd., 2011 or latest edition
2	Basic Electrical Engineering	Mittle V.N.	Tata McGraw-Hill latest edition.
3	Principles of Electrical Engineering	Gupta B.R.	S.K. Kataria,2012 or latest edition

4	Basic Electrical Engineering	Rao Uma. K.	Pearson Education, India, 2012 or latest edition
5	Basic Electrical Engineering	Murthy R. S.	Pearson Education, India,2011 or latest edition
6	A Course in Electrical Technology Vol. I	Gupta J.B.	S.K.Kataria& Sons, 2012 or latest edition
7	Fundamentals of Electrical Engineering	Singh Tarlok	S.K.Kataria& Sons,2012or latest edition

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED:

Sr. No	Name of the Equipment	Brief specification
1	Ammeter	(0-5A)
2	Voltmeter	0-150/300
3	Wattmeter	0-500 watt
4	Multimeter	0-250v, 0-10000kohm,0-20uF
5	Stopwatch	60 seconds
6	Thermometer	-10C to 100C
7	Rheostats	0-50/90/250/350 ohm
8	Capacitors	1uf
9	Inductors	100mH

12. LEARNING WEBSITE & SOFTWARE

a. www.allaboutcircuits.com/vol_1/chpt_ml
b. http://openbookproject.net/electricCircml
c. www.kpsec.freeuk.com
d. www.howstuffwork/
e. www.nptel/electrical.com

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs)WITH COURSE OUTCOMES (COs)

SNo	Course Outcome	Pos										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Determine electrical circuit parameters using basic laws.	1	3	2	1								
2	Identify the different types of capacitors for different applications.		3	1									
3	Select magnetic material for given application.		3	1	1								
4	Apply the basic laws of electromagnetic induction.		3	1	1							1	
5	Use different terms related to alternating voltage and current.		2	1									

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	M.D. Kharad	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad
2	S.J. Ghorpade	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

+COURSE TITLE- FUNDAMENTALS OF ELECTRONICS(FOE)

COURSE CODE 6E202

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Electrical	Second

1. RATIONALE

Electronics is becoming a part and parcel of electrical systems in the industry/power system. Hence it is essential for an electrical diploma engineer to have fundamental understanding of use of various electronic devices and circuits. This course provides the knowledge of working and applications of various types of semiconductor components.

2. COMPETENCY

At the end of studying this course students will be able to

"Identify the discrete electronic devices and components in various electrical circuits."

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (PR)	PA (TW)	150
4	-	2	6	80	20	25 @	25	
Duration of the Examination (Hrs)				3	1	--	--	

Legends : L-Lecture**; T-**Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment; **OR-**Oral Examination, **PR-** Practical Examination; **TW** - Term Work, # External, @ Internal,~ Online.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Identify the semiconductor diodes and its characteristics.
2. Select a suitable rectifier and filter for given application.

3. Use transistors and transistor biasing in electronic circuit.
4. Select power amplifier for given application.
5. Select the proper regulated power supplies and instruments.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (in Cognitive Domain only)	Topics and Sub-topics
Unit – I Semiconductors and Semiconductor devices	1a. Compare conductor, insulator & semiconductor. 1b.Distinguish the intrinsic and extrinsic semiconductor materials. 1c.Select Zener diode for given application.	1.1Classification of materials as conductors, insulators & semiconductor. 1.2 Extrinsic & Intrinsic semiconductor (P & N type) Effect of temperature on Extrinsic semiconductors. 1.3 Concept of P-N junction Diode & Zener diode, formation of depletion layer, forward biased and reverse biased P-N junction Diode, working, characteristics of P-N junction Diode and Zener diode. 1.4 Zener diode as load voltage Regulator. 1.5 Photo diode, Varactor diode, Light Emitting Diode. 1.6 Symbols of FET, MOSFET, UJT, SCR, Static Induction Thyristor (SIT)
Unit-II Rectifiers and filters	2a.Select the rectifier circuit for given application. 2b. Differentiate between C, L, LC and Π filters.	2.1 Rectifier circuits: Half wave Rectifier, Full wave Rectifier--Centre tap & Bridge Rectifier. Their Merits & Demerits. 2.2 Ripple factor, Transformer utilization factor, Rectification Efficiency, Peak Inverse Voltage. 2.3 Simple numericals on rectifiers based on 2.2 2.4 Filters-Necessity of filter, Types of Filters-L,C, LC, Π

Unit– III Transistor and Transistor biasing	3a. Distinguish between PNP and NPN transistors. 3b. Compare CB, CE and CC transistors.	3.1 Construction, working of PNP and NPN transistors, relationship between α and β. 3.2 Transistor as a switch. 3.3Transistor configurations & characteristics for CB, CE, CC configurations. 3.4 Concept of Load line. 3.5 Biasing methods of transistors: a) Base bias b) Base bias with emitter feedback c) Base bias with collector feedback d) Voltage Divider Bias e) Emitter Bias
Unit–IV Power Amplifier	4a. Identify the transistor amplifier as an CE amplifier. 4b. Identify the power amplifier for the given application.	4.1 Transistor as an amplifier-CE amplifier. 4.2 Different Methods of Cascading of amplifiers. 4.3 R-C coupled amplifier 4.4 Concept of Oscillatory circuit and enlist its type of oscillator.
UNIT –V Regulated power supplies and Instruments	5a. Identify the different types of voltage regulator circuits. 5b.Genearate the different waveforms through function generator. 5c.Use CRO to plot output of function generator.	5.1 Regulated power supply, Shunt voltage regulator. 5.2 Transistorized series voltage regulator – basic circuit and circuit with feedback, (without derivation) 5.3 3Terminal Fixed/variable voltage regulator: 78xx, 79xx, LM317 5.4 Function Generator. 5.5 Cathode Ray Oscilloscope(CRO)

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Teaching Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL
1	Semiconductor and Semiconductor devices	18	10	8	6	24
2	Rectifiers and filters	14	6	8	2	16
3	Transistor and Transistor biasing	16	6	8	6	20
4	Power amplifier	08	4	4	2	10
5	Regulated power supplies and Instruments	08	4	4	2	10
Total		64	30	32	18	80

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	1	Identify passive Components and Active components.	02
2	1	Identify the terminals of PNP and NPN	02
3	1	Test the performance of PN junction diode.	02
4	1	Test the performance of Zener diode.	02
5	2	Build/ test Half wave Rectifier & measure output voltage.	02
6	2	Build/ test Full wave Rectifier & measure output voltage.	02
7	2	Use LC filter to minimize ripple factor.	02
8	3	Test different transistor using multimeter	02
9	3	Plot input & output characteristics of transistor in CE configuration	02
10	3	Plot input & output characteristics of transistor in CB configuration	02
11	4	Identify the different transistor as an amplifier	02
12	5	Test the performance of regulator -IC 78XX,79XX	02
13	5	Connect the function generator to CRO and plot different waveforms	02
14	5	Troubleshoot given DC regulated power supply	02
Total Hours			28

8. SUGGESTED STUDENTS ACTIVITIES

Other than class room and laboratory activities following are the suggested guided co-curricular students activities which need to be undertaken to facilitate the attainment of various course outcomes of this course. The students are required to maintain portfolio of their experiences which he/ she will submit at the end of the term.

a. Test the electronic components such as diode, transistor, SCR, IC etc.
b. Prepare mini project on semiconductor/rectifier/transistors.
c. Prepare chart for characteristic of various electronics components.
d. Field survey for various electronics components used in different circuits.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Improved Lecture methods
b. Demonstration

10. SUGGESTED LEARNING RESOURCE

S.No.	Name of Book	Author	Publication
1.	Basic Electronics and linear circuits	Bhargava, N.N.	TMH, New Delhi 2012
2.	Principle of Electronics	Mehta, V.K.	S.Chand, New Delhi 2012
3	Electronics Principles	Malvino, Albert	TMH, New Delhi 2012
4	Electronics Fundamental and application	Chattopadhyay , D.	New Age International Publishers 2011
5	Basic electronics	B. L. Theraja	S. Chand, New Delhi2012

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED :

S. No.	Name of equipment	Brief specification
1.	Regulated power supply	Dual DC, 0-30V/1A & 5V /1A with resolution of 10mV, 2mA

2.	Digital Storage Oscilloscope	300 MHZ Bandwidth , 2GSa/s maximum real time sampling rate refresh rate upto 2000 wfams/s , RS232 & USB connectivity
4	C.R.O	30 MHz Bandwidth, 2 channels, 20 ns sampling time.
5	Function generator	10 HZ to 10 MHZ, 10 Vpp, rise & fall time =20ns, manual / external triggering
6	Digital Multimeter	51/2 digits resolutions with all basics measurement facility like DC Voltage: 200 mV ~ 1000 V, DC Current: 200 μA ~ 10 A, AC Voltage: True-RMS, 200 mV ~ 750 V, AC Current: True-RMS, 20 mA ~ 10 A, 2-Wire, 4-Wire Resistance: 200 Ω ~ 100 MΩ, Capacitance Measurement: 2 nF ~ 10000μF, Frequency Measurement: 20 Hz ~ 1 MHz etc., 0.015% DC Voltage Accuracy.

12. LEARNING WEBSITE & SOFTWARE

i. http://www.radio-electronics.com/info/data/semicond/semiconductor/diodes-theory-basics-tutorial.php
ii. www.academia.edu/.../UNIT_II_RECTIFIERS_FILTERS_AND_REGULATORS
iii. http://www.electronics-tutorials.ws/amplifier/amp_5.html
iv. https://www.electrical4u.com/what-is-an-oscillator/
v. http://www.sigmainstruments.com/p03_dc_regulated_power_supply.htm

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

SNo	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Identify the semiconductor diodes and its characteristics.	1	3	1	1								
2	Select a suitable rectifier and filter for given application.		3	2									
3	Use transistors and transistor biasing in electronic circuit.		3	1									
4	Select power amplifier for given application.		2	1	1								

5	Select the proper regulated power supplies and instruments.		2	1		1						1	

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	L.B.Nehate	Lecturer in Electrical Engineering, Govt. Polytechnic,Aurangabad
2	S.R.Bhasme	Lecturer in Electrical Engineering, Govt Polytechnic, Aurangabad
3	V.R.Jadhav	Lecturer in Electrical Engineering, Govt Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **ELEMENTS OF MECHANICAL ENGINEERING(EME)**

COURSE CODE **6E207**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Electrical	Second

1. RATIONALE

This course introduce the basic knowledge of elements of mechanical engineering which makes the student to understand the process of different mechanical components. This course introduces simple machine elements like shafts, belts, keys couplings, bearings, different drives, prime movers, AC and refrigeration, turbines, compressors, pumps etc. The fundamental knowledge of Mechanical engineering components is essential for electrical engineer.

2. COMPETENCY

At the end of studying this course students will be able to

"Identify major mechanical machine and components."

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (OR)	PA (TW)	50
2	-	2	4	--	--	25@	25	
Duration of the Examination (Hrs)				--	--	--	--	

Legends : L-Lecture**; T-**Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment; **OR** – Oral Examination, **PR**-Practical Examination; **TW** - Term Work, # External, @ Internal, ~ Online.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Identify the parts of boiler.
2. Identify the parts of IC engines and turbines.
3. Describe working of refrigerators and AC.
4. Identify and describe different mechanical power transmission elements.
5. Describe the working of pumps and compressors.
6. Select different manufacturing processes for given machine.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (in cognitive domain only)	Topics and Sub-topics
Unit– I Steam Generator	1a. Identify the Boiler for given application. 1b. Compare Water Tube and Fire tube Boiler.	Steam Generator: 1.1 Terminology of boiler 1.2 Classification of boilers. 1.3 Requirement of good boiler. 1.4 Constructional details and working of Water tube & Fire tube boiler 1. 5 Compare Water tube & Fire tube boiler.
Unit– II Prime Movers	2a. Identify parts of I.C. Engine 2b. Compare 4-Stroke and 2-Stroke engine. 2c. Describe the working principle of different turbines.	Prime Movers: 2.1 I. C. Engine- Classification, Constructional details of IC engine, Working principal of 4 stroke and 2 stroke IC engines(S. I. and C. I.), Comparison between 4 S & 2-S engine. (No analytical treatment) 2.2 Steam turbine – Working principle, Simple impulse turbine and reaction turbine. 2.3 Gas turbine - Working principal, basic components, open cycle type gas turbine 2.4 Hydraulic turbine – Working principal, Impulse turbine(Pelton wheel)
Unit– III Refrigeration and Air Conditioning	3a. Recognize and List the parts of refrigeration and Air conditioner. 3b. Describe the working principle of Refrigeration system.	Refrigeration and Air Conditioning 3.1 Introduction to Refrigeration and AC. 3.2 Refrigerating effect, Unit of refrigeration and C. O. P. 3.3 Basic components and working of vapor compression refrigeration system. 3.4 Introduction of domestic refrigerator and water cooler.

Unit – IV Machine Elements and Mechanical Power Transmission	4a. Identify different Machine Elements. 4b. Select drives for given application.	Machine Elements and Mechanical Power Transmission- 4.1 Shaft, keys and Bearings. 4.2 Coupling- Different types & its applications. 4.3 Selection criteria for drives. 4.4 Types and applications of following drives. 4.4.1 Rope drive. 4.4.2 Belt drive. 4.4.3 Chain drive. 4.4.4 Gear drive. 4.5 Power transmission in Machine tools- Lathe, Drilling machine, Grinding machine.
Unit – V Compressors And Pumps	5a. Select the pumps for given application. 5b. Describe construction and working of Single stage air compressor.	Compressors And Pumps 5.1 Introduction to Compressors and Pumps 5.2 Industrial application of compressed air &Pumps. 5.3 Construction and working of single stage reciprocating air compressor with PV diagram 5.4 Construction and working of Reciprocating and centrifugal pump, Mono-block pump, Submersible pump, Deep Well pump.
Unit – VI Basic Manufacturing Processes	6a. Select manufacturing processes for specific application.	6.1 Manufacturing Process – Definition and types. 6.2 Introduction to machining, joining, forming and casting. 6.3 Applications of above processes.

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Teaching Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL
1	Steam Generator	04				NA
2	Prime Movers	07				NA
3	Refrigeration and Air Conditioning	08				NA
4	Machine Elements and Mechanical Power Transmission	06				NA
5	Compressors And Pumps	05				NA
6	Basic Manufacturing Processes	02				NA
Total		32				

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	1	a) Outline constructional details of Babcock & Wilcox boiler, La-Mont boiler models.	02
		b)Identify Boiler mountings and accessories	02
2	2	a) Operate 2 Stroke petrol/Diesel engine.	02
		b) Operate 4 stroke petrol/Diesel engine.	02
3	2	Assemble and dissemble gas turbine model.	02
4	3	a) Operate Domestic Water cooler.	02
		b) Operate Window Air Conditioner.	02
5	4	Prepare layout showing constructional details of different power transmission elements used in Crane, sugar cane machine, Lathe machine and different machines in Workshops. (By visit)	04

6	5	a) Operate Compressor for given application.	02
		b) Assemble submersible pump.	02
7	6	Prepare a report on different manufacturing processes in an Industry.(By visit)	06
Total Hours			28

8. SUGGESTED STUDENTS ACTIVITIES

Other than class room and laboratory activities following are the suggested guided co-curricular students activities which need to be undertaken to facilitate the attainment of various course outcomes of this course. The students are required to maintain portfolio of their experiences which he/ she will submit at the end of the term.

a. Internet survey of thermal power plants available in India and their capacities.
b. Survey of Prime movers – Electric motors / I.C. Engines available in the market along with specifications.
c. Field visit to maintenance shops of AC and Refrigerator.
d. Field survey of the supplier/trader for commercial sizes of components such as shafts, keys, bolts, fasteners, springs, bearings available in market.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Demonstration of different mechanical machines.
b. Activity based learning
c. Field visit

10. SUGGESTED LEARNING RESOURCE

S.No.	Name of Book	Author	Publication
1	Thermal Engineering	P. L. Ballany	Khanna Publication New Delhi
2	Refrigeration& Air Conditioning	DR. V. M. Domkundwar	Dhanpat Rai & Sons. New Delhi

3	Elements of Mechanical Engineering	Bhave And Tamne	Nirali Prakashan,Jalgaon
4	Fluid Mechanics & Machinery	Modi And Seth	Standard Publication House New Delhi
5	Mechanical Engineering Drawing	N D Bhat	Charotor Publication
6	Thermal Engineering	Rajput	Dhanpat Rai & Sons
7	A course on workshop Technology	B.S.Raghuvanshi	Dhanpat Rai & Sons

11. **LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED** :

S. No.	Name of equipment	Brief specification
1.	Model of Boiler	As per Mechanical industry specification
2.	Shafts, couplings, keys Bearings, pulleys, belt drive, chain drive, gear drive, model.	As per Mechanical industry specification
3.	Compressors and pumps.	As per Mechanical industry specification
4.	Prime movers	As per Mechanical industry specification
5.	Refrigeration and AC.	As per Mechanical industry specification

12. LEARNING WEBSITE & SOFTWARE

a. http://www.turbineworking/overview
b. http://www.prime movers.com
c. http://www.engineering design.com
d. http:/www.slideshare.net/QRCE/product-design-development
e. http:// https://en.wikipedia.org/wiki/Machine_Design
f. www.pumps.com/
g. www.compressors.com

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

SNo	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Identify the parts of boiler.	3	2	1									
2	Identify the parts of IC engines and turbines.	1	2										2
3	Describe working of refrigerators and AC.	3	2	1	1								
4	Identify and describe different mechanical power transmission elements.	2	1	1	1								1
5	Describe the working of pumps and compressors.	2	1	1									2
6	Select different manufacturing processes for given machine.	1	1	1							1		

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	A.A.Ghate	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad
2	A.W.Nemade	Lecturer in Mechanical Engineering, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE : COMMUNICATION SKILLS(CMS)
COURSE CODE : 6G302

Diploma Programme in which this course is offered	Semester in which offered
All Branches of Diploma in Engineering and Technology	Second Semester

1. RATIONALE

Proficiency in communication skills is one of the prime needs of diploma engineer/ technician who has to communicate all the time with peers, superiors, sub-ordinates and clients in his professional life. The need of acquiring effective communication skills is more essential. As the world is shrinking into a global village with the new technologies, technically sound diploma holders may be a quality human resource, if their communicative abilities are shaped properly. Therefore, this course is designed to develop the ability of students to stand as a skilled and effective communicator with employability skills.

2. COMPETENCY

At the end of studying this course students will be able to

"Communicate effectively at workplaces."

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	**T**	**P**	**C**	**ESE**	**PT**	**ESE(OR)**	PA	TOTAL MARKS
1	0	2	3	-	-	25	50@	75
Exam Duration				-	-	-	-	

(*): *Out of 50 marks, 10 marks -micro-project assessment; 40 marks-progressive assessments*

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

4. COURSE OUTCOMES

1. Express new ideas effectively.
2. Select suitable type of communication in different situations.
3. Avoid communication barriers for effective communication.
4. Use appropriate body language to communicate effectively.
5. Formulate various ways to face interview effectively.
6. Draft different types of business letters, notices, memoranda and E-mails using correct formats.

5. COURSE DETAILS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
UNIT-I Introduction to communication	1a. Describe significance of Communication. 1b. Describe the elements of communication. 1c. Explain the cycle & process of communication. 1d. Identify the various communication situations.	1.1. Definition, importance 1.2. Communication cycle / process 1.3. Elements of Communication
UNIT-II Types of communication	2a.Identify the types of communication. 2b.Explain the types of communication.	2.1. Verbal-nonverbal , formal-informal, upward-downward, horizontal-diagonal communication
UNIT -III Principles of effective communication	3a.Explain the principles of communication. 3b.Illustrate principles of effective communication. 3c. Describe communication barriers. 3d. Identify the types of communication barriers. 3e. Select ways to overcome communication barriers.	3.1.Effective Communication 3.2.Barriers to communication & ways to overcome them
UNIT-IV Non -Verbal Communication	4a. Understanding non-verbal communication. 4b. Know the uses of body language. 4c. Uses of pictorial representations.	4.1.Non-verbal codes 4.2.Aspects of body language 4.3. Pictorial representation
UNIT –V Interview Techniques	5a. Listening& comprehending the passage. 5b. Having presence of mind. 5c. Managing stress. 5d. Facing viva.	5.1.Listening skills 5.2.Stress management 5.3.facing oral communication
UNIT-VI Formal Written Skills	6a. Correct format with correct language. 6b. Identify the types of letters. 6c.Applying different techniques of drafting letters.	6.1.Business Letters: Enquiry, Order, Complaint, Adjustment, Seeking Permission etc.

6. SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to Communication	03	NA	NA	NA	NA
II	Types of communication	02	NA	NA	NA	NA
III	Principles of Effective Communication	03	NA	NA	NA	NA
IV	Non-verbal communication	03	NA	NA	NA	NA
V	Interview Techniques	02	NA	NA	NA	NA
VI	Formal written skills	03	NA	NA	NA	NA
	Total	16	NA	NA	NA	NA

Legends: R = Remembrance; U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

7. SUGGESTED EXERCISES/PRACTICALS

The tutorial/practical/exercises should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psycho-motor and affective domain)** so that students are able to acquire the competencies.

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	I & II	Identify the elements of communication cycle with three Suitable examples.	04
2	II	Deliver two short and long prepared speeches.	04
3	III	Present a role-play.	04
4	III	Form a group of four students and make a group discussion on current issues and summarize it.	04
5	II&IV	Prepare a power point presentation on any one technical topic.	04
6	III	Demonstrate any assigned activity using appropriate body language.	04
7	III	Face a mock-interview.	04
8	IV	Write two formal letters in correct format.	04
Total			**32**

8. SUGGESTED STUDENT ACTIVITIES

Following is the list of proposed student activities:

a. List the different communication situations.
b. Use audio visual aids to learn different skills in communication.
c. Conversations –formal/informal.
d. Read newspaper.
e. Collect different audio clips.
f. SWOT analysis.
g. Deliver welcome/farewell speeches in various programmes.
h. Use of graphics in technical writings.
i. Interviewing common people.
j. Debating practices.
k. Summarizing discussions.
l. Practicing interviews

9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

a. Arrange various debate/elocution competitions to develop spoken communication skills.
b. Show audio/video clips to develop listening skills.
c. Collect various pictures/charts to demonstrate body language.
d. Prepare and give oral presentations.
e. Guide micro-projects in groups as well as individually.

10. SUGGESTED TITLES OF MICRO PROJECTS

A micro-project is planned to be undertaken by a student. He/she ought to submit it by the end of the semester to develop the industry oriented COs. The micro-project could be industry application-based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty**:**

a. Find out five communication events from day to day life and explain them in the form of communication process.
b. Find out various reasons of communication gap in certain official situations.
c. Identify various types of communication situations in student's life.
d. Study various barriers occurring in communication among diploma students.
e. Find out the remedies to overcome psychological barriers in communication.
f. Collect different types of letters and analyze the language and format used in it.
g. Prepare a review on the listened story/news/discussion/meeting.

11. SUGGESTED LEARNING RESOURCES

Sr.No.	Title of Book	Author	Publication
1.	Business Communication	R.C.Bhatiya	Ane Books India, New Delhi.
2.	Developing Communication Skills	Krishna Mohan& Meera Banerjee	Macmillan
3.	Power Point Presentation	Adam B Cooper	Macmillan
4.	Group Discussions & Interviews	Dr.B.R.Kishor& D. S.Paul	Vee Kumar
5.	Body Language	Allan Pease	Sheldon Press, London.

12. Major Equipment/ Instrument with Broad Specifications

Sr.No.	Name of the Equipment	Specification
1	Digital English Language Laboratory	
2	Computers and Headphones	
3	Magazines,Articles,Journals in Lab.	

13. E-learning resources

(Please mention complete URL of the E- resourses CO wise)

1	https://www.nptel.ac.in/courses
2	https://www.k12reader.com
3.	https://www.eduaction.com
4.	https://www.k5learning.com
5.	https://www.english4u.com

POs and PSOs assignment and its strength of assignment with each CO of the Course -

CO. NO.	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	Develop the habit to express new ideas properly.	1	1	3	-	1	-	-	-	1	1	-	-	-
CO2	Select correct type of communication in different situations.	-	-	1	-	1	-	1	1	1	1	-	-	-
CO3	Avoid communication barriers for effective communication.	-	-	2	-	2	2	2	2	2	2	-	-	-
CO4	Use appropriate body language to communicate effectively	-	-	1	-	2	2	2	3	3	3	-	-	-

CO5	Formulate various ways to face interview effectively.	-	-	2	-	3	2	2	3	3	3	-	-	-
CO6	Draft different types of business letters, notices, memoranda and E-mails using correct formats.	-	-	1	-	1	-	-	1	1	1	-	-	-

Sr. No	Name of the faculty member	Designation and Institute
1	Mrs. P.Y. Kamble	Lecturer in English, Government Polytechnic, Aurangabad
2	Mrs. M.S. Ban	Lecturer in English, Government Polytechnic, Aurangabad
3	Mr. P.V. Deshmukh	Lecturer in English, Government Polytechnic, Aurangabad
4	Mr. R.L. Korde	Lecturer in English, Government Polytechnic, Aurangabad
5	Mr. D.D. Gangthade	Lecturer in English, Government Polytechnic, Aurangabad
6	Mr. A.P. Jagtap	Lecturer in English, Government Polytechnic, Osmanabad

Member Secretary PBOS Chairman PBOS Co-coordinator
science and Humanities

COURSE TITLE- ELECTRICAL MEASUREMENTS (ELM)

COURSE CODE 6E203

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Electrical	Third

1. RATIONALE

Measurement of the quantities is essential to operate and maintain the electrical machines and systems. The electrical diploma engineer needs to be competent to use, calibrate and maintain different types of electrical measuring instruments. This basic technology course provides better understanding of construction, working and use of various types of measuring instruments. This course is at Basic level.

2. COMPETENCY

At the end of studying this course students will be able to

"Use different types of electrical measuring instruments proficiently."

3. TEACHING AND EXAMNATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (PR)	PA (TW)	150
4	-	2	6	80	20	25#	25	
Duration of the Examination (Hrs)				3	1	--	--	

Legends : L-Lecture**; T-**Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, OR – Oral Examination, TW - Term Work, # External, @ Internal

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Select the electrical instruments for given application

2. Use different methods of resistance measurement
3. Identify various parts of indicating instruments
4. Calibrate given instrument
5. Select the proper method of power measurement

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (Cognitive Domain Only)	Topics And Sub-Topics
Unit - I Fundamentals of measurement	1a. Differentiate between direct and indirect measurement 1b. Discriminate between Indicating, integrating and recording, absolute and secondary instruments 1c. Differentiate between defecting, controlling and damping torques 1d. Explain different terms related to measurement 1e. Differentiate between different types of errors with example	1.1 Methods of Measurement – Direct and Indirect methods 1.2 Types of Instruments – Indicating, integrating and recording, absolute and secondary instruments 1.3 Deflecting, controlling and damping torques 1.4 Methods of developing these torques 1.5 Range, error, true value, indicated value, reliability, sensitivity, repeatability, reproducibility, precision, accuracy 1.6 Types and sources of errors – gross error, systematic error, random error 1.7 Remedies for above error
Unit - II Measurement of Resistance	2a. Select an instrument for measuring resistance in given application 2b. Differentiate between different types of potentiometers 2c. Classify different types of resistances	2.1 Construction and working of DC potentiometer, and its applications 2.2 Dial type and Crompton type 2.3 Standardization of potentiometer 2.4 Low, Medium and High resistance 2.5 Kelvin's Double Bridge 2.6 Wheatstone bridge, Ammeter-voltmeter method, Ohmmeter 2.7 High resistance by Megger 2.8 Earth resistance by earth tester
Unit - III Electro mechanical Instruments	3a. Use instruments in a given application 3b. Differentiate between moving iron & PMMC instruments 3c. Select different types of electro-mechanical instruments for different kinds of measurement	3.1 Moving iron instruments: Attraction type and repulsion type 3.2 PMMC instruments: ammeter, voltmeter 3.3 Electrodyanometer type meter: wattmeter 3.4 Single-phase and 3 phase power factor meter 3.5 Frequency meter (resonance type, Weston type) 3.6 Phase sequence indicator(static type and rotating type) 3.7 Clamp on meter 3.8 Extension of range using shunt,

		multipliers and derive equation Simple Numerical 3.9 Extension of range of meters using instrument transformer such as CT & PT
Unit - IV Calibration	4a. State the procedure to calibrate various electrical instruments	4.1 Concept of standard meter 4.2 Calibration and its importance 4.3 Calibration of ammeter, voltmeter and single phase energy meter by potentiometer
Unit - V Measurement of power &Energy	5a. Calculate the power factor in a given circuit 5b. Use appropriate method for measurement of power in a given circuit	5.1 Significance of power factor 5.2 Concept of active, reactive, apparent power 5.3 One wattmeter method, two wattmeter method for measurement of active power for balanced load 5.4 One wattmeter method for measurement of reactive power for balanced load 5.5 Multiplying factor of wattmeter 5.6 Measurement of energy 5.7 Construction, working of single phase energy meter (induction type) 5.8 Different types of errors & their compensations 5.9 Working principle of digital energy meter 5.10 Block diagram, advantages over analog meter

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Teaching Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL
1	Fundamentals of measurement	10	06	06	-	12
2	Potentiometers and bridges	12	06	04	04	14

3	Electromechanical instruments	19	06	10	08	24
4	Calibration	05	04	-	04	08
5	Power and energy measurement	18	08	08	06	22

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	2	Identify the measuring instruments on the basis of symbols.	04
2	2	Identify component of PMMC and MI instrument using working model	02
3	2	Measure earth resistance using earth tester on a given site.	04
4	2	Measure the medium resistance using Wheatstone bridge.	02
5	2	Measure the low resistance using Kelvin bridge	02
6	2	Measure insulation resistance using Megger in a given circuit.	04
7	3	Measure electrical current using clamp on meter.	02
8	4	Calibrate d.c.ammeter and d.c.voltmeter by potentiometer	04
9	4	Calibrate single phase energy meter by comparison	02
10	5	Measure Power using one wattmeter method of three phase circuits	02
11	5	Measure 3 phase Power using two wattmeter method for three phase circuits	02
12	5	Measure reactive power by one wattmeter method	04
Total Hours (Perform any **10 practical worth 28 hours** so that most units are covered)			34

8. SUGGESTED STUDENTS ACTIVITIES

Other than class room and laboratory activities following are the suggested guided co-curricular students activities which need to be undertaken to facilitate the attainment of various course outcomes of this course. The students are required to maintain portfolio of their experiences which he/ she will submit at the end of the term.

a. Market survey on different measuring instruments available in market
b. Prepare charts for understanding various electro-magnetic instruments
c. Preventive maintenance of various instruments in the laboratory.
d. Prepare a survey report for various latest measuring instruments available in market
e. Prepare a survey report to know the ratings of current transformer and potential transformer used in substation/industries

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Improved Lecture methods-
b. Q & A technique.
c. Demonstration
d. Expert Lecture

10. SUGGESTED LEARNING RESOURCE

S.No.	Name of Book	Author	Publication
1	Electrical and electronic instruments	A.K. Sawhney	Dhanpat Rai Publications, New Delhi, 2010
2	A course in electronics & electrical measurement & instrumentation	J.B. Gupta	S.K. Kataria and Sons, New Delhi, 2011
3	Electrical Measurements and measuring instruments	E.W. Golding, F.C. Widdis	Reem publications New Delhi, 2011
4	Principles of measurement & Instrumentation	Morris, Alan. S	PHI publication, New Delhi, 2011
5	Electrical Measurements & Measuring Instruments	R.K. Rajput	S. Chand & Company
6	Electrical Measurements & Measuring Instruments	N.V. Suryanarayana	S. Chand & Company

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED :

S. No.	Name of equipment	Brief Specification
1	D.C.Potentiometer 0-1.1VD.C.	Test Terminals-Coarse & Fine
2	Wheatstone bridge	Measuring Range- 1.00Ω to 10.00MΩ
3	Kelvin double bridge	Range- 0.2microΩ to 11Ω
4	Energy meter	1ϕ & 3- ϕ analog & digital meters with latest specification
	Power factor meter	Analog & digital meters with latest specification

5		
6	2-Element wattmeter	Latest specifications
7	3- ϕ power factor meter	Analog & digital meters with latest specification
8	Megger	Mains / battery pack operated
9	Phase sequence indicator	Analog & digital meters with latest specification
10	Clip on meter	Analog & digital meters with latest specification
11	Current – Transformer & Potential Transformer	As electrical Industry specification
12	Decade Resistance box	Accuracy: ± 1%, Max. D.C. voltage
13	Shunts with ammeters	Accuracy: ± 1%, Measuring range in ohms like-x0.001x0.01

12. LEARNING WEBSITE & SOFTWARE

a. www.scientechworld.com
b. ii. www.ni.com/labview/
c. iii www.scientificindia.com/home/scientificindia.asp
d. iv. http://electricalandelectronics.org/
e. v. www.electrical-electronics.co.in/

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

SNo	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
CO 1	Select the electrical instruments for given application.	-	3	-	-	-	-	-	-	-	-	-	-
CO 2	Use different methods of resistance measurement.	1	2	2	-	-	-	-	-	-	-	-	-

CO 3	Identify various parts of indicating instruments	2	-	2	-	-	-	-	-	-	-		
CO 4	Calibrate the given instrument	1	2	2	-	-		-	-	-	-	-	-
CO 5	Select the proper method of power measurement	1	1	1	-	-		-	-	-	-	-	-

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	D.S. Bhalerao	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad
2	Mrs M.V. Kunte	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **NETWORK ANALYSIS(NWA)**

COURSE CODE **6E204**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Electrical	Third

1. RATIONALE

Most of electrical power generation, transmission, distribution and utilization are in the form of alternating current. It is essential for every electrical engineer to know the performance of network for different parameters. This is basic technology course for diploma students to develop skill for solving different AC and DC networks.

2. COMPETENCY

At the end of studying this course students will be able to

"Apply the principles of circuit analysis to solve given network".

TEACHING AND EXAMINATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE(PR)	PA (TW)	150
4	--	2	6	80	20	25#	25	
Duration of the Examination (Hrs)				3	1	--	--	

Legends : L-Lecture**; T**-Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment; **OR** – Oral Examination, **PR**-Practical Examination; **TW** - Term Work, # External, @ Internal, ~ Online.

3. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Solve electrical circuits using source transformation.
2. Apply network theorems for solution of DC resistive circuits.

3. Determine the parameters for given AC series circuits.
4. Determine the parameters for given AC parallel circuits.
5. Calculate various quantities in given three phase ac circuit.

4. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (in cognitive domain only)	Topics and Sub-topics
Unit –I Basic Circuit Elements	1a. Classify types of electrical Circuits. 1b. Use source transformation to solve electrical Circuits. 1c. Convert star to delta and delta to star transformations.	1.1 Definitions of Node, branch, mesh. Active & Passive network, Linear &Non linear network, Bilateral and unilateral network. 1.2 Concept of open circuit and short circuit 1.3 Ideal and practical voltage and current sources. 1.4 Source transformation. 1.5 Delta-star and Star-delta transformation (simple numerical on topics 1.4 & 1.5)
Unit – II Network Theorems	2a. Calculate voltage and current of resistive circuits using Mesh and nodal analysis method. 2b. Apply Superposition, Thevenin's, Maximum power transfer, Norton's Theorem to calculate the parameters.	2.1 Mesh analysis 2.2 Nodal analysis 2.3 Superposition theorem 2.4 Thevenin's theorem 2.5 Norton's theorem 2.6 Maximum power transfer theorem (Numerical based on above topics only for DC network)
Unit– III AC Series circuits	3a. Compare the behavior of AC voltage, current and power through RL, RC and RLC series circuit. 3b.Apply concept of active power, reactive power and apparent power for given network. 3c.Apply concept of resonance in RLC series circuit.	3.1 Waveforms, phasor diagram and expression of voltage, current and power in pure: Resistance, Inductance, Capacitance 3.2 AC through RL, RC, RLC series circuit, impedance, reactance, phasor diagram, impedance triangle, power factor, active power, reactive power, apparent power, power triangle. 3.3 Resonant frequency and Resonance condition in RLC series circuit (numerical based on above topics)
Unit– IV AC Parallel Circuits	4a Compare the behavior of AC voltage, current and power through RL, RC and RLC parallel circuit. 4b. Apply the concept of resonance in RLC Parallel circuit. 4c. Comparison of series and parallel circuits	4.1 Parallel AC circuits: i) Resistance in parallel with pure inductance. ii) Resistance in parallel with capacitance. iii) Series combination of resistance and inductance in parallel with Capacitance 4.2 Concept of Admittance, Conductance &Susceptance, Solution by admittance

		method and impedance method. (Numerical only) 4.3 Parallel resonance, quality factor.
Unit– V Poly phase circuits	5a.Develop the concept of generation of three Phase alternating voltage. 5b.Compare three phase Circuits and single phase. 5c.Calculate various quantities in given three phase ac circuit	5.1 Generation of three phase alternating voltage. 5.2 Concept of phase sequence, Balanced and unbalanced load. 5.3 Line, phase quantities and power in three phase system with balanced star and Delta connected load and their interrelationship. (Numerical on 5.3)

5. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Teaching Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL
1	Basic Circuit Elements	08	6	02	02	10
2	Network Theorems	16	-	08	12	20
3	AC Series circuits	14	6	04	08	18
4	AC Parallel Circuits	12	4	06	06	16
5	Poly phase circuits	14	4	08	04	16
	Total	64	20	28	32	80

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

6. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	2	Verify Superposition theorem for a given electrical circuit.	02
2	2	Verify Thevenin's theorem for a given circuit.	02
3	2	Verify Norton's theorem for a given circuit.	02
4	2	Verify condition for maximum power transfer to load using maximum power transfer theorem.	02
5	3	Measure inductance and resistance of choke coil and also the active power through resistor	02
6	3	Measure voltage, current, power and power factor in a series RL circuit with relevant phasor diagram.	02
7	3	Measure voltage, current, power and power factor in a series RC circuit with relevant phasor diagram.	02
8	3	Measure voltage, current, power and power factor in a series RLC circuit with relevant phasor diagram.	04
9	4	Measure voltage, current, power and power factor in a RLC parallel circuit with relevant phasor diagram.	04
10	5	Verify line and phase values of voltage and current relation for 3 phase balanced star connections.	04
11	5	Verify line and phase values of voltage and current relation for 3 phase balanced delta connections.	04
Total Hours (perform practical worth 28 Hrs so that most units are covered)			30

7. SUGGESTED STUDENTS ACTIVITIES

Other than class room and laboratory activities following are the suggested guided co-curricular students activities which need to be undertaken to facilitate the attainment of various course outcomes of this course. The students are required to maintain portfolio of their experiences which he/ she will submit at the end of the term.

a. Identify and select various measuring instruments as per required range.

b. Assignments on solving numerical.

8. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Demonstration of software for ac dc construction kit for solving network problem.
b. Activity based learning

9. SUGGESTED LEARNING RESOURCE

Sr.No.	Name of Book	Author	Publication
1	ElectricalTechnologyVol-1	B.L.Theraja	S.Chand&Co.Ltd.,2011or latest edition
2	Electrical Networks	Ravish R singh	Tata McGraw-Hill latest edition.
3	Principles of Electrical Engineering	B.R.Gupta	S.K.Kataria,2012orlatestedition
4	Basic Electrical Engineering	K.U.Rao	PearsonEducation,India,2012 Or latest edition
5	Basic Electrical Engineering	Ananda Murthy ,R.S.	PearsonEducation,India,2011or Latest edition
6	A Course in Electrical Technology Vol.I	J.B.Gupta	S.K.Kataria & Sons,2012or Latest edition

10. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED :

S. No.	Name of equipment	Brief specification
1.	Ammeter	(0-5A)
2.	Voltmeter	0-150/300
4	Wattmeter	0-500 watt
5	Multimeter	250mA,250V
6	Stopwatch	60 Second
7	Thermometer	-10 C to 110 C
8	Rheostats	0-50/90/250/350 ohm
9	Capacitors	0.5uf

11. LEARNING WEBSITE & SOFTWARE

a www.allaboutcircuits.com/vol_1/chpt_ml
b http://openbookproject.net/electricCircml
c www.kpsec.freeuk.com
d www.howstuffwork/
e www.nptel/electrical.com

12. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

SNo	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Solve electrical circuits using source transformation.	-	2	2	1	-	-	-	-	-	-	-	-
2	Apply network theorems for solution of DC resistive circuits.	-	3	3	2	-	-	-	-	-	-	-	-
3	Determine the parameters for given AC series circuits.	1	3	2	2	-	-	-	-	-	-	-	-
4	Determine the parameters for given AC parallel circuits.	-	3	2	2	-	-	-	-	-	-	-	-
5	Calculate various quantities in given three phase ac circuit.	-	3	3	2	-	-	-	-	-	-	-	-

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	M D Kharad	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad
2	S J Ghorpade	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE- **GENERATION AND TRANSMISSION ENGINEERING (GTE)**

COURSE CODE **6E205**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Electrical	Third

1. RATIONALE

Generation and transmission of Electric Power is most important activity in power system and need highly skilled technicians who are capable of operating various control equipments in generation plant. The generation and transmission of electric power is a complex issue which requires knowledge of different types of transmission lines and power equipments. This course attempts to develop the basic skills required to maintain and operate the various equipments available in the generation and transmission of electrical system.

2. COMPETENCY

At the end of studying this course students will be able to

"Operate and maintain various equipments in generation and transmission system"

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (Hours/Credits)			Total Credits (L+T+P)	Examination Scheme(Marks)				
				Theory		Practical		Total Marks
L	T	P	C	ESE	PT	ESE (OR)	PA (TW)	150
04	--	02	06	80	20	25@	25	
Duration of the Examination (Hrs)				3	1	--	--	

Legends : L-Lecture**; T-**Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, **OR** – Oral Examination, **PR-** Practical Examination ; **TW -** Term Work, # External, @ Internal, ~ Online.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Identify and operate major equipment in thermal power generating stations.
2. Identify and operate major equipment of Hydro power plant.

3. Identify and operate major equipment nuclear power station.
4. Select the power generation technique based on economy.
5. Calculate the performance for given transmission system.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (Cognitive Domain Only)	Topics and Sub-topics
Unit – I Thermal Power Station	1a Compare various energy sources 1b. Select the appropriate site of a TPS . 1c.Operate and maintain the Thermal power station (TPS)	1.1 Conventional and non-conventional sources of energy 1.2 Selection criteria for site of thermal power station. 1.3 Line diagram of thermal power station (TPS); Different cycles of TPS 1.4 Major equipment and auxiliaries of TPS (including Boiler, steam turbine, Turbo Generator, super heater, economizer, chimney, draught and electro static precipitator). 1.5 Major Thermal power stations in Maharashtra
Unit – II Hydro Power Station	2a. Select the appropriate site of HPS . 2b.Operate and maintain the Hydro power station (HPS)	2.1 Selection criteria for site for Hydro Power Station. 2.2 Energy conversion process for hydro-power station (HPS) with plant layout. 2.3 Classification of HPS: based on head, Storage and pondage, Plant Layout, types of hydro turbines; Auxiliaries. 2.4 Major equipment and auxiliaries of HPS (including reservoir, dam, fore bay, spillway, surge tank, penstock, tail race, prime movers or water turbines, Generators and power house). 2.5 Hydro power stations in Maharashtra
Unit – III Nuclear Power Station and economic power generation	3a.Select the appropriate site of a NPS . 3b.Operate and maintain the Nuclear power station (NPS) 3c.Compare TPS, HPS and NPS 3d.Scheduling the generation according to the given load curves.	3.1 Energy conversion process for Nuclear power station: Nuclear fusion and fission, Chain reaction. 3.2 Selection of site for NPS. 3.3 Working of nuclear power station with schematic arrangement of NPS. 3.4 Various types of reactors. 3.5 Nuclear waste, disposal of nuclear waste. 3.6 Nuclear power stations in Maharashtra.

	3e.Identify and calculate the factors affecting cost of generation	3.7 Comparisons between TPS, HPS and NPS. 3.8 Load curve and load duration curve(Simple numerical based on this topic) 3.9 Base load and peak load power plants. 3.10Factors affecting the cost of Generation: Average demand, Maximum demand, demand factor, plant capacity factor, plant use factor, diversity factor, load factor and plant load factor (Simple numerical based on this topic)
Unit – IV Transmission Line Components	4a.Compare various transmission systems. 4b. Select size and type of conductor for transmission line based on its rating 4c. Use appropriate insulators for given application. 4d. Calculate string efficiency, of given transmission line .	4.1 Classification of Transmission Lines according to voltage level, Length of Transmission line, Type of Supply Voltage & Method of Construction 4.2 Types of conductors-Copper, Aluminum: Solid, stranded and bundled conductors. 4.3 Line insulators – requirements, types, Failure of insulator. 4.4 String efficiency, methods of improving string efficiency. (Simple numerical based this topic) 4.5 Line supports-classification 4.6 Spacing between conductors, span length and sag calculation.
Unit – V Performance Of Transmission Lines	5a.Classify transmission line. 5b. State the effects of different parameters on transmission line. 5c. Determine performance, efficiency and regulation of given transmission line	5.1 Short, medium and long transmission line. 5.2 Transmission line parameters-resistance, inductance and capacitance.(no derivation) 5.3 Skin effect and proximity effect 5.4 Losses, efficiency and regulation of short and medium transmission line. 5.5 Performance of short and medium transmission line(Nominal T and pi methods) 5.6 Effect of load power factor on voltage regulation. 5.7 Ferranti effect and Corona

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Teaching Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL
1	Thermal Power Station	10	02	06	04	12
2	Hydro Power Station	10	02	06	04	12
3	Nuclear Power Station and Economic of power generation	14	04	06	08	18
4	Transmission Line Components	14	06	04	08	18
5	Performance Of Transmission Lines	16	06	06	08	20
Total		64	04	48	28	80

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	01	Collect the information about Power Scenario of India.	4
2	02	Prepare technical report of visit to a nearby power generating station .	4
3	03	Collect the online data of power station for load curve preparation and interpret it.	4
4	04	Draw a sheet of different type of insulators used in transmission system with their specifications.	4
5	04	Prepare a report on different type of insulators used in transmission system with their specifications.	4
6	04	Prepare a report about types of conductors used in transmission system by visiting nearby conductor suppliers/industries or otherwise with the help of internet.	4
7	04	Prepare technical report of visit to a 33/11kv substation.	4
Total Hours			28

Note: Arrange visit to nearby hydro power station or thermal power station and 132/33kv substation.

8. SUGGESTED STUDENTS ACTIVITIES

Following is the list of proposed student activities like:

a. Collect the data of per capita power consumption state wise as well as country wise.
b. Collect data of generating capacity of conventional and non- conventional power plants in India and Maharashtra.
c. Prepare models of different power station

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

a. Expert lecture.
b. Group discussion.
c. Online learning.

10. SUGGESTED LEARNING RESOURCE

S.No.	Name of Book	Author	Publication
1	Generation of Electrical Energy	B. R. Gupta	Eurasia Publishing House Pvt. Ltd
2	A Course in Electrical Power	Soni , Gupta bhatnagar	Soni,Gupta,
3	Principles of Power System	V.K.Mehta	S.Chand
4	Electrical Power System	Wadhwa C. L.	New Age, New Delhi, Latest edition
5	Transmission and Distribution ofElectrical Energy	J.B.Gupta	S.K.Khanna

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED:

Sr. No	Name of the Equipment	Brief specification
1	Model of Generating station	Demo Model

12. LEARNING WEBSITE & SOFTWARE

a. www.electrical4u.com
b. www. electricaleasy.com

c. www.mahagenco.com
d. www.mahatransco.com

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

SN	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Identify and operate major equipment in thermal power generating stations.	1	3	-	-	1	1	-	-	-	-	-	2
2	Identify and operate major equipment of Hydro power plant.	-	3	-	-	1	2	-	-	-	-	-	3
3	Identify and operate major equipment nuclear power station.	2	3	-	2	1	2	-	-	-	-	-	3
4	Select the power generation technique based on economy.	-	3	3	3	-	-	-	-	-	-	-	2
5	Calculate the performance for given transmission system.	-	3	2	3	-	-	-	-	-	-	-	3

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	M.D.Kharad	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad
2	S.J.Ghorpade	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad
3	A.A.Ghate	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **ELECTRICAL WORKSHOP PRACTICE (EWP)**

COURSE CODE **6E206**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Electrical	Third

1. RATIONALE

This course will help the students for handling various tools and gives technical knowledge about the electrical accessories. The students will able to know the operation of domestic electrical appliances. **Diploma Engineer** has to identify the type of the fault in order to repair and maintain electrical appliances.**Diploma engineer** has to achieve skill electrical appliances.

2. COMPETENCY

At the end of studying this course students will be able to

"To perform wiring, repairing and maintenance of electrical appliances with the help of hand tools."

TEACHING AND EXAMINATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (PR)	PA (TW)	100
-	-	4	4	--	--	50@	50	
Duration of the Examination (Hrs)				--	--	--	--	

Legends : L-Lecture**; T**-Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment; **OR** – Oral Examination, **PR**-Practical Examination; **TW** - Term Work, # External, @ Internal, ~ Online.

3. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Identify the electrical hand tools and wiring diagram of electrical workshop.
2. Install the lamps used in domestic premises.
3. Develop internal connections of the domestic appliances.
4. Select proper earthing method for a given system.
5. Identify the faults occurs in appliances and apply remedies.
6. Develop different methods of wiring

4. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (in cognitive domain only)	Topics and Sub-topics
Unit– I Wiring connections	1a. Identify the symbols of wiring accessories	1.1 Electrical accessories 1.1.1 Holder 1.1.2 Plug 1.1.3 Switches 1.1.4 Meters 1.2 Lightning circuit 1.3 Symbols of electrical accessories.
Unit– II Lamps	2a. Select different lamps for given application.	2.1 Different lamps 2.1.1 Fluorescent Tubelight 2.1.2 Sodium Vapour lamp 2.1.3 Mercury Vapour lamp
Unit– III Domestic Appliances	3a. Repair and maintain the domestic appliances.	3.1 Study of different domestic appliances - Mixer, Fan, Oven, Electric iron, Geyser, heater, washing machine and small electrical machine. 3.2 Parts of appliances and connection of appliances
Unit – IV Earthing	4a. Compare and select type of earthing for a given application.	4.1Concept of earthing 4.2Types of earthing 4.3Difference between earthing and neutral grounding
Unit – V Faults	5a. Identify different faults occur in appliances and apply the remedial measures.	5.1 Types of faults 5.1.1. Short circuit fault 5.1.2 Ground Fault 5.2 Fuse 5.3 Miniature Circuit Breaker
Unit – VI Mini Project	6a. Prepare a board as per requirement	6.1 Wiring Practice done by student:- 6.1.1Prepare a board using DP switch, lamp, socket, lamp controller 6.1.2Prepare wiring of Single phase Energy Meter along with accessories

5. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Not Applicable

6. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	1	Study of different accessories of electrical wiring.	02
2	1	Identify the symbols used in electrical wiring diagram.	04
3	1	Prepare lighting circuit using two way switch.	04
4	1	Prepare lighting circuit for a Godown wiring	04
5	2	Make a connection of fluorescent tubelight	04
6	3	Test and repair any two domestic appliances:- Mixer, Fan, Oven, Electric iron, Geyser, heater, washing machine and small electrical machine.	06
7	4	Observe different types of earthing.	04
8	5	Prepare a series circuit for detection of faults.	06
9	5	Identify different faults occurred in the electrical appliances e.g.Fan	04
10	5	Operate protective device such as fuse and MCB.	04
11	6	Prepare wiring with the help of lamp, switches, holder, socket.	06
12	6	Prepare wiring of Single phase Energy Meter. Or any Mini project	08
Total (All practical's are compulsory)			56

7. SUGGESTED STUDENTS ACTIVITIES

Other than class room and laboratory activities following are the suggested guided co-curricular students activities which need to be undertaken to facilitate the attainment of various course outcomes of this course. The students are required to maintain portfolio of their experiences which he/ she will submit at the end of the term.

a. The students should collect the data about wiring accessories
b. Prepare the chart for different wiring connection.

8. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Visit to any repairing workshop of electrical appliances.
b. Demonstration
c. Mini Project
d. Activity based learning

9. SUGGESTED LEARNING RESOURCE

S.No.	Name of Book	Author	Publication
1	Electrical wiring and estimation and costing	S.L.Uppal	Khanna Publication New Delhi
2	Workshop practice in Electrical Engineering	M. L. Gupta	Dhanpat Rai & Sons
3	Electrical Wiring	Arora & B Dass	Rainbow Publication
4	Study of electrical Appliances	K.B.Bhatia	Khanna Publication New Delhi
5	IS/International Codes: IS 2032, 8270, 3722		

10. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED :

S. No.	Name of equipment	Brief specification
1.	Wiring striper, holder, socket, fuse, indicator, switches,two way switch, lamp, regulator,	As per Electrical industry specification
2.	Earthing rod, megger, fault testing kit, fuse, MCB, ELCB	As per Electrical industry specification
4	Mixer, Fan, Oven, Electric iron, Geyser, heater, washing machine and small machine	As per Electrical industry specification
5	Soldering kit	As per Electrical industry specification

11. LEARNING WEBSITE & SOFTWARE

a. http://en.wikipedia.org/electrical wiring
b. https://www.scribd.com/doc/79705734/Electrical-Workshop
c. https://www.tpctrainco.com/.../electrical.../electrical-workshop

12. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

SNo	Course Outcome	Pos										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Identify the electrical hand tools and wiring diagram of electrical workshop.	3	1	1	1	-	-	-	-	-	-	-	-
2	Install the lamps used in domestic premises.	-	2	-	1	-	-	-	-	-	1	-	-
3	Develop internal connections of the domestic appliances.	-	1	1	-	-	-	-	-	-	1	-	1
4	Select proper earthing method for a given system.	1	1	1	-	-	-	-	-	-	1	-	-
5	Identify the faults occurs in appliances and apply remedies.	-	1	2	-	-	-	-	-	-	1	1	1
6	Develop different methods of wiring	-	1	1	1	-	-	-	1	-	1	-	1

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	V.R.Jadhav	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad
2	A.A.Ghate	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE PROGRAMMING IN 'C'(PRC)

COURSE CODE 6E210

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Electrical	Third

1. RATIONALE

This Course intends to develop programming skills in the students, using a popular structured programming language `C'. The students will learn step by step procedure (i.e. flow charting & Algorithm) of any program development process. The programming skills thus acquired using `C' language can be used for acquiring necessary programming skill to work with advance level programming languages which in turn will be helping in developing programs for the scientific, research and business purposes.

2. COMPETENCY

At the end of studying this course students will be able to

"Develop Simple Programs using 'C' Language."

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (PR)	PA (TW)	50
1	-	2	3	--	--	25@	25	
Duration of the Examination (Hrs)				--	--	--	--	

Legends : L-Lecture**; T**-Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment; **OR** – Oral Examination, **PR**-Practical Examination; **TW** - Term Work, # External, @ Internal, ~ Online.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1.Develop algorithm and draw flowchart for given problem.
2.Build basic 'C' program.
3.Analyze the use of operators and expressions.
4.Interprete on the decision and looping statements & its use.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (in cognitive domain only)	Topics and Sub-topics
Unit– I Flowchart and Algorithm	1a. Draw flow chart to solve given problem logically. 1b. Develop Algorithm to solve given program	1.1 Flowchart 1.2 Definition and Importance of flowchart. 1.3 Symbols of Flowchart. 1.4 Flow lines, Terminals, Input/Output, Processing Decision, Connection off-page connectors 1.5 Guidelines for preparing Flowchart. 1.6 Flowchart structure Sequence, selection, repetition. 1.7 Limitation of flowchart 1.8 Algorithm 1.9 Developing and writing algorithm using Pseudo Codes.
Unit– II Basics of 'C'	2a. Declare and define variables 2b. Write and execute simple program in 'C'	2.1 General structure of 'C' program and Standard directories 2.2 Advantages of C language. 2.3Character set, 'C' tokens 2.4 Keywords and Identifiers , Constants and Variables 2.5 Data Types in 'C' 2.6Rules for defining variables 2.7Declaration and Initialization 2.8 Dynamic initialization 2.9 Type modifiers and type conversion 2.10 Constant and volatile variable 2.11 Input and Output statements in 'C' 2.12 Write, compile, execute a simple 'C' program

Unit– III Operators and Expression	3a. Use arithmetic, relational and logical operators for forming expressions. 3b. Format input and output using 'C' statements.	3.1 Introduction of different types of operators and their symbolic representation 3.2 Properties of operator 3.3 Priority of operator and their clubbing 3.4 Comma and conditional operator 3.5 Arithmetic operators 3.6 Relational operators 3.7 Assignment operators and expressions 3.8 Logical operators 3.9 Bitwise operators 3.10 Formatted input and output in 'C'
Unit – IV Decision Statements	4a. Develop programs using decision making statements in 'C' language.	4.1 Unconditional branching: goto statement 4.2 Conditional branching statements: If statement 4.3 If-else statement 4.4 Nested If-else statement 4.5 If-else-if Ladder statement 4.6 break, continue and goto statements 4.7 switch statements
Unit – V Loop Control Statements	5a. Develop programs using structured loop control statements in 'C' language.	5.1for loop 5.2 Nested for loop 5.3While loop 5.4 Do-while loop

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Teaching Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL
1	Flowchart and Algorithm	3				NA
2	Basics of 'C'	3				NA

3	Operators and Expression	3				NA
4	Decision Statements	4				NA
5	Loop Control Statements	3				NA

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	I	Draw Flow Chart and write algorithm for at least four problems.	02
2	II	Write minimum 5 programs using Constants, Variables & arithmetic expression.	04
3	II	Write programs to understand Data types, Type modifiers and Type conversion.	02
4	II	Write programs providing insight to formatted and unformatted input and output in C	02
5	III	Write minimum 5 programs providing understanding of Relational operators.	04
6	III	Write programs using logical and bitwise operators.	04
7	IV	Make programs using If, If-else, If-else-if and Nested If statements.	04
8	IV	Make programs using break, continue, goto and switch statements.	02
9	V	Write programs to understand simple For loop and nested loops.	02
10	V	Write programs using While Loop and Do-while loop.	04
Total Hours(perform practical worth 28 hours so that most units are covered)			**30**

8. SUGGESTED STUDENTS ACTIVITIES

Other than class room and laboratory activities following are the suggested guided co-curricular students activities which need to be undertaken to facilitate the attainment of

various course outcomes of this course. The students are required to maintain portfolio of their experiences which he/ she will submit at the end of the term.

a. Search and Identify areas where C programming is widely used as sole programming language.
b. Development of charts explaining various flow chart features.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

Not applicable

10. SUGGESTED LEARNING RESOURCE

Sr.No.	Name of Book	Author	Publication
1	Let us 'C'	Kanetkar Yashavant	BPB publications, Latest Edition
2	Programming in ANSI C	Balaguruswami E.	Tata McGraw-Hills publication, Latest Edition
3	Programming with ANSI And Turbo C	Kamthane Ashok N.	Pearson publication, Latest Edition

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED :

S. No.	Name of equipment	Brief specification
1.	Computer Systems	Latest configuration and memory

12. LEARNING WEBSITE & SOFTWARE

Not applicable

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

SNo	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Develop algorithm and draw flowchart for given problem.	-	3	-	-	-	-	-	-	-	-	-	-
2	Build basic 'C' program.	-	3		-	-	-	-	-	-	-	-	-
3	Analyze the use of operators and expressions	-	3	-	-	-	-	-	-	-	-	-	-
4	Interpret on the decision and looping statements & its use.	-	3	2	3	-	-	-	-	-	2	-	-

Course Curriculum Design Committee

Sr. No.	Name of the faculty members	Designation and Institute
1	S.D.Pardeshi	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **INDUSTRIAL INSTRUMENTATION(IIN)**

COURSE CODE **6E409**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Electrical	Third

1. **RATIONALE-** This is a applied technology course which focuses on basic principles of transduction of physical variables into electrical signals, signal conditioning circuits and basic data acquisitions systems. The course will also help electrical Diploma Engineer to measure various electrical and mechanical quantities required to operate and maintain the system effectively and efficiently.

2. COMPETENCY

At the end of studying this course students will be able to

"Use different types of transducers and instrumentation systems for different measurements in Industry and Power system."

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (Hours/Credits)			Total Credits (L+T+P)	Examination Scheme(Marks)				
				Theory		Practical		Total Marks
L	T	P	C	ESE	PT	ESE (PR)	PA (TW)	150
04	--	02	06	80	20	25#	25	
Duration of the Examination (Hrs)				3	1	--	--	

Legends : L-Lecture**; T**-Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, **OR** – Oral Examination, **PR-** Practical Examination ; **TW** - Term Work, # External, @ Internal, ~ Online.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Identify different components and characteristics of Instrumentation system.

2. Select proper transducer for measurement of different quantities.
3. Use OP AMP for different signal conditioning circuits.
4. Use different types of display and recording systems.
5. Select proper data acquisition systems for different applications.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (Cognitive Domain Only)	Topics and Sub-topics
Unit – I Basic Instrumentation system	1a. Illustrate the function of each block of Instrumentation system. 1b.List characteristics of Instruments.	1.1-Basic block diagram of general Instrumentation system. Function of each block. 1.2-Static characteristics of Instruments-Accuracy, Precision, Sensitivity, Repeatability, Reproducibility, Linearity, Drift, Tolerance, Range.(Definition only)
Unit – II Transducers	2a. Classify equipments on the basis of applications. 2b.Select appropriate transducer for measurement of different quantities from their characteristics.	2.1-Tranducers-Introduction and Classification. 2.2-Measurement of Temperature - Resistance thermometer, Thermocouple &Thermister. 2.3-Measurement of Displacement- Linear Variable Differential Transformer and Rotary Variable Differential Transformer. 2.4-Measurement of Pressure and Force- Types of Bourdon tube pressure gauge, Bellow pressure gauge , strain gauges (Bonded metal wire & Bonded metal foil type), Load Cell. 2.5-Measurement of Flow- Venturimeter , Rotameter ,Electromagnetic flow meter. 2.6- Measurement of Magnetic Field- Construction , working , operation & advantages/disadvantages of – Hall effect transducer
Unit– III Signal Conditioning circuits	3a-Identify pins of OP-Amp IC. 3b- Use OP-AMP in different signal conditioning circuits.	3.1-Block diagram of OP-AMP. Explanation of each block. 3.2-IC741 pin diagram and pin function. 3.3-OP-AMP basic circuits-Open loop and closed loop configuration of op-amp, its

		comparison. 3.4-Inverting, non- inverting, Differential amplifier, voltage follower, inverter, Adder, Subtractor, Integrator, Differentiator, Instrumentation amplifier 3.5-Voltage to Current converter(with floating load and with grounded load) Current to Voltage converters. 3.6-Sample and hold circuit (IC LF398 , Pin diagram, specification and pin functions)
Unit–IV Display and Recording System	4a- Make use of display devices. 4b- Select recorder for given application.	4.1- Study of Digital display devices (LED, seven segment only) 4.2-Necessity of Recorder in Instrumentation System. 4.3-Classification of Recorders. 4.4-Block diagram and working principles of strip-chart, X-Y recorder. 4.5-Introduction to LCD.
Unit–V Data acquisition system	5a-Identify parts of data acquisition system. 5b-Explain different techniques of signal conditioning in DAS. 5c- Convert analog signal to digital signal and vice versa .	5.1-Generalized Data acquisition system: Block diagram & explanation. 5.2-Signal conditioning in DAS, Ratio metric conversion, Logarithmic Conversion. 5.3-DAS Types-Single channel, multi-channel DAS (only block diagram). 5.4-Study of different techniques of Analog to Digital convertors (ADC) and Digital to Analog converters (DAC)-working Principle and block diagram .

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Teaching Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL
1	Basic Instrumentation system	08	06	04	--	10
2	Transducers	24	06	18	06	30
3	Signal Conditioning circuits	14	04	08	06	18

4	Display and Recording System	08	04	04	02	10
5	Data acquisition system	10	04	06	02	12
Total		64	24	40	16	80

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	1	Compare different transducers available in Instrumentation laboratory on	02
2	2	Verify the relation between the output voltage and temperature by using a RTD (PT 100) / Thermistor / Thermocouple.	04
3	2	Plot the characteristics of Output Voltage Vs Displacement in LVDT.	02
4	2	Plot the characteristics of Output Voltage Vs Pressure in Strain gauge.	02
5	2	Use of Hall Effect transducer for sensing the position of magnetic object.	02
6	3	Read different characteristics of IC 741 from manual.	02
7	3	Verify the function of OPAMP as inverting,non inverting amplifier, adder, subtractor.	04
8	3	Verify the function of OPAMP as integrator and differentiator with Step input and Sine input.	04
9	3	Use OP-AMP for Voltage to Current and Current to Voltage conversion	04
10	3	Read different characteristics of IC LF398 from manual.	02
11	4	Plot the curves on X-Y Recorder for different input signals.	02
12	5	Convert given Analog signal to Digital signal and Digital signal to Analog signal using OpAmp circuits and resistors.	02
Total Hours(Perform any 10 experiments worth 28 hours so that most units are covered)			32

8. SUGGESTED STUDENTS ACTIVITIES

Following is the list of proposed student activities such as:

a. Prepare a chart showing comparison of different transducers used for measurement of different quantities mentioned in the curriculum on the basis of 1) Construction,2) working , 3)operation & 4)advantages/disadvantages .

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

1. Students should be shown animations/video films to explain the applications of different types of Transducers for measurement of various quantities.
2. An Industrial visit should be arranged to study actual application of Instrumentation systems in Industry.

10. SUGGESTED LEARNING RESOURCE

S.No.	Name of Book	Author	Publication
1	Electronic measurement and Instrumentation	R.K.Rajput	Laxmi publications
2	Electrical and Electronics Measurement and Instrumentation	A.K.Sawhney	Dhanpat Rai& Co.
3	Fundamentals of Industrial Instrumentation	AlokBarua	Wiley India
4	A course in Electronics and Electrical Measurement and Instrumentation.	J.B.Gupta	S.K.Kataria and sons
5	Op-AMPs and linear integrated circuits (4th Edition)	Ramakant Gayakwad	Prentice-Hall India

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED:

Sr. No	Name of the Equipment	Brief specification
1	Experimental kit for the measurement of Temperature using Thermistor , RTD and Thermocouple.	As per electrical Industry specification
2	Experimental kit for the measurement of Displacement using LVDT.	As per electrical Industry specification
3	Experimental kit for the measurement of Pressure using Strain Gauge.	As per electrical Industry specification
4	Experimental Kit of applications of OP – AMP – such as inverting ,non inverting amplifier, adder, subtractor, integrator , differentiator.	As per electronics Industry specification
5	Function generator.	As per electronics Industry specification
6	Digital Multimeter.	As per electrical Industry specification

12. LEARNING WEBSITE & SOFTWARE

a. http://www.electronics-tutorials.ws/io/io_1.html

b. http://www.electrical4u.com/temperature-transducers
c. http://www.instrumentationtoday.com/linear-voltage-differential-transformer-lvdt/2011/07/
d. Free video lectures by Prof. AlokBarua, IIT Kharagpur
e. http://freevideolectures.com/Course/2347/Industrial-Instrumentation
f. http://www.allaboutcircuits.com/video-lectures/op-amp-applications/

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

SN	Course Outcome	Pos										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Identify different components and characteristics of Instrumentation system.	2	2	-	-	-	-	-	-	-	-	-	-
2	Select proper transducer for measurement of different quantities.	1	3	3	-	-	-	-	-	-	-	-	2
3	Use OP AMP for different signal conditioning circuits.	1	1	2	2	-	-	-	-	-	-	-	1
4	Use different types of display and recording systems.	1	2	-	-	-	-	-	-	-	-	1	1
5	Select proper data acquisition systems for different applications.	2	2	1	-	-	-	-	-	-	-	-	-

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	A.A.Ghate	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE- ENTREPRENEURSHIP DEVELOPMENT(EDP)
COURSE CODE 6G306

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Electrical Engineering	Third

1. RATIONALE

In the post liberalization era significant growth in industrial sector has led to creation of huge opportunities in manufacturing and service sector. In such a scenario especially in Indian contest it has led to innumerable opportunities for first generation entrepreneurs on a large scale. Therefore it is expected that engineers need to be developed for manufacturing, service sector and entrepreneurship development. This course, which represents Allied level of courses, aims at imparting entrepreneurial skills amongst engineers of all disciplines.

2. COMPETENCY

At the end of studying this course students will be able to

"Design a project proposal for an enterprise"

3. TEACHING AND EXAMNATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE @ (PR/OR)	PA (TW)	50
2	-	2	4	--	--	--	50	
Duration of the Examination (Hrs)				--	--	--	--	

Legends : L-Lecture**; T**-Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C**- Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, OR – Oral Examination, TW - Term Work, # External, @ Internal,~ Online examination.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -.

1 Apply business/enterprise principals and characteristics.
2 Design information and supporting system related to start a business.
3 Estimate and record financial requirements.
4 Develop detailed project report.
5 Use various software related to business.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit –I Basic Concepts of Entrepreneur	1a. Describe Entrepreneur. 1b. Identify Risk Use Creative skills 1c. Describe Risk Situation. 1d. Generate Business Idea Methods and techniques to generate Business. 1e. Plan for Transforming Ideas in to opportunities. 1f. Carryout of SWOT Analysis.	**Basic Concepts** of Entrepreneur 1.1. Concept, Classification & Characteristics of Entrepreneur. Creativity and Risk taking, Concept of Creativity & Qualities of Creative person. Risk Situation, Types of risk & risk takers. 1.2 Business Idea Methods and techniques to generate business idea. 1.3 Transforming Ideas in to opportunities- transformation involves Assessment of idea & Feasibility of opportunity, 1.4 SWOT Analysis.

Unit– II **Information And Support Systems**	2a. Use Information data for business. 2b. Information related to support system. 2c. Lay down the Procedures and related to Information. 2d. Identify Govt. Support Systems related to EDP. 2e. Explore subsidies to entrepreneur.	2.1Information Needed and Their Sources. Information related to project, Information related to support system, Information related to Procedures and formalities. 2.2 Support Systems: • Small Scale Business Planning, Requirements. • Govt. & Institutional Agencies, Formalities • Statutory Requirements and Agencies. Government Support and subsidies to entrepreneur.
Unit– III **Market Assessment**	3a Undertake Market survey. 3b Use Marketing skills and Survey. 3c Assess market for business opportunities.	**Market Assessment** 3.1 Marketing -Concept and Importance 3.2 Market Identification, Survey Key components. (Market Segmentation) 3.3 Market Assessment.
Unit– IV **Business Finance & Accounts**	4a. Determine product cost. 4b. Analyze for breakeven of business proposal. 4c. Maintain Business finance and accounts.	**Business Finance & Accounts** **4.1 Business Finance** • Cost of Project • Sources of Finance • Assessment of working capital • Product costing • Profitability • Break Even Analysis • Financial Ratios and Significance 4.2 **Business Account** Accounting Principles, Methodology • Book Keeping • Financial Statements • Concept of Audit, • Trial Balance

		Balance Sheet
Unit - V **Business Plan & Project Report**	5a. Prepare Business proposal. 5b. Undertake project appraisal. 5c. Undertake cost benefit analysis. Cost benefits analysis.	**Business Plan & Project Report** 5.1 Business plan steps involved from concept to commissioning Activity Recourses, Time, Cost 5.2 **Project Report** 1) Meaning and Importance 2) Components of project report/profile(Give list) 5.3 **Project Appraisal** 1) Meaning and definition 2) Technical, Economic feasibility 3) Cost benefit Analysis.
Unit – VI **Enterprise Management And Modern Trends**	6a. Manage resources. 6b. Prepare plan for productivity. 6c. Assure Quality. 6d. Explore Govt facilities (Industrial zones and SEZ.) 6e. Explore E-Commerce avenues for business.	**Enterprise Management And Modern Trends** 6.1 Enterprise Management: - 1) Essential roles of Entrepreneur in managing enterprise 2) Product Cycle: Concept And Importance 3) Probable Causes Of Sickness 4) Quality Assurance, Importance of Quality, Importance of testing 5) Industrial zones and SEZ. 6.2 E-Commerce, Concept and process. 6.3 Global Entrepreneur: role and opportunities.
Unit – VII **INTRODUCTION**	7a.Use business related software's. 7b. Survey Software's used in Mall , industries. 7c. Identify Software's	**INTRODUCTION BUSSINESS** **RELATED SOFTWARES** 7.1 Software's used in Mall.

BUSSINESS **RELATED SOFTWARES**	used For accounting.	7.2 Software's used in Medical shops. 7.3 Software's used in industrial stores such as SAP, ERP. 7.4 Software's used for accounting such as FICO, FINNACLE

6. 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	Basic Concepts of Entrepreneur.	04	NA	NA	NA	NA
II	Information And Support Systems	05	NA	NA	NA	NA
III	Market Assessment	05	NA	NA	NA	NA
IV	Business Finance & Accounts	05	NA	NA	NA	NA
V	Business Plan & Project Report	05	NA	NA	NA	NA
VI	Enterprise Management And Modern Trends	04	NA	NA	NA	NA
VII	Introduction business related software's	04	NA	NA	NA	NA
	Total	**32**	NA	NA	NA	NA

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

S. No.	**Unit No.**	**Practical Exercises** (Outcomes in Psychomotor Domain)	**Approx. Hrs. required**
1	I	Literature survey of Financial Banks for Industries– MSFC/IDBI/MSSIDC/CIDBI/MSME/DIC/ ROLE OF DIFFERENT COMMERCIAL BANKS etc.	04

2	II	Administration of readymade tools like questionnaires, opinionative, Interview schedule for product identification purpose (decision making process)	04
3	III	Development of "Business Ideas". Take any product and develop the business idea for it.	04
4	IV	Visit to MCED/MITCON- going through the product related library.	04
5	VI	Preparation of Preliminary / Detailed project report in the formats recommended by MCED/MITCON Prepare project report and study its feasibility.	04
6	VI	At least one case study of successful entrepreneur.	04
7	---	Assess yourself-are you an entrepreneur?	04
Total			**28**

8. SUGGESTED STUDENTS ACTIVITIES

1. Prepare journals based on assignments.
2. Carry out Literature survey of Financial Banks for Industries.
3. Analyze the specifications, costs, quality and availability for various types of engineering components and find the business opportunity for it.
4. Interact with supplier/trader and discuss about business opportunities available in market.
5. Designing software for requirements to start business or similar type of issues. .
6. preparing project report for any product to be manufactured.
7. Search online PPT's, PDF's, video's on the design and software's for business.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

1. Group discussion among students.
2. Arrange visits to industries and show various industrial jobs.
3. Motivate students to use internet and collect name, addresses, catalogues, rates, specifications of institutes and industries working in the area of business promotions.
4. Arrange expert lecture on various opportunities in business.

10. SUGGESTED LEARNING RESOURCE

Sr.No.	Title of Book	Author	Publication
1	Entrepreneurship Development	----	NITTTR, Bhopal
2	The Seven Business Crisis& How to Beat them	V.G.Patel	S.Chand and Co. New Delhi
3	A handbook of New Entrepreneurs	P.C.Jain	,Dhanpat Rai and Sons
4	Entrepreneurship development	E.Gorden, K. Natrajan	Charotar Publication House
5	New Initiatives in Entrepreneurship Education And training	Gautam Jain, Debmuni Gupta	Tata Mc- Graw Hill
6	Entrepreneurship Theory and Practice	J.S.Saini,B.S.Rathore	Tata Mc- Graw Hill
7	Enterpreneurship Development and management	A.K.Singh	Laxmi Publications
8	The Beer mat Entrepreneur	South on D F	Pearson Education limited

11. **LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED** :

Computers for Practical's with internet facility
1. Software's used in Mall.
2. Software's used in Medical shops.
3. Software's used in industrial stores such as SAP, ERP.
4. Software's used for accounting such as FICO, FINNACLE.

12. LEARNING WEBSITE & SOFTWARE

i. http://www. product-list. php
ii. http://www.SAP.com/products/faro-software
iii. http://www.ERP.com

iv. http://www.fico.com
v. http://finnacle.com
vi. Visit www.ediindia.org.
vii. http://www.project reports.com

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

CO. NO.	Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PSO 1	PSO 2	No. of hours allocated in curriculum
CO 1	Apply business/enterprise principals and characteristics.	3	3					2		3		2	6
CO 2	Design information and supporting system related to start a business.	3	3					3		3			8
CO 3	Estimate and record financial requirements.	3	3					3		3		2	6
CO 4	Develop detailed project report.	3	3							3	2		6
CO 5	Use various software related to business.	3	3							3	3		6

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	Prof. A. W. Nemade	Lecturer in Mechanical Engineering, Govt. Polytechnic,Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **DC MACHINES AND TRANSFORMER(DMT)**

COURSE CODE **6E401**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Electrical	Fourth

1. RATIONALE

This course is intended to teach the student principles and working of DC Machines and transformers which are widely used in power systems, industries and commercial applications. Diploma engineer will be able to analyze characteristics of DC machines and transformers. Therefore, this course is introduced at applied level.

2. COMPETENCY

At the end of studying this course students will be able to

"Operate various types of DC machines and Transformers efficiently."

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (PR)	PA (TW)	175
4	-	2	6	80	20	50#	25	
Duration of the Examination (Hrs)				3	1	--	--	

Legends : L-Lecture**; T**-Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment; **OR** – Oral Examination, **PR**-Practical Examination; **TW** - Term Work, # External, @ Internal, ~ Online.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Operate different types DC generators.
2. Use DC machine for given application.

3. Determine the performance parameters of single phase transformer.
4. Conduct different tests for single phase transformer.
5. Select three phase transformer for different application.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (in cognitive domain only)	Topics and Sub-topics
Unit– I DC Generators	1a. Compare the different types of generator. 1b. Calculate efficiency and regulation of Dc generator.	1.1 Construction and materials used for various parts of DC generator. 1.2 Functions of various parts of DC generator. 1.3 EMF equation of DC generator 1.4 Working principle of DC generator 1.5 Simplex lap and wave winding 1.6 Classification of DC generators 1.7 Load Characteristics of DC Shunt generators. 1.8 Efficiency and losses of DC generator. Simple numerical on above 1.9 Armature reaction and its effects and commutation
Unit– II DC Motors	2a. Classify different types of DC Motors. 2b. Compare performance of different types of DC motors. 2c. Calculate the losses and efficiency 2d. Select DC motors for given application.	2.1 Working principle of DC motor, back emf. 2.2 Torque equation for DC motor. 2.3 Need DC motor starters 2.4 Construction and working of DC motor starters 2.5 Series, Shunt and Compound DC motors 2.6 Performance characteristics of DC Series, Shunt and Compound motor. 2.7 Speed control of D.C. motor 2.8 Losses in DC motors and its computation Simple numerical on above 2.9 Applications of DC Series, Shunt and compound motor.
Unit– III Single Phase Transformer	3a. Identify the parts of single phase transformer. 3b. Classify the transformer . 3c. Distinguish between single phase Autotransformer and single phase transformer.	3.1 Single phase transformer: Working principle, construction, materials used for different parts. 3.2 EMF equation and transformation ratio. 3.3 Classification of single phase transformer.

	3d. Plot phasor diagram of transformer for given load. 3e. Calculate efficiency of a single phase transformer. 3f. Determine various parameters for the transformer equivalent circuit	3.4 Single phase Autotransformer-Construction, working, advantages and disadvantages. 3.5Phasor diagram for no load and different types of loads. 3.6 Losses in transformer: Iron loss, Copper loss, Hysteresis loss and eddy current loss. 3.7 All Day Efficiency, Efficiency Condition for maximum efficiency of single phase transformer. 3.8 Voltage regulation 3.9 Equivalent circuit of single phase transformer. 3.10 Numerical on above
Unit – IV Testing of Single phase Transformer	4a. Carry out different test on single phase transformer. 4b. List the conditions for parallel operation of transformers. 4c. Distinguish between autotransformer and two winding transformer. 4d. Use of auto transformer for specified application.	4.1 Direct load test, OC and SC test and Sumpner Test along with connection diagrams, efficiency and regulation of transformer. 4.2 Derivation of equivalent circuit and its related parameters. 4.3 Need of parallel operation, essential and desirable conditions for parallel operation. 4.4 Parallel operation and load sharing of single phase transformer. Simple numerical on above 4.5 Construction and working of autotransformer. 4.6Advantages and disadvantages of auto transformer. 4.7 Applications of auto transformer.
Unit – V Three Phase Transformer	5a. Identify the parts of the Three phase transformer. 5b. Choose different types of connections of 3-phase transformer for given application. 5c. State the importance of parallel operation.	5.1 Comparison of three phase transformer with bank of three single phase transformers. 5.2 Construction - Accessories of 3 phase transformer: Main tank, bushings, conservator with breather, oil level gauge, radiators, buchholz relay, explosion vent, temperature indicators, junction box. 5.3Types of losses in transformers. 5.4 Different connections (y-y, y-Δ, Δ-Δ,Δ-y)connections and vector groups. 5.6 Parallel operation – Essential and desirable Conditions

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Teaching Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL
1	DC Generators	10	03	04	06	13
2	DC Motors	10	03	04	06	13
3	Single Phase Transformer	28	06	10	14	30
4	Testing of Single Phase Transformers	08	03	03	06	12
5	Three Phase Transformer	08	---	06	06	12
	Total	64	15	27	38	80

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	1	Identify various parts of DC machine	02
2	1	Conduct load test on DC shunt generator and plot V-I Characteristics.	04
3	1	Perform the characteristics of a separately excited DC shunt generator	02
4	2	Connect three point and four point starters for DC motor.	02
5	2	Reverse the direction of rotation of DC shunt motor.	02
6	2	Control the speed of DC series motor.	02
7	2	Control the speed of DC shunt motor by field control method.	02
8	2	Control the speed of DC shunt motor by armature voltage control method.	02
9	3	Identify various parts of single phase transformer	02
10	3	Find efficiency and regulation of transformer by direct loading method	04

11	4	Perform Load test on single phase transformer.	02
12	4	Perform OC and SC test on single phase transformer.	04
Total Hours(perform 10 practical worth 28 hours so that most units are covered)			30

8. SUGGESTED STUDENTS ACTIVITIES

Other than class room and laboratory activities following are the suggested guided co-curricular students activities which need to be undertaken to facilitate the attainment of various course outcomes of this course. The students are required to maintain portfolio of their experiences which he/ she will submit at the end of the term.

a. Prepare charts for construction of various DC machines and transformer.
b. Identify different types of dc machine based on their winding arrangement
c. Prepare chart displaying the various parts of a three and four point dc motor starter
d. Guided Visit power plant/substation for observing controlling action of three phase transformer.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Improved lecture
b. Demonstration
c. Expert Lecture
d. Field visit

10. SUGGESTED LEARNING RESOURCE

S.No.	Name of Book	Author	Publication
1	Electrical Technology Vol-II	Theraja, B.L.	S. Chand, New Delhi, 2012 or latest
2	Electrical Machines	Despande, M.V.	PHI Learning,, New Delhi, 2012 or latest
3	Electrical Technology	Uppal, S.L.	Khanna Publication, New Delhi, 2012 or latest
4	Electrical Machine	Nagrath, I.J. a Kothari, D.P.	Tata McGraw Hill, New Delhi, 2012 or latest
5	Electrical Machine-I	Gupta, J. B.	S. K. Kataria& Sons, New Delhi, 2012 or latest
6	DC Machines and Transformers	K.Murungesh Kumar	Vikas Publishing House Pvt. Ltd.

			New Delhi
7	Principles of Electrical Machines	V. K. Mehta &Rohit Mehta,	S.Chand and Co.Ltd., New Delhi

11. **LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED** :

S. No.	Name of equipment	Brief specification
1.	DC shunt, series and compound motor	230 V DC , 19 A, 1000 RPM, 5HP
2.	DC shunt motor-generator set	230 V DC, 16 A, 1000 RPM, 5 HP
3.	Single phase transformer	230 V / 115 V, 1 kVA 1-phase transformer
4.	Auto transformer	0 – 230 V, 10 Amp
5.	Three phase transformer	415/230,2 kva,208 amp

12. LEARNING WEBSITE & SOFTWARE

a. www.nptel.com/iitm/
b. www.howstuffworks.com/
c. www.vlab.com
d. www.sskphdmm.com
e. http://www.youtube.com/watch?v=RAc1RYilugI
f. http://www.youtube.com/watch?v=Ue6S8L4On-&feature=related
g. http://www.youtube.com/watch?v=d_aTC0iKO68&feature=related
h. http://www.youtube.com/watch?v=Xi7o8cMPI0E&feature=related
i. http://www.youtube.com/watch?v=VucsoEhB0NA&feature=related
j. http://www.youtube.com/watch?v=A951LRFRL_M&feature=related

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

SNo	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02

1	Operate different types DC generators.	2	1	1								1	
2	Use DC machine for given application.		2	2	1							1	
3	Determine the performance parameters of single phase transformer		2	2	2								1
4	Conduct different tests for single phase transformer	1	1	1			1						1
5	Select three phase transformer for different application.		2	2	1								

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	S.G.Shaha	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad
2	V.R.Jadhav	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **DISTRIBUTION & UTILIZATION ENGINEERING(DUE)**

COURSE CODE **6E404**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Electrical	Fourth

1. RATIONALE

Every diploma electrical engineer should possess knowledge about performance characteristics of transmission and distribution line and he should be able to operate and maintain electrical utilities for their efficient operations. This course develops skill of troubleshooting in various electrical equipment /appliances in domestic, commercial and industrial sector. This course is at applied level.

2. COMPETENCY

At the end of studying this course students will be able to

"Supervise various operations of electrical power distribution and utilization systems.''

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (OR)	PA (TW)	150
4	-	2	6	80	20	25@	25	
Duration of the Examination (Hrs)				3	1	--	--	

Legends : L-Lecture**; T**-Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment; **OR** – Oral Examination, **PR**-Practical Examination; **TW** - Term Work, # External, @ Internal, ~ Online.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Compare distribution system on the basis different criteria's.
2. Identify the parts of underground cable.
3. Select a motor for given application.
4. Compare different methods of electric heating.
5. Choose methods of electric welding for given application.
6. Identify parts of electric Locomotive.

DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (in cognitive domain only)	Topics and Sub-topics
Unit– I Distribution Systems & Substations	1a. Classify distribution system 1b. Compare different connection schemes. 1c.Identify the different equipments in 33/11kv substation.	1.1 Introduction 1.2 Classification of distribution systems 1.3 A.C. distribution (Primary and secondary distribution system) 1.4 Connection schemes of distribution systems (Radial, ring main and interconnected systems) 1.5 Requirements of distribution system 1.6 A.C. distribution calculations 1.7 Methods of solving A.C. single phase and three phase connected balanced distribution systems with numerical 1.8 Introduction/ requirements 1.10 Advantages and disadvantages 1.11 Selection and location of site 1.12 Pole mounted substation 1.13 Indoor and outdoor substations 1.14 Symbols for equipments in substation 1.15 Equipments used in substation (brief description) 1.16 Layout of 33/11 kV distribution substation
Unit– II Underground Power Cables	2a.Listvarious parts of cable. 2c. List different insulating materials used for cable 2d. Classify underground cables	2.1 Introduction and requirements 2.2 Cable construction 2.3 Insulating materials for cables 2.4 Classification (Only List) 2.5 Laying of underground cables(Methods)

Unit– III Electric Drives	3b. Differentiate between Individual and group drive 3c. List factors governing selection of electric motors in a electric drive.	3.1 Advantages and disadvantages 3.2 Individual and group drive 3.3 Selection of a electric motor for a particular application 3.4 Duty cycle 3.5 Size and rating of electric motor
Unit – IV Electric Heating	4b. Compare different modes of heat transfer 4c. Explain the different methods of electric heating.	4.1 Advantages 4.2 Modes of heat transfer (Conduction, convection and radiation) 4.3 Types of electric heating 4.4 Resistance heating (Construction and operation) 4.4.1 Direct resistance heating – salt bath furnace 4.4.2 Indirect resistance heating – resistance ovens 4.4.3 Requirement of heating elements 4.4.4 Causes of failure of heating elements 4.5 Applications of resistance heating 4.6 Arc heating (Construction and operation) 4.6.1 Direct arc furnace 4.6.2 Indirect arc furnace 4.7 Applications of arc heating 4.8 Induction heating (Construction and operation) 4.8.1 Direct core type induction furnace 4.8.2 Indirect core type induction furnace 4.9 Applications of induction heating 4.10 Dielectric heating – principle, advantages, disadvantages and applications
Unit – V Electric Welding	5c.List the types of electric welding. 5e.Compare different methods of electric welding.	5.1 Definition 5.2 Resistance welding – principle, advantages, disadvantages and applications 5.3 Types of resistance welding (only list) 5.4 Electric arc welding – principle, advantages, disadvantages and applications 5.5 Comparison of resistance and arc welding
Unit – VI Electric	6a.List requirement of ideal traction system. 6b.Explain different types of track	6.1 Requirements of an ideal traction system 6.2 Systems of track electrification

Traction	electrification system 6c.State different overhead equipments used in traction system. 6d.Draw block diagram of A.C. Locomotive 6g.Compare different types of electric braking used in electric traction.	6.2.1 D.C. system 6.2.2 Single phase A.C. system 6.2.3 Three phase A.C. system 6.2.4 Composite system 6.3 Overhead equipments 6.3.1 Catnary construction 6.3.2 Current collecting equipments 6.4 Block diagram of A.C. locomotive 6.5 Traction motors 6.5.1 Desirable characteristics of traction motors 6.5.2 Suitability of D.C. series motor for traction 6.7 Braking 6.7.1 Requirements of braking system 6.7.2 Types of braking (Only List) 6.7.3 Electric braking – Rheostatic and Regenerative braking (No derivation, no numerical)

5. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Teaching Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL
1	Distribution Systems & Substations	14	4	7	7	18
2	Underground power cables	06	-	3	3	06
3	Electric Drives	06	-	2	4	06
4	Electric Heating	16	4	8	8	20
5	Electric Welding	06	2	3	3	08
6	Electric Traction	16	4	6	12	22
	Total	64	14	29	37	80

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	1	Prepare a technical report on primary and secondary distribution systems (From Internet)	04
2	1	Prepare a technical report after visiting a 132kV/33kV substation	04
3	2	Prepare a technical report on H.T & L.T underground cables used in power system(From Internet)	04
4	3	Compare various Electric Drives for Traction.	02
5	4	Prepare a technical report after visiting an industry, manufacturing electrical heating furnaces. (otherwise from internet)	04
6	4	Prepare a report of specification of various heating furnaces used in industries.	02
7	5	Prepare a report of specification of various electrical welding machines available in college workshop.	04
8	6	Select the appropriate motors and justify selection for given different load situations	02
9	6	Prepare a report on various types of traction systems.	04
10	6	Prepare a report on various types of electrical breaking.	04
Total (28 Hours of Practical is Compulsory)			34

6. SUGGESTED STUDENTS ACTIVITIES

Other than class room and laboratory activities following are the suggested guided co-curricular student's activities which need to be undertaken to facilitate the attainment of various course outcomes of this course. The students are required to maintain portfolio of their experiences which he/ she will submit at the end of the term.

a. Prepare charts showing different connection schemes of distribution system
b. Prepare a report on different types of traction motors.
c. Prepare charts showing different methods of electric heating.

d. Prepare charts showing different methods of electric welding.

7. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Expert Lecture
b. Field Visit

8. SUGGESTED LEARNING RESOURCE

S.No.	Name of Book	Author	Publication
1	Electrical Power system	V. K. Mehta	S. Chand, New Delhi, Latest edition
2	Electrical power system	Soni, Gupta, Bhatnagar	Dhanpat Rai & sons
3	Utilization of electrical energy	H. Partab	Khanna Publications
4	Utilization of electrical power and electric traction	J. B. Gupta	S. Kataria & Sons
5	Utilization of electrical power and electric traction	G. C. Garg	Khanna Publications
6	Electrical Power system	V. K. Mehta	S. Chand, New Delhi, Latest edition

9. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED

S. No.	Name of equipment	Brief specification
1.	Samples of H.T and L.T Cables	As Per Electrical Industry Specification

10. LEARNING WEBSITE & SOFTWARE

a. https://en.wikipedia.org/wiki/Electric_power_distribution
b. http://www.mahadiscom.in/
c. https://en.wikipedia.org/wiki/Electricity_distribution_companies_by_country
d. http://nptel.ac.in/courses/108102047/
e. https://en.wikipedia.org/wiki/Railway_electric_traction

11. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

SNo	Course Outcome	Pos										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Compare distribution system on the basis different criteria's.	2	3	-	1	-	-	-	-	-	-	-	2
2	Identify the parts of cable.	1	1	-	-	-	-	-	-	-	-	-	1
3	Select a motor for given application.		1	-	-	-	-	-	-	-	-	1	-
4	Compare different methods of electric heating.	3	3	-	-	-	-	-	-	-	-	-	-
5	Choose methods of electric welding for given application.	1	2	-	-	-	-	-	-	-	-	-	-
6	Identify parts of electric Locomotive	1	3	-	-	-	-	-	-	-	-	2	1

Course Curriculum Design Committee

Sr No	Name of the Faculty members	Designation and Institute
1	P. M. Raut	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE Domestic Installation and Wiring(DIW)

COURSE CODE 6E406

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Electrical	Fourth

1. RATIONALE

Electrical wiring, estimation and costing plays a major role in distributing the electrical energy from electric utilities to consumer. The subject develops the skill of planning, estimation- costing,, tendering and installing various electrical wiring installations in residential electrification schemes.

2. COMPETENCY

At the end of studying this course students will be able to

"Complete the electrification of residential buildings As per IE rules."

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (OR)	PA (TW)	175
4	-	2	6	80	20	50@	25	
Duration of the Examination (Hrs)				--	--	--	--	

Legends : L-Lecture**; T**-Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment; **OR** – Oral Examination, **PR**-Practical Examination; **TW** - Term Work, # External, @ Internal, ~ Online.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Prepare an estimate of quantity and cost of the material for an electrical project following IE rules.

2. Estimate the materials and cost of electrification for residential buildings and for service connections.
3. Design Illumination schemes for various applications in residential Locations.
4. interpret procedure for inviting tenders and contracts

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (in cognitive domain only)	Topics and Sub-topics
Unit– I Installation and earthing	1a- List the Tools required for residential Installation work. 1b- Select the I.E. rules for residential installation, earthing, residential wiring.	1.1 Tools and accessories required for domestic installation work. 1.2 Introduction to Indian Electricity rules relating to transmission and distribution lines and domestic installation regarding: 1.2.1 Service lines and apparatus on consumers premises 1.2.2 cutout on consumers premises 1.2.3 Identification of earthed and earthed neutral conductor 1.2.4 earthed terminal or consumers premises. 1.2.5 Supply to consumers 1.2.6 Declared voltage of supply to consumers 1.2.7 Declared frequency of supply to consumers 1.2.8 Point of commencement of supply 1.2.9 Clearance above ground of lowest conductor 1.2.10 Clearance from buildings of low and medium voltage lines and service lines 1.3 Electrical installation in residential premises. 1.4 Installation of transmission and distribution lines. 1.4.1 survey to fix the route 1.4.2 pole errection 1.4.3 fixing of insulators, cross arms, etc) 1.4.4 Conductor errection 1.5 Purpose of earthing and installation (plate and pipe) 1.6 maximum values of earth resistance for different installations

		such as power stations, substations, domestic installation, O.H. installation 1.7 Factors on which earth resistance depends 1.8 methods of reducing earth resistance.
Unit– II Estimation and Wiring	2a. Prepare wiring layout of Electrical installation. 2e. Calculate total load on electrical distribution work. Prepare specification of wiring material and Estimate the cost of material and accessories required for various service connections.	2.1 Wiring systems: Factors, Types of wiring (casing capping ,conduit), fundamentals of wiring system, looping in system, tree system, ring system 2.2 testing of wiring installation. 2.2.1 Insulation test between conductor and earth. 2.2.2 Insulation test between conductors. 2.2.3 earth continuity test 2.2.4 Polarity test of switches. 2.3 Concept of estimation: Purpose, types of estimates, schedule of rates, rate analysis, labor Cost. 2.4 Estimation of service connections for residential installation: 2.4.1 Service connection for single storey buildings. 2.4.2 Service connection for double storey buildings 2.4.3 Underground service connection 2.5 Residential wiring: Rules for residential wiring ,Rating of different apparatus such as lamps, fans, socket outlet, fuses, switches, MCB, ELCB, Load assessment, Determination of conductor size Permissible voltage drops and size of wires, Estimation and costing of electrical installation in a two and three room flat.
Unit– III Illumination	3a. Calculate illumination requirements. 3b. Design illumination scheme for residential purposes.	3.1Definitions : Plane angle, solid angle, luminous flux, luminous intensity, lumen, illumination, MHCP, MSCP, MHSCP, reduction factor, brightness 3.2 Laws of illumination 3.2.1 Inverse square law 3.2.2 Cosine law 3.3 Factors on which quality of lighting system depends.

		3.4 Lighting schemes 3.4.1 Direct 3.4.2 Indirect 3.4.2 Semi direct 3.4.3 Semi indirect. 3.3 Design of lighting scheme 3.3.1 Space to height ratio, 3.3.2 Utilization factor 3.3.3 Depreciation factor 3.3.4 waste light factor 3.4 Calculation of total 3.4.1 Lumens required 3.4.2 Illumination required for residential purposes 3.5 simple numerical
Unit – IV Principles of Contracting	4a. prepare contract and tender document for given project.	4.1 Concept of contract and tendering: Contract, contractors, tender and tender notice. 4.2 Procedure for inviting tenders, procedure followed by contractor to fill the tender and for the award of work. 4.3 Preparation of tender documents, Concept of following terms: i)Schedule of material, ii) Schedule of cost, iii) Valid contract, iv) Earnest money deposit v) Security deposit, vi) Comparative statements. 4.4 Permit system: Introduction to permit system, precaution to be taken, by issuer of permit, logging of permit issue and return, precautions to be taken when working with permit.

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Teaching Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL

1	Installation and earthing.	18	6	9	8	23
2	Estimation and Wiring	22	6	8	12	26
3	Illumination	12	4	4	8	16
4	Principles of Contracting	12	4	4	7	15

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	1	Draw different symbols used in residential wiring.	06
2	2	Draw layout of service connections and estimation report of Overhead line and underground line.	06
3	2	Draw layout of residential unit and prepare visit report for residential unit.	06
4	3	Design an Illumination scheme for a residential complex.	06
5	4	Preparation of tender documents.	04
Total (All practical's are compulsory)			28

8. SUGGESTED STUDENTS ACTIVITIES

Other than class room and laboratory activities following are the suggested guided co-curricular students activities which need to be undertaken to facilitate the attainment of various course outcomes of this course. The students are required to maintain portfolio of their experiences which he/ she will submit at the end of the term.

a. Compare various earthing methods according to its applications.
b. Analyze the standard specifications of various electrical accessories and fittings.
c. Make comparative table of different types of wiring installations.
d. Visit to see the electrification of residential complex and prepare report.
e. Make comparative table of different lighting schemes.
f. Prepare charts for different tools required for residential installation work.
g. Make a chart for tender document.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

i. Arrange lectures by contractors engaged in electrification works of residential complexes.
ii. Arrange a visit to a residential complex under construction where electrification work is in progress.
iii. Show video/animation film to demonstrate the different types of wiring and installations
iv. Carry out a survey and prepare a report on different type of modern electrical accessories and fittings available in local market.
v. Arrange lectures by contractors engaged for how to prepare tender document.

10. SUGGESTED LEARNING RESOURCE

Sr.No.	Name of Book	Author	Publication
1	S. L. Uppal	Electrical wiring estimation and costing	Khanna
2	S.K. Bhattacharya	Estimation and costing	New Age
3	B. P. Patil	Electrical Installation system I and II	Nirali
4	Jack L. Lindsey	Applied Illumination Engineering	The Fairmont Press Inc.

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED :

S. No.	Name of equipment	Brief specification
1.	NA	NA

12. LEARNING WEBSITE & SOFTWARE

a.https://electricalnotes.wordpress.com
b.nitp.ac.in/php/EE152Electrical Wiring
c.nptel.ac.in/courses/Lesson11
d. https://m.youtube.com/watch/Illumination Engineering Part 10
e.Tenders.gov.in/view tenddoc

f.Gradestack.com/types-and its effects

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

Sr. No.	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Prepare an estimate of quantity and cost of the material for an electrical project following IE rules.	-	3	1	1	-	-	-	-	-	2	-	-
2	Estimate the materials and cost of electrification for residential buildings and for service connections	-	3	3	-	-	-	-	-	-	-	-	-
3	Design Illumination schemes for various applications in residential Locations.	-	3	-	-	-	-	-	-	-	1	-	-
4	Interpret procedure for inviting tenders and contracts.	-	3	-	-	-	-	-	-	-	2	-	-

Course Curriculum Design Committee

Sr. No	Name of the faculty members	Designation and Institute
1	S.D.Pardeshi	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad
2	M.L.Bhagwat	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE- COMPUTER AIDED DESIGN(CAD)

COURSE CODE 6E209

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Electrical	Fourth

1. **RATIONALE :** This course develops the skill of reading and interpreting the drawing of equipments , installations and circuits.Due to rapid changes in technology, the advanced drafting software are essential . The role of the CAD is in aiding Diploma Engineer by providing accurately generated and easily modifiable graphical representation of the product on screen.

2. COMPETENCY

At the end of studying this course students will be able to

"Plan the effective and efficient use of Electrical Energy in different applications."

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (Hours/Credits)			Total Credits (L+T+P)	Examination Scheme(Marks)				
				Theory		Practical		Total Marks
L	T	P	C	ESE	PT	ESE (PR)	PA (TW)	50
--	--	02	02	--	--	25@	25	
Duration of the Examination (Hrs)				--	--	--	--	

Legends : L-Lecture**; T-**Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, **OR** – Oral Examination, **PR-** Practical Examination ; **TW** - Term Work, # External, @ Internal, ~ Online.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Create AutoCAD environment.
2. Draw basic elements of Electrical circuits.
3. Use LAYERS in drawing major electrical circuit.
4. Use of MODIFY commands.
5. Use BLOCKcommand in circuit having repetitive components.
6. Draw any type of Electrical Circuit / Network using combination of above commands.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (Cognitive Domain Only)	Topics and Sub-topics
Unit–I Introduction to AutoCAD	1a. Compare conventional drawing methods and AutoCAD.	1.1-Starting AutoCAD and understanding the display. 1.2-Advantages of AutoCAD.
Unit – II Creating Drawing	2a.Use DRAW commands to draw electrical symbols. .	2.1- Basic MENUs in AutoCAD. 2.2-Coordinate System basics. 2.3-Using DRAW commands. 2.4-Annotating a Drawing with Text and Hatching.
Unit– III Understanding Layers and Line types	3a.Draw an Electrical circuit with many components in different layers.	3.1-Working with Layers. 3.2-Understanding and Creating line types.
Unit–IV Modifying the object	4a .Modify the drawing using various MODIFY commands. 4b. Draw electrical symbols using ARRAY.	4.1-Moving and Copying the Objects 4.2-Rotating, Mirroring, Scaling, and Stretching, trimming the Objects 4.3-Producing Arrays of Objects (ARRAY)
Unit–V Application of Block	5a. Use block command to draw a circuit with repetitive components.	5.1-Creating Blocks 5.2Adding Information to a Block with Attributes.
Unit VI Plotting the circuit	6a- Draw any Electrical circuit.	6.1-Drawing a Circuit using above Commands.

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Teaching Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL
	---- Not Applicable------					

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	1	Create specific folder for Electrical and add file name.	02
2	1	Setting the limits for Electrical paper size.	02
3	2	Create the symbol for Fuse, resistor	02
4	2	Draw different types of Cables using Hatch command.	04
5	2	Adding Text to drawing (Annotation)	02
6	3	Draw a circuit by creating different Electrical symbols in different layers(Min 5)	04
7	4	Create a star- delta combination of resistors using ARRAY command.	04
8	4	Create Electrical symbols like Inductor using Modify command.	04
9	5	Create a Blocks of the Electrical Symbols. and Insert the Symbol into a Drawing	04
10	6	Draw a detailed circuit from any course you have studied using Minimum 10 AutoCAD commands.	04
Total Hours(perform practical worth 28 hours so that most units are covered)			**32**

8. SUGGESTED STUDENTS ACTIVITIES

Following is the list of proposed student activities like:

---------- Not applicable----------

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

1. Students should be shown video films to explain the applications of different types commands.
2. An Expert lecture on Applications of CAD in the field of Engineering

10. SUGGESTED LEARNING RESOURCE

S.No.	Name of Book	Author	Publication
1	AutoCAD 2015 For Beginners	CADFolks	Amazon India
2	Mastering AutoCAD	George Omura/ Brian Benton	Autodesk official press.
3	AutoCAD 2013 for Engineers and Designers.	Sham Tickoo	Dream tech press, New Delhi, Latest edition
4	100 CAD exercises	Jason Artes	12CAD.com
5	AutoCAD 2015 and AutoCAD LT 2015 Bible- 1st Edition	Ellen Finklestein	Wiley publication.

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED:

Sr. No	Name of the Equipment	Brief specification
1	PCs with AutoCAD 2015 installed in it.	---NA----

12. LEARNING WEBSITE & SOFTWARE

a. https://www.youtube.com/watch?v=JyE-6loC_Aw
b. https://www.youtube.com/watch?v=dBAGbkU-Bwk&nohtml5=False
c. https://www.youtube.com/watch?v=U0EomtqANFQ&nohtml5=False

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

SN	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
CO1	Create AutoCAD environment.	-	3	-	-	-	-	-	-	-	-	-	-
CO2	Draw basic elements of Electrical circuits.	-	2	2	2	-	-	-	-	-	-	-	-
CO3	Use Layers in drawing major electrical circuit.	-	1	2	1	-	-	-	-	-	-	-	-
CO4	Use of MODIFY commands.	-	-	3	3	-	-	-	-	-	-	-	-
CO5	Use Block command in circuit having repetitive components.	-	-	2	2	-	-	-	-	-	-	-	-
CO6	Draw any type of ElectricalCircuit/Network using combination of above commands.	-	-	-	3	-	-	-	-	-	-	-	-

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	A.A.Ghate	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE: NON CONVENTIONAL ENERGY RESOURSES(NCR)

COURSE CODE: 6E506

Diploma Programmers in which this course is offered	**Semester in which offered**
Electrical Engineering	Fourth

1. RATIONALE

Maharashtra is one of the several states in India where a large number of wind and solar grid connected electric power installations, and competent technicians to maintain these vital renewable energy power plants is a dire need of the industry. It is to fulfil this need, that this curriculum has been designed so that the diploma engineer would be able to maintain the installations thereby minimizing the downtime. It is presumed that the students have studied

2. COMPETENCY

At the end of studying this course students will be able

Maintain various types of power plants based on Renewable Energy resources

3.TEACHING AND EXAMINATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (PR)	PA (TW)	100
4	-	-	4	80	20	-	-	
Duration of the Examination (Hrs)				3	1	--	--	

4.COURSE OUTCOMES

At end of studying this course student will be able to:

1. Know the importance of non conventional energy recourses
2. Use of renewable energy sources to generate Power
3. Maintain variable speed wind power plants and solar Energy power plant
4. Maintain concentrated solar power (CSP) and solar photovoltaic (PV) wind power plants and Biogas plant
5. Use of biogas plant for given application.

5. DETAILED COURSE CONTENTS

UNIT	Major Learning Outcomes (Major outcomes in Cognitive Domain)	Topics and Sub-topics
Unit – I **General Introduction to Renewal Energy sources**	1a. Know different available renewable energy recourses	1.1 Renewable energy sources 1.2 Types of Renewable energy sources. 1.3 Advantages and disadvantages of renewable energy sources 1.4 Future Prospects of renewable energy sources.
Unit – 2 **Solar Energy and Solar Photovoltaic System**	1a. Use of solar recourses to generate electrical power. 1d. Differentiate among All mechanical and electrical energy storage systems	2.1 Types of Solar Radiation. 2.2 Solar Energy collector. 2.2.1 Flat plate collector. 2.2.3 Concentrating collector. 2.2.3 Solar ponds. 2.3 Solar power tower. 2.4 Solar Energy storage. 2.4.1 Electrical storage (Battery storage) 2.4.2 Mechanical storage (Pumped Hydroelectric, fly wheel Compressed air) 2.5 Advantages and disadvantages of solar energy 2.6 Photovoltaic cell 2.7 Photovoltaic power generation (block diagram) 2.8Types of Photovoltaic power generation systems 2.8.1 Stand alone PV power generation systems. 2.8.2 Hybrid systems. 2.8.3 Grid connected systems. 2.8.4 Consumer application.
Unit 3: **Wind Power**	1a. Use of wind recourses to generate electrical power. 1d. Differentiate among All types of wind power systems.	3.1 Introduction 3.2 Historical development of wind power. 3.3 Block diagram of a wind electric system 3.4 Types of wind turbine (Horizontal axis & Vertical axis) 3.5 Variation of power output with wind speed. 3.6 Selection of site for WTGS

		3.7 Economic size of wind turbine generator (WTG) 3.8 Modes of wind power generation (Stand alone, Grid connected) 3.9 Advantages and disadvantages of Wind energy
Unit 4: **Wind and Solar Power Quality and Grid Connections**	4a. Suggest ways to handle Solar and wind power plant. 4b. Connect solar and wind and Solar Power plant to grid.	4.1. Local impact of wind power on the grid. 4a. Describe the phenomenon of local impact of wind power on the grid 4b. Suggest ways to handle these system wide impacts safely 4.2. System wide impact of wind power on the grid. 4.3. Power Quality of solar PV systems 4.4 Differentiate the features of the power obtained from the solar PV and CSP power plant 4.5. Grid interface issues of wind power. 4.6. Grid operational issues of wind power 4.7 Grid interface issues of Solar power. 4.8. Grid operational issues of Solar power
Unit 5: **Energy from Biomass**	5a. Use of biomass recourses to generate biogas. 5b. Generate electrical energy from biomass recourses.	6.1 Introduction to Biomass. 6.2 Biomass resources. 6.3 Biogas generation. 6.4 Biogas plant: 6.4.1 Floating drum type biogas plant. 6.4.2 Fixed dome type biogas plant. 6.5 Advantages and disadvantages of Biomass energy.

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Title Of Unit	Teaching Hour	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
1	Introduction to Renewable Energy Recourses	10	02	06	02	10

2	Solar Energy	15	02	08	10	20
3	Wind Energy	15	02	08	10	20
4	Wind and Solar Power Quality and Grid Connections	12	02	08	06	16
5	Biogas Energy	12	02	06	06	14
	Total	**64**	**10**	**36**	**34**	**80**

Legends: R = Remembrance; U = Understanding; A = Apply and above levels (Revised Bloom's taxonomy)

7. SUGGESTED STUDENT ACTIVITIES:

a. Use Video films/animation films on working of various types of wind power plants.
b. Use Video films/animation films on working of various types of solar power plants.
c. Visit to wind farms
d. Visit to solar power plants
e. Mini project.

8. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Demonstration of various non conventional power plants by audio , video technique
b. Activity based learning
c. Seminar on given topics

10. SUGGESTED LEARNING RESOURSES

Sr. No.	Title of Book	Author	Publication
1.	Wind Power Technology	Earnest , Joshua	PHI Learning, New Delhi, 2014
2.	Solar Photovoltaic: A Lab Training Module	Solanki, Chetan Singh, Arora, Brij M., Vasi Juzer, Patil, Mahesh B.	Cambridge University Press, New Delhi, 2009
3.	Solar Photovoltaic: Fundamentals, Technologies and Application	Solanki, Chetan Singh	PHI Learning, New Delhi, 2009
4.	Wind Power Plants and Project Development	Earnest , Joshua and Wizelius, Tore	PHI Learning, New Delhi, 2011
5.	Solar Energy	S.P. Sukhatme, J.K.Nayak.	Tata McGraw, New Delhi, 2010.
6.	Introduction to Photovoltaics	John R. Balfour, Michael L. Shaw, Sharlave Jarosek	Jones & Bartlett Publishers, Burlington, 2011
7.	Concentrator Photovoltaic	Luque A. L. and Andreev V.M.	Springer, 2007

8.	Solar Cells and Their Applications	Partain L.D., Fraas L.M.	Wiley, 2nd Ed., New Delhi, 2010

11. LEARNING WEBSITES & SOFTWARE

1. http://www.awea.org/Resources/Content.aspx?ItemNumber=900
2. http://www.windpowerwiki.dk/
3. http://learn.kidwind.org/teach
4. http://www.fao.org/docrep/010/ah810e/AH810E11.htm
5. http://www.renewables-made-in-germany.com/en/renewables-made-in-germany-start/solar-energy/solar-thermal-energy/overview.html

12. MAPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMMES SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

CO. NO.	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	1	2
CO1	Know the importance of non conventional energy recourses	3	-	-	-	-	-	-	-	-	-	-	-
CO2	Use of renewable energy sources to generate Power	1	2	2	2	-	-	-	-	-	-	-	-
CO3	Maintain variable speed wind power plants and solar Energy power plant	1	1	1	-	-	-	-	-	-	-	1	1
CO4	Maintain concentrated solar power (CSP) and solar photovoltaic (PV) wind power plants and Biogas plant	1	1	2	-	-	-	-	-	-	-	1	1
CO5	Use of Biogas plant for given application	1	1	2							-	-	-

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	S.R.Bhasme	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE- **DIGITAL TECHNIQUES(DTC)**

COURSE CODE **6E410**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Electrical	Fourth

1. RATIONALE

The knowledge of basic building blocks of digital electronics and awareness of various number systems, logic gates, logic families and combinational and sequential logic circuits, are essential for understanding the digital controls, microprocessors and computer systems. Through this basic course the student will be able to apply the same concepts in almost all areas of electronic controls and develop the testing skills.

2. COMPETENCY

At the end of studying this course students will be able to

"Test digital logic circuits"

3. TEACHING AND EXAMNATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (PR)	PA (TW)	150
4	-	2	6	80	20	25#	25	
Duration of the Examination (Hrs)				3	1	--	--	

Legends : L-Lecture**; T-**Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, OR – Oral Examination, TW - Term Work, # External, @ Internal

4. COURSE OUTCOMES(font size)

At the end of studying this course students will be able to: -

1. Perform the conversions on various number systems & binary arithmetic operations
2. Build basic logic circuits
3. Compare various logic families.
4. Use the basic sequential circuit & its types.
5. Interpret the basic combinational circuit & its types.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (Cognitive Domain Only)	Topics And Sub-Topics
Unit - I Number Systems and Binary Codes	1a. Compare weighted and un-weighted codes. 1b. Convert number from decimal to binary no. system, decimal to octal no. system, decimal to hexadecimal no. system and vice-versa. 1c. Perform binary arithmetic operations.	1.1 Decimal number, binary number, octal and Hexadecimal number. 1.2 Basic mathematical operations – 1's complement, 2's complement . 1.3 Weighted and un-weighted codes. Uses of codes-BCD, Gray, Excess-3, ASCII, EBCDIC code 1.4 Conversion: conversion of one number system to the other. 1.5 Binary addition, subtraction.
Unit - II Boolean Algebra & Logic gates	2a. Differentiate positive and negative logic system. 2b. Draw symbol & describe truth-table, logic equation, and applications of basic logic gates, Special type of logic gates, Universal logic gates 2c. Design basic logic gates using universal gates. 2d. Apply laws of Boolean Algebra and Build logic circuits for a given Boolean expression by algebraic method. 2e. Represent upto 4 variables on K-map and reduce K- map with various techniques.	2.1 Positive logic system and negative logic system. 2.2 Basic logic gates - NOT, AND, OR 2.3 Special type of logic gates - Ex-OR gate, Ex-NOR gate 2.4 Universal logic gates - NAND & NOR gate 2.5 De Morgan's theorem. 2.6 Concept, laws and applications of Boolean algebra 2.7 Boolean expression and logic diagram, Simplification of given Boolean equation 2.8 Sum of product (SOP) & Product of sum (POS) equation. 2.9 Introduction to K-map: Definition, advantages, representation of 2, 3, 4 variable K-map, K- map reduction techniques, Don't care condition, Numericals based on this topic.
Unit – III Logic Families	3a. Compare various logic families. 3b. Draw the pin diagrams of IC's of 7400 TTL series & CD4000 series .	3.1 Characteristics of logic gates: speed of operation, power dissipation, figure of merit, fan in, fan out, current sinking, current sourcing 3.2 Classifications of logic families: Saturated and non-saturated logic families, RTL, DTL, TTL, MOS & CMOS families.

Unit - IV Sequential Logic Circuits	4a. Difference between combinational & Sequential logic circuit. 4b. Compare Triggering methods. 4c. Implement various sequential circuits with their truth tables. 4d. Select various types of shift registers and counters in given condition.	4.1 Introduction to Sequential logic circuit 4.2 Triggering methods :Edge and level triggering 4.3 Flip Flops: S R flip flop using NAND gates, clocked SR flip flop with present & clear, JK flip-flop, clocked JK flip flop with present & clear, Master slave JK flip-flop, D & T flip flops . 4.4 Shift Registers : Introduction ,Types- SISO,SIPO,PISO,PIPO Counters: Introduction, Types- Asynchronous counter, synchronous counter, ripple counter, ring counter, MOD - N counter.
Unit - V Combinational Logic Circuits	5a. Compare combinational & sequential logic circuits. 5b. Implement various combinational logic circuits. 5c. Compare multiplexers and De-multiplexers.	5.1 Introduction to combinational logic circuits. 5.2 Arithmetic Logic unit: Introduction, half & full adder, Sub tractor: Half & full sub tractor. 5.3 Multiplexer: Necessity of Mux, types of Mux; 2: 1, 4: 1, 8: 1, 16: 1 with block diagrams circuit diagrams, operating principles & applications. Study of Mux ICS: IC74150, 74151 5.4 Demultiplexer: Necessity of DEMUX. Types of Demux: 1: 2, 1: 4, 1: 8, 1: 16 with block diagrams, circuit diagrams, operating principles & applications. Study of DEMUX ICS: IC74138, IC74139.

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Teaching Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL
1	Number Systems and Binary Codes	12	2	4	8	14
2	Boolean Algebra & Logic gates	17	6	8	8	22
3	Logic Families	06	2	2	4	08
4	Sequential Logic Circuits	17	6	6	10	22
5	Combinational Logic Circuits	12	2	4	8	14
	TOTAL	64	18	24	38	80

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	01	Build/Test the basic logic gates (AND, OR and NOT).	04
2	01	Build/Test the EX-OR, EX-NOR logic gates	04
3	01	Build/Test NAND and NOR as universal gate.	02
4	02	Build/Test basic logic gates using NAND gates.	02
5	02	Build/Test basic logic gates using NOR gates	02
6	02	Build the circuit for De Morgan's theorem and verify its truth table.	04
7	03	Compare performance of logic families	04
8	04	Build/Test RS flip flop using NAND gate	02
9	04	Build/Test SISO/PISO shift register performing right shift operation	02
10	04	Build/Test D & T type of flip flop.	02
11	05	Build/Test full adder & verify its truth table	02

12	05	Build/Test half adder & verify its truth table.	02
13	05	Build/Test full sub tractor & verify its truth table	02
14	05	Build/Test half sub tractor & verify its truth table	02
Total Hours(perform practical worth 28 hours so that most units are covered)			32

8. SUGGESTED STUDENTS ACTIVITIES

Other than class room and laboratory activities following are the suggested guided co-curricular students activities which need to be undertaken to facilitate the attainment of various course outcomes of this course. The students are required to maintain portfolio of their experiences which he/ she will submit at the end of the term.

a. Read and note down specifications of Digital ICs using data sheet: IC number/ Pin diagram/voltage levels, applications for the following Digital ICs (TTL/CMOS): AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR gates, Multiplexer, De-multiplexer, SR FF,JK FF, D FF, T FF, Shift Register, Counter.

b. Prepare mini project using Various Digital IC and display devices.

SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Improved Lecture methods-
b. Q & A technique.
c. Demonstration
d. Expert lecture
e. Mini project

9. SUGGESTED LEARNING RESOURCE

S.No.	Name of Book	Author	Publication
1.	Principles of digital electronics	Malvino & Leach	Tata McGraw-Hill, New Delhi, latest edition
2.	Digital principles & applications	A. P. Malvino	Tata McGraw-Hill, New Delhi, latest edition
3	Modern digital electronics	R. P. Jain.	TMH Education , New Delhi, 3rd Edition or latest
4	Fundamentals of Digital Circuits	Anand Kumar	PHI Learning, New Delhi, 2nd Edition or latest

10. **LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED** :

S. No.	Name of equipment	Brief specification
1.	Digital IC tester	As per Electronics industry specification
2.	Digital Logic trainer board	As per Electronics industry specification
3	Digital ICs	As per Electronics industry specification

11. LEARNING WEBSITE & SOFTWARE

a. http://www.nptel.ac.in/
b. https://ocw.mit.edu/courses/find-by-topic/#cat=engineering&subcat=electricalengineering&spec=electronics
c. https://www.slideshare.net/

12. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

SNo	Course Outcome	Pos										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Perform the conversions on various number systems & binary arithmetic operations.	1	1	3	-	-	-	-	-	-	-	-	-
2	Build basic logic circuits.	1	3	1	-	-	-	-	-	-	-	-	-
3	Compare various logic families.	1	1	-	-	-	-	-	-	-	-	-	-

4	Use the basic sequential circuit & its types	3	3	-	-	-	-	-	-	-	-	-	-
5	Interpret the basic combinational circuit & its types.	2	2	2	-	-	-	-	-	-	-	-	-

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	Dr. L. I. Shaikh	Head of the Department, Govt. Polytechnic, Aurangabad
2	L. B. Nehate	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad
3	S. B. Choudhari	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **INTRODUCTION TO POWER QUALITY(IPQ)**

COURSE CODE **6E411**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Electrical	Fourth

1. RATIONALE

This course is intended to teach the student facts, concepts, operation of the power system. As power quality is the major issue in the power system operation. All electrical appliances are prone to failure or malfunction when exposed to one or more power quality problems. The students will able to understand the power quality issues and their effects on the performance of the system.

2. COMPETENCY

At the end of studying this course students will be able to

"Identify the various power quality problems occur in the power system."

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (PR)	PA (TW)	150
4	-	2	6	80	20	25#	25	
Duration of the Examination (Hrs)				3	1	--	--	

Legends : L-Lecture**; T**-Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment; **OR** – Oral Examination, **PR**-Practical Examination; **TW** - Term Work, # External, @ Internal, ~ Online.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Identify the power quality problems in give situation.
2. Identify the concept of voltage transients, flickers and its cause.

3. Distinguish between voltage sags, interruption and voltage swell in system.
4. Identify harmonic occurs in the electrical system.
5. Select power quality monitoring instruments for the given system.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (in cognitive domain only)	Topics and Sub-topics
Unit– I Power quality Terminologies	1a. Identify the different terms of power quality issues. 1b. Compare Linear and Non linear loads.	1.1 Concept of Power Quality 1.2 Importance of power quality 1.3 Causes of power quality deterioration 1.4 Definitions of power qualities problems such as interruption, voltage sag, voltage swell, under voltage and overvoltage, Transients, Flicker, harmonics and frequency fluctuation. 1.5 Comparison between linear and non linear loads.
Unit– II Flickers and Transient voltages	2a. Compare flicker, transient voltage occurs in system. 2b. Identify the causes of flickers and its effect on the given system.	2.1 Define -short and long term flicker 2.2 Causes of flickers 2.3 Effects of flickers 2.4 Principle of voltage regulation 2.5Causes of voltage transients 2.6 Effects of transients
Unit– III Voltage sags, Swell and Interruption	3a. Draw characteristics of voltage sags for a given system. 3b. Compare voltage sags with interruption and swell. 3c. Classify the voltage sags according to IEEE 1159 3d. Identify the causes of voltage sags, interruption and swell in given system	Basic terms of Power quality terms: 3.1 Definition of voltage sags, swell and interruption. 3.2 Characteristics of voltage sags- magnitude, duration of sag, Phase angle jump and Point on wave. 3.3 Clasiification of voltage sags according to IEEE 1159 3.4 Differentiate voltage sags and interruption 3.5 Common causes of voltage sags and interruption 3.6 Basics of Power system stability

Unit – IV Harmonics & Reactive power compensation	4a. Calculate THD for a given system. 4b. Identify the causes of harmonics and its effect on the system. 4c. Select the appropriate method to improve power factor.	4.1 Concept of harmonics – number, odd and even. 4.2 Individual and Total Harmonics distortion. 4.3 Causes of harmonics 4.4Effects of Harmonics 4.5Active Power and Reactive Power 4.6 Displacement and true power Factor 4.7 Power factor improvement methods:- static capacitor, condenser. 4.8 Power factor penalty.
Unit – V Power Quality Monitoring	5a. Use the power quality measurement equipments for Power quality monitoring 5b. Select the power quality monitoring location and duration	5.1 Need of power quality monitoring. 5.2 Power quality monitoring objectives and requirement. 5.3Power quality measurement devices:- Wiring and grounding test devices, Multimeters, Oscilloscopes, Disturbance analyzers, Harmonic analyzers, spectrum analyzers, Flicker meters, Energy monitors 5.4 Selection of power quality monitoring Location and period.

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Teaching Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL
1	Power Quality Terminology	10	03	04	06	13
2	Flickers and Transient	10	03	04	06	13
3	Voltage sag, swell and Interruption	20	06	10	08	24
4	Harmonics & Reactive Power Compensation	12	03	05	10	18
5	Power Quality Monitoring	12	---	06	06	12
	TOTAL	64	15	29	36	80

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	1	Compare Linear and Non linear load	02
2	1	Identify power quality problem in a given system	02
3	2	Observe the flicker of lamp or starting of large motor on CRO	04
4	3	Observe voltage sags occurred in the power system(through visit)	04
5	3	Study Classification of voltage sags according to IEEE 1159.	02
6	4	Observe the THD occurs in the power system.(through visit)	04
7	4	Improve the power factor of a given load.	02
8	2,3,4	Prepare a sheet for different power quality issues with comparison.	04
9	5	Select the location for power quality monitoring	02
10	5	Perform power quality monitoring by using Power quality instruments in small substation.	04
Total Hours(perform 9 practical worth 28 hours so that most units are covered)			30

8. SUGGESTED STUDENTS ACTIVITIES

Other than class room and laboratory activities following are the suggested guided co-curricular students activities which need to be undertaken to facilitate the attainment of various course outcomes of this course. The students are required to maintain portfolio of their experiences which he/ she will submit at the end of the term.

a. Prepare charts of power quality problems
b. Guided Visit for observing power quality problem.
c. Make a report on Power Quality monitoring for given site.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Demonstration method
b. Expert lecture

c. Field visit

10. SUGGESTED LEARNING RESOURCE

S.No.	Name of Book	Author	Publication
1	Power system quality assessment	J. Arrillaga, M.R. Watson, S. Chan,.	John Wiley and sons
2	Power System Harmonics	J. Arrillaga, N.R.Watson	John Wiley and sons
3	Power Quality Problems and Mitigation Techniques	Bhim Singh, Ambrish Chandra, Kamal Al-Haddad	John Wiley and sons
4	Electrical Power System Quality	Roger C.Dugan	McGraw Hill Publication
5	Understanding power Quality Problems-Voltage sags and Interruptions	M.H.JBollen	New York IEEE 2009
6	Handbook of Power Quality	Angelo Baggini	John Wiley and sons

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED :

S. No.	Name of equipment	Brief specification
1.	DSO	As per electrical industry specification
2.	Clip on meter	As per electrical industry specification
4	Power Analyser	As per electrical industry specification

12. LEARNING WEBSITE & SOFTWARE

a. http://nptel.ac.in/syllabus/108106025
b. www.howstuffworks.com/
c. www.vlab.com
d. www.mathworks.com
e. https://www.youtube.com/watch?v=YutEqt6IFCk
f. https://www.youtube.com/watch?v=um0Shx9DWSI
g. https://www.youtube.com/watch?v=zH0MTKjxujI
h. https://www.youtube.com/watch?v=gi0iJJ5f6VA

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

SNo	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Identify the power quality problems in give situation.	1	1	-	-	2	-	-	-	-	-	-	-
2	Identify the concept of voltage transients, flickers and its cause.	1	1	1	2	-	-	-	-	-	-	1	-
3	Distinguish between voltage sags, interruption and voltage swell in system.	-	3	2	2	-	-	-	-	-	-	-	2
4	Identify the harmonics occur in the electrical system.	1	1	2	-	-	-	-	-	-	-	-	-
5	Select power quality monitoring instruments for the given system	-	1	1	1	-	-	-	1	-	-	-	-

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	V.R.Jadhav	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad
2	A.A.Ghate	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **AUTO-ELECTRICAL SYSTEMS (AES)**

COURSE CODE **6E412**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Electrical	Fourth

1. RATIONALE

This is one of optional courses offered to students undergoing to their diploma programme in electrical engineering to make them aware of motor vehicle in general and various systems inclusive of electrical systems in particular. This course is offered with the objective to enhance employment opportunities to electrical engineering in automobile sector. There is extensive use of electrical, electronics, instrumentation, micro processing , information systems in modern motor vehicles, due to which this vehicle has immerged as an interdisciplinary product .This has created job avenues for diploma graduates of electronic instrumentation and also electrical engineering in this important sector of any economy .

In this course students will study motor vehicle as a system and its subsystem at systematic level and they will appreciate use of various electrical systems in almost all subsystems of every motor vehicle.

2. COMPETENCY

At the end of studying this course students will be able to

"Identify various electrical systems in different subsystems of in particular a motor vehicle in general".

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (PR)	PA (TW)	150
4	-	2	6	80	20	25#	25	
Duration of the Examination (Hrs)				3Hrs	1 Hr	--	--	

Legends : L-Lecture**; T-**Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment; **OR** – Oral Examination, **PR**-Practical Examination; **TW** - Term Work, # External, @ Internal, ~ Online.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Apply systems approach to any motor vehicle.
2. Identify electrical systems in any motor vehicle.
3. Maintain charging systems.
4. Maintain electrical consumers and wiring system.
5. Identify sensors used in motor vehicle.
6. Identify micro-controllers used in motor vehicle.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (Cognitive Domain Only)	Topics And Sub-Topics
Unit– I A Motor Vehicle as a system	1a. Analyze the motor vehicle in detail. 1b. To study the attributes of motor vehicle. 1c. To study the concepts, types and functions of direct and indirect systems. 1d. To analyze different engineering systems related to vehicle.	1.1 Application of input and process and output to motor 1.2 Mobility service as Output of MV and its attributes. 1.3 Direct and indirect systems concept, types and function 1.4 Vehicle as an interdisciplinary engineering system Mechanical, thermal, fluid, electrical, electronics, Measurement & communication in motor vehicle
Unit-II Introduction to Auto Electrical & Auto-Electronic Components	2a. Explain role of auto-electrical systems, their function and types. 2b. Describe concept of generation, storage charging , distribution and consumers. 2c. Describe types load in detail. 2d. Explain role of auto-electronic systems, their function and types.	2.1 Introduction to auto-electrical systems Role, function, and types 2.2 Concept of Electrical Generation, Storage charging, distribution and consumers 2.3 Types of load – intermittent, prolonged and continuous loads based on consumers 2.4 Introduction to auto-electronics systems Role, function, and types. 2.5 Concept of measurement, control and communication functions
Unit – III Vehicle charging systems.	3a. Describe requirement of charging system and circuit diagram for vehicle. 3b. Explain alternator in detail. 3c. To study rectification and regulation techniques in charging system.	3.1 Requirement of charging system and circuit diagram. 3.2 Alternator - requirement , types ,construction ,working 3.3 Battery-requirement, types ,construction ,working 3.4 Battery charging and maintenance. 3.5 Rectification in charging system. 3.6 Regulation in charging system

Unit–IV Vehicle consumers and wiring	4a. Analyze wiring loom in motor vehicles and its components. 4b. Detail study about ignition and injection systems. 4c. Explain Lighting systems and indicator systems with their types. 4d. Detail study about starting system and to analyse its working. 4e. Detail study about driver assist systems and related to it such other systems..	4.1 Introduction to wiring loom in motor vehicle.-switches, conductors , circuit ,protectors and connectors. 4.2 Ignition and injection systems-types , construction and working. 4.3 Lighting systems- types, requirements, types of lamps (fog lamp) and bulbs , indicator system-types , circuit and working. 4.4 Starting system-circuit diagram , starter motor –types , construction ,working 4.5 Driver assist systems –horn, windshield wiper and washer system (front and rear), defogger system , auto-upper dipper and automatic headlamp systems.
UNIT –V Vehicle instrumentation and measurement systems.	5a. Necessity of instrumentation and measurement in motor vehicle. 5b. Analyze importance of sensors in engine, safety systems, comfort systems, and in security systems along with types , construction and working.	5.1 Requirement of instrumentation and measurement in motor vehicle. 5.2 Sensors in engine – types, construction and working. 5.3 Sensors in safety systems - types, construction and working. 5.4 Sensors in comfort systems- types, construction and working. 5.5 Sensors in security system-types,construction and working.
UNIT –VI Controllers and communication	6a. To be familiar with controllers and communication in motor vehicle. 6b. To study architecture of microcontroller in motor vehicle	6.1 Requirement of controllers and communication in motor vehicle. 6.2 Microcontroller –Architecture to motor vehicle. 6.3 ECU as an microcontroller 6.4 Power train ECU –construction and working

		6.5 Comfort system ECU. 6.6 Safety system ECU.

6. 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	A Motor Vehicle as a system	12	05	05	04	14
II	Introduction to Auto Electrical & Auto-Electronic Components	10	05	05	00	10
III	Vehicle charging systems(font size)	12	05	05	04	14
IV	Vehicle consumers and wiring	14	05	05	04	14
V	Vehicle instrumentation and measurement systems.	08	5	5	04	14
V I	Controllers and communication	08	05	05	04	14
	TOTAL	64	30	30	20	80

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	1	Demonstration of motor vehicles (two wheeler ,four-wheeler)	04
2	2	Identification of auto-electrical systems in two wheeler and four-wheeler.	02
3	2	Identification of auto-electronic systems in two wheeler and four-wheeler.	02
4	3	Removal and replacement of battery in given vehicle.	04
5	3	Dismentalling and assembling of alternator.	02
6	3	Inspection of rectifier and regulator in alternator.	02
7	4	Demonstration of ignition systems in given vehicle.	02
8	4	Draw and navigation through starting systems.	02

9	4	To study lighting system of given vehicle	02
10	5	Identification and testing of sensors in engine of given fourwheeler.	04
11	6	Locate and study engine control module of given vehicle.	02
12	6	Study inter-microcontroller communication in given vehicle.	02
Total Hours(perform practical worth 28 hours so that most units are covered)			30

8. SUGGESTED STUDENTS ACTIVITIES

Other than class room and laboratory activities following are the suggested guided co-curricular student activities which need to be undertaken to facilitate the attainment of various course outcomes of this course. The students are required to maintain portfolio of their experiences which he/ she will submit at the end of the term.

a. Survey of two – wheeler and four-wheeler vehicles .(Students need to survey Electrical wiring of two wheelers and four wheelers)

b. Survey about typical technical faults occurred in different parts of Electrical wiring of Automobiles.

c. Internet based literature survey about various electronic control units.

d. Miniproject on selected topic.

SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Arrange Guided visit to nearby two-wheeler and four-wheeler dealerships, service stations.
b. Show video/animation films to explain functioning of vehicle systems and their accessories.

9. SUGGESTED LEARNING RESOURCE

S. No.	Title of Books	Author	Publication
1	Automotive Technology	Crouse anglin	Tata McGraw-Hill, New Delhi, latest edition
2	Autoelectrical and electronic system	Tom denton	Routledge
3	Autoelectrics and electronics	Konrad Reif Ed.	Springer Vieweg

4	Automotive Mechatronics	Konrad Reif Ed	Springer Vieweg
5	Automotive Electricals	P.M.Kohli	Tata McGraw-Hill, New Delhi, latest edition

10. **LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED** :

S. No.	Name of equipment	Brief specification
1.	Two-wheeler	As per Auto industry specification
2.	Four-wheeler	As per Auto industry specification
3	Starter	As per Auto industry specification
4	Automotive Battery	As per Auto industry specification
5	Alternator	As per Auto industry specification

11. LEARNING WEBSITE & SOFTWARE

a. http://www.nptel.ac.in/
b. self study programs from volkswagan
c. Workshop information system (WIS) of Mercedes Benz
d. Websites of auto manufacturers

12. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

SNo	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02

1	Apply systems approach to any motor vehicle		2	2	2								
2	Identify electrical systems in any motor vehicle		2	2	2								
3	Maintain charging systems.			1	1	2						1	
4	Maintain electrical consumers and wiring system				1	1	2						1
5	Identify sensors used in motor vehicle					2	1	3					
6	Identify microcontrollers used in motor vehicle						2	1	2				

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	Prof. G. B. Dalvi	HOD, Dept. of Automobile engineering Govt. polytechnic ,Aurangabad
2	S. B. Choudhari	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE- **INDUSTRIAL ORGANIZATION AND MANAGEMENT(IOM)**

COURSE CODE **6G305**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Electrical Engineering	Fifth

1. RATIONALE

Diploma graduate works atmiddle management level in the industries/engineering organizations. Therefore he has to be proficient in planning, organizing & coordinating various activities of industries/ organizations or when he is required to work in different types of projects.

They are also expected to deal with workforce and management problems. In the present era of competition, optimum utilization of the resources with achieving higher productivity is essential for any industry to survive. Quality and cost controls are also other important factors which contribute to the day to day supervision issues. This course aims to deal effectively with such issues along with familiarization of acts and laws applied to industries.

2. COMPETENCY

At the end of studying this course students will be able to

"**Plan, Organize andCoordinate various activities/ processes in industry/projects by ensuring optimal use of resources "**

3. TEACHING AND EXAMNATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE@ (PR/OR)	PA (TW)	125
03	--	02	05	80~	20	--	25	
Duration of the Examination (Hrs)				03	01	--	--	

Legends : L-Lecture**; T-**Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, OR – Oral Examination, TW - Term. Work, # External, @ Internal,~ Online Examination.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Plan , Organize and Coordinate various activities in industry or a project.
2. Apply PERT/CPM method for project scheduling of given project
3. Ensure the optimal use of resources.
4. Identify the need of finance and its optimal use in an organization.
5. Manage materials &Stores .
6. Apply marketing strategies to promote the sales &services.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics (Containing POs and PSOs assignment in each Sub-topic)
1.Business overview	1a. Classify businesses. 1b. Outline the impact of Globalization and IPR on business. 1c.Identifyneed of e-commerce.	1.1 Type of sectors. Service, Manufacturing, Trade. 1.2 Globalization and IPR- Introduction, Advantage and Disadvantage w.r.t India. 1.3 e - Commerce: Merits and Demerits.
2. Evolution of Scientific Management.	2a Outline the historical perspective of management. 2b Identify the functions of management. 2c Develop organization structure. 2d Select appropriate form of ownership.	2.1 Evolution of management thoughts. 2.2 Definition of management, levels of management. 2.3 Scientific management by F W Taylor 2.4 Administration vs. Management 2.5 Henry Fayol'sPrinciples of management. 2.6 Functions of management-Planning, Organizing, Staffing, Directing & controlling 2.7 Types of organization- Line, Line& Staff, Functional & Project 2.8 Centralization and decentralization. 2.9 Forms of Ownership- Proprietorship, Partnership, Joint Stock Company, Co-operative society & Government Sector.
3	3a.Identify & develop human	3.1 Definition, Objectives and Function of Personnel management

Personnel Management & LegislativeAct.	resource 3b.Apply strategiesof motivation. 3c.Practice safety procedure 3d.Identify the features of industrial acts.	3.2 Recruitment &Selection Procedure 3.3 Training & its type: Induction, Skill Enhancement & Motivation. 3.4 Leadership & its style. 3.5 Motivation-Definition, its type & Maslow Theory 3.6 Safety management: Causes of Accident and Safety procedure 3.7 Salient Features of (Introduction, Objective, Scope, Important definition & Related provision) 1 Indian Factory act 1948. 2 Industrial dispute acts 1947. 3 Workmen compensation act 1923. 4 The employees state insurance Act 1948. 5 Contract Labour Act.
4 Financial Management	4a.Identify sources of finance 4b.Prepare budget. 4c.Acquaint with prevailing taxation policy.	4.1 Objectives & Functions of financial management, 4.2 Capital Generation & Management 4.3 Types of Capitals-Fixed & Working Capital 4.4 Elements of Cost-Direct & Indirect Cost 4.5 Sources of raising Capital-Internal & external sources 4.6 Introduction of budget, budgetary control 4.7Production Budget (including Variance Report) 4.8Labour Budget 4.9Introduction to Profit & Loss Account (only concepts) 4.10Introduction of Income Tax &GST (Good & Service Tax)
5 Materials Management	5a. Plan Inventory for processes . 5b. Calculate EOQ. 5c. Practice purchase procedure.	5.1 Objective and function of material management 5.2 Inventory – Concept , its Classification & Objective 5.3 Economic Order Quantity (EOQ)- Concept & Graphical Representation 5.4 ABC Analysis- Definition & Step 5.5 Purchase Procedure 5.6 Overview of ERP, JIT, 5's Kaizen& six sigma (Introduction, Objective & Benefit).

6 Project Management	6a.Use CPM/PERT for project scheduling for execution. 6b. Track the project with the help of project management techniques.	6.1 Introduction of Project Management, project Network Analysis 6.2 Concept and introduction of CPM/PERT. 6.3 Concept of Breakeven analysis. 6.4 Progress tracking charts-bar charts, Gantt charts and histogram. 6.5 Solving simple network using CPM/ PERT
7 Marketing Management	7a. Apply marketing strategies .	7.1 Objective & Function of marketing management 7.2 Sellers and Buyers markets, Marketing, Sales, Selling vs. Marketing, Sales promotion, Marketing Mix, Pricing Policies. 7.3 Marketing Strategies: Segmentation, Targeting & Positioning. 7.4 Marketing Information System.

6. 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	Business Overview	03	02	04	00	06
II	Evolution of Scientific Management	09	04	10	00	14
III	Personnel Management & Legislative Act	11	04	10	04	18
IV	Financial Management.	07	04	06	02	12
V	Materials Management	06	04	04	02	10
VI	Project Management	07	02	02	08	12
VII	Marketing Management	05	02	04	02	08
	Total	**48**	**22**	**40**	**18**	**80**

Legends:*R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills **(outcomes in psychomotor and affective domain)** so that students are able to acquire the competencies/ programme outcomes. Following is the list of practical exercises for guidance.

Note: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes (**as given in a common list at the beginning of curriculum document for this programme) would be assured.

Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

The tutorial/practical/exercises should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the competencies.

1. Plan, Organize and Coordinate various activities in industry or a project.
2. Ensure the optimal use of resources.
3. Identify the need of finance and its optimal use in an organization.
4. Manage materials &Stores .
5. Apply PERT/CPM method for project scheduling of given project
6. Apply marketing strategies to promote the sales & services.

S. No.	**Unit No.**	**Practical Exercises** (Outcomes in Psychomotor Domain)	**Approx. Hrs. required**
		Part A- Common to all programmes	
1.	I	To collect data / information and prepare report about business/organization and identify the nature of business and prepare organization structure.	04
2.	III	Identify and propose Safety requirements/ mechanism for an industry .	04
3	V	Prepare a report of inventoryby visiting stores of an industry/organization.	02
4	VI	Prepare network diagram using CPM& PERT (3-4 networks	04

		each)) for identified Projects	
5.	IV/VII	Undertake Survey/Data Collection, Presentation and Data interpretation for following . (Any One) a. Sales Promotion. b. Channel of Distribution c. Capital Generation & Management	04
		Part B- Programme Specific Practical (Five Numbers)	
6	III	Prepare a report on Human Resource (HR) policies used in Multinational companies	02
7	IV	Give presentation(PPT)on various Financial budget of a company	02
8	IV/V/VII	Data collection on i)GST ii) Six sigma iii)Market segmentation	02
9	VII	Discuss Global marketing strategies by making small presentation(PPT)	04
10	All Units	Micro Project (visit to an industry ,observe & prepare a report on various management techniques adopted by the company)	04
Total			**32 Hrs**

8. SUGGESTED STUDENTS ACTIVITIES

Sr No	Activities
1	Prepare a group of five students and write qualities of a good leader.
2	Prepare a group of 10 students and conduct a group activity like housekeeping of a class room.
3	Draw a network for given set of activities and identify the critical path
4	Calculate the total time required to accomplish a task when t_e, t_p and t_m is given.
5	Visit to nearest ESIC office and collect information about services provided by ESIC office to the working employees.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

Sr no	Unit no	Unit name	Strategy
1	1	Business Overview	Live explanation, videos.
2	2	Evolution of Scientific Management	Live explanation, , case study
3	3	Personnel Management & Legislative Act	Live explanation, movie, case study
4	4	Financial Management.	Case study, survey, industrial visits
5	5	Materials Management	Net survey, Case study, industrial visits
6	6	Project Management	Net survey, Case study, industrial visits
7	7	Marketing Management	Net survey, Case study, industrial visits

10. SUGGESTED LEARNING RESOURCE

S. No.	**Title of Book**	**Author**	**Publication**
1.	Industrial Organization and Management	O.P.Khanna,	DhanpatRai and Sons
2.	Industrial Organization and Management	Banga and Sharma,	Khanna Publications
3.	Modern Business Organization & Management	S.A.Sherlekar& V.A. Sherlekar,	Himalaya Publications

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED

NIL

12. LEARNING WEBSITE & SOFTWARE

i) https://mitpress.mit.edu

ii) http://iveybusinessjournal.com/publication/a-new-role-for-management

iii) https://en.wikipedia.org/wiki/Project_management

iv) http://www.pmi.org.in/

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs)WITH COURSE OUTCOMES (COs)

SR No	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Plan,Organize,and Coordinate various activities in industry or a project.	03	03	02		03			01			03	
2	Ensure the optimal use of resources.	02	03		02	03			01			02	02
3	Identify the need of finance and its optimal use in an organization	03	03		02						01	03	03
4	Manage materials & Stores	02	03		03							03	
5	Apply PERT/CPM method for project scheduling of given project	01	03		03						02	03	02
6	Apply marketing strategies to promote the sales &services.		03		03			02	02		02	03	

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	A.B.Deshpande	Lecturer in Mechanical Engineering, Govt. Polytechnic, Aurangabad
2	K.S.Borde	Lecturer in Civil Engineering, Govt. Polytechnic, Aurangabad
3	P.B.Lahoti	Lecturer in Computer Engineering, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE- **MATLAB(MTB)**

COURSE CODE **6E208**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Electrical	Fifth

1. RATIONALE

Due to complexity of power system it is essential to use MATLAB to handle large data and solve complex equations accurately. Students will learn basic matrix formulation and operations, programming techniques and simulating simple electric circuits using MATLAB. This is a basic engineering course for electrical engineering students.

2. COMPETENCY

At the end of studying this course students will be able to

"**Design simple electrical systems using MATLAB simulation**"

3. TEACHING AND EXAMNATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (PR)	PA (TW)	50
--	-	2	2	--	--	25@	25	
Duration of the Examination (Hrs)				--	--	--	--	

Legends : L-Lecture**; T**-Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, OR – Oral Examination, TW - Term Work, # External, @ Internal

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Construct a matrix and Apply different mathematical operations
2. Solve a simple problem using different loops
3. Identify and use basic tools required for Electrical Engineering

4. Simulate the simple electrical circuits

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (Cognitive Domain Only)	Topics And Sub-Topics
Unit - I MATLAB Basics	1a. Identify MATLAB Toolbox	1.1 The MATLAB environment 1.2 Basic computer programming 1.3 Variables and constants, operators & simple calculations 1.4 Formulas and functions, MATLAB toolboxes
Unit – II Matrices and Vectors	2a. Perform Matrix operations and functions in MATLAB	2.1 Matrix and linear algebra review 2.2 Vectors and matrices in MATLAB 2.3 Matrix operations and functions in MATLAB
Unit - III Computer Programming	3a. Create MATLAB scripts and functions	3.1 Algorithms and structures 3.2 MATLAB scripts and functions (m-files) 3.3 Simple sequential algorithms, Control structures (if…..then, loops)
Unit - IV MATLAB Programming	4a. Read and write data 4b. Handle MATLAB files	4.1 Reading and writing data, file handling 4.2 MATLAB graphic functions

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Teaching Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL
1	MATLAB Basics	Not Applicable				
2	Matrices and Vectors					
3	Computer Programming					
4	MATLAB Programming					

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	1	Start MATLAB	2
2	2	Construct a matrix of given dimensions and calculate inverse and Eigen values for the same matrix.	2
3	2	Apply different mathematical operations such as addition, subtraction, multiplication and division for given matrices.	2
4	3	Use different loop such as 'for', 'while', 'if' and 'if—else' to solve a simple problems.	2
5	3	Construct n dimensional vector and plot the graph by using different commands.	2
6	4	Simulate simple R,L,C of single phase circuit.	2
7	4	Simulate short Transmission Line.	4
8	4	Simulate Numerical 'T' circuit representation of medium transmission line.	4
9	4	Simulate Numerical 'π' circuit representation of medium transmission line.	4
10	4	Construct Y bus matrix for given three bus power system.	4
Total			28

8. SUGGESTED STUDENTS ACTIVITIES

Other than class room and laboratory activities following are the suggested guided co-curricular students activities which need to be undertaken to facilitate the attainment of various course outcomes of this course. The students are required to maintain portfolio of their experiences which he/ she will submit at the end of the term.

a. Identify applications of MATLAB in electrical engineering
b. Assignments on solving numerical

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

Not Applicable

10. SUGGESTED LEARNING RESOURCE

S.No.	Name of Book	Author	Publication
1.	Getting started with MATLAB	RudraPratap	New York Oxford University Press

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED :

S. No.	Name of equipment	Brief specification
1.	MATLAB Software	Latest software available in the Market

12. LEARNING WEBSITE & SOFTWARE

a. www.nptel/matlab.com
b. www.nptel/introductiontomatlab.com

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

SNo	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Construct a matrix & apply different mathematical operations	-	2	3	3	-	-	-	-	-	-	-	-
2	Solve a simple problem using different loops	-	1	2	3	-	-	-	-	-	-	-	-
3	Identify and use basic tools for Electrical Engineering	-	2	2	3	-	-	-	-	-	-	-	-
4	Simulate the simple electrical circuits	-	1	3	3	-	-	-	-	-	-	-	-

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	D.S.Bhalerao	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad
2	M.D.Kharad	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE- **A.C.MACHINES (ACM)**

COURSE CODE **6E402**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Electrical	Fifth

1. **RATIONALE**

AC Machines are widely used in generating station, industries, farms and domestic applications. Diploma engineers should possess knowledge and skills required to operate and maintain AC machines. Therefore, this course is intended to enable the Diploma engineer understand the concepts, operation and control of various AC machines used in the industry. This course is at Applied level.

2. **COMPETENCY**

At the end of studying this course students will be able to

"Operate and Maintain different types of AC machines efficiently."

3. **TEACHING AND EXAMNATION SCHEME**

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (PR)	PA (TW)	175
4	----	2	6	80	20	50#	25	
Duration of the Examination (Hrs)				3	1	--	--	

Legends : L-Lecture**; T**-Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, OR – Oral Examination, TW - Term Work, # External, @ Internal

4. **COURSE OUTCOMES**

At the end of studying this course students will be able to: -

1. Select a 3- phase induction motor for a given application.
2. Select a single phase induction motor for given application.
3. Synchronize an alternator with bus bar or with another alternator.

4. Operate synchronous machines for improvement of power factor.
5. Select the special motors for specific application.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (Cognitive Domain Only)	Topics And Sub-Topics
Unit - I Three Phase Induction Machines	1a. Differentiate between squirrel cage and wound rotor 1b. Calculate losses and efficiency of induction motor by conducting different tests 1c. Compare starting and speed control methods of three phase induction motors	1.1 Three phase induction motor and types: Construction, working principle, power across air gap, torque and output, Phasor diagram 1.2 Rotor frequency, rotor emf, current and power, Losses and efficiency 1.3 Torque-slip and power-slip characteristics 1.4 Torque equation , Starting, running and condition for the maximum torque 1.5 No load test and Blocked Rotor test, Losses and efficiency Numerical on above 1.6 Necessary and types of starters- DOL, Star delta, autotransformer type and rotor Resistance starter 1.7 Starting: starting methods of squirrel-cage and wound rotor motor 1.8 Speed control methods 1.9 Squirrel cage induction generator 1.10 Wound rotor induction generator 1.11 Doubly fed Induction motor
Unit - II Single Phase Induction Motors	2a. Compare different types of single phase motors 2b. Select the motor for given application depending on characteristics	2.1 Working of different types of single-phase induction motors (split phase ,capacitor start capacitor run IM,shaded pole) 2.2 Working of AC series motor, universal motor. 2.3 Speed torque characteristics.
Unit - III Alternator	3a. Differentiate between turbo generator and hydro generator 3b. Determine the voltage regulation of an alternator by synchronous impedance method	3.1 Principle of working and construction.-Salient and Cylindrical rotor 3.2 Equivalent circuit and phasor diagram 3.3 Voltage regulation by synchronous impedance method, OC, SC

	3c. Synchronize an alternator with infinite busbar 3d. Select cooling methods for alternators	characteristics 3.4 Synchronization of alternator with bus bar/alternator 3.5 Cooling system of alternator 3.6 Simple numerical on above
Unit - IV Synchronous Motor	4a. Start and operate synchronous motor using proper starting method 4b. Improve the power factor using synchronous condenser 4c. Differentiate the features of synchronous motor and induction motor	4.1 Principle of working, starting methods 4.2 Equivalent circuit and phasor diagram 4.3 Effect of change in excitation 'V'- curves 4.4 Synchronous condenser 4.5 Hunting and its prevention 4.6 Different torque of a Synchronous motor. 4.7 simple numerical on above
Unit - V Special Electrical Machines	5a. Compare working principle of special motors	5.1 Reluctance Motor: working principle, characteristics and its applications 5.2 Stepper Motor: construction, working principle, characteristics 5.3 Hysteresis Motor: working principle, torque-speed characteristics and applications

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Teaching Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL
1	Three Phase Induction Machines	19	06	06	12	24
2	Single Phase Induction Motors	08	02	03	05	10
3	Alternator	16	04	06	10	20
4	Synchronous Motor	13	03	03	10	16
5	Special Electrical Machines	08	04	06	00	10

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	1	Identify the parts of the 3-phase squirrel cage and wound rotor induction motors and different types of single induction motors	02
2	1	Reverse the direction of rotation of a 3-phase IM.	02
3	1	Measure the slip of 3-phase Induction motor by using Tachometer and by Stroboscopic method.	04
4	1	Perform direct load test on three phase induction motor and draw performance curves	02
5	1	Make connections of DOL starter / star-delta starter / auto transformer / rotor rheostat starter for appropriate three phase induction motor	02
6	1	Perform speed control of slip-ring induction motor by: 1. Rotor rheostat control. 2. Injecting an emf from rotor side.	04
7	2	Reverse the direction of rotation single-phase induction motor.	02
8	3	Perform direct loading test on alternator to find out voltage regulation	02
9	3	Find out voltage regulation of alternator by synchronous impedance method for Unity, lagging and leading power factor.	04
10	4	Construct V-curves of synchronous motor at different load conditions to see the effect of variation of excitation	04
Total (perform practical worth 28 hours so that most units are covered)			28

8. SUGGESTED STUDENTS ACTIVITIES

Following is the list of proposed student activities such as:

a. Prepare charts for construction of various AC motors.
b. Compare various AC motors according to its applications.
c. Guided Visit power plant for observing controlling action of AC motors.
d. Prepare/Download a dynamic animation to illustrate the following:
    - Working principle of 3 phase induction motor
    - Working principle of 3 phase alternator
    - Working of different types of 3 phase induction motor starters
e. Carry out a market survey of local dealers for 1-phase Induction motor and compare them on following points:
f. i)Rating ii) Method of starting iii) Cost iv) Starting torque and v) Performance
g. Download the catalogue of three phase induction motor, Synchronous motor and alternator from websites of reputed manufacturers such as BHEL, SIMENS, CROMPTON, JYOTI, ABB, VOLTAS etc. to learn the latest Developments

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Improved Lecture methods-
b. Q & A technique.
c. Demonstration
d. Expert Lecture
e. Online learning
f. Field Visit

10. SUGGESTED LEARNING RESOURCE

S.No.	Name of Book	Author	Publication
1.	Electrical Machines	Kothari D. P. Nagrath I. J.	Tata McGraw-Hill, New Delhi, latest edition
2.	Electrical Machines	AshfaqHussain	DhanpatRai and Company, New Delhi
3	Electrical Machinery	Bimbhra P. S.	Khanna Publishers, New Delhi, latest edition
4	Electrical Technology Volume II	Theraja B.L.	S. Chand & Company
5	Electrical Machines	Bhattacharya S.K.	Tata Mcgraw-Hill
6	The performance & design of a.c.machines	Say M.G.	CBS Publication

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED :

S. No.	Name of equipment	Brief specification
1.	Synchronous motor	(3-phase, 415v, 3kva,3.5a,1500 rpm)
2.	1 phase Induction motor	1phase (55 W max , AC 220V, 50 Hz)
3	3 phase Induction motor	, 3-phase (415 V, 50 Hz,5 hp,1500rpm,8A)
4	Starter	DOL
5	Rheostat	250/1.5A

6	Stepper motor	(FHP)
7	Wattmeter	5A/300V LPF10A/75V UPF.

12. LEARNING WEBSITE & SOFTWARE

i. www.nptel.iitm.ac.in
ii. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-867-machine learning-fall-2006/
iii. http://www.indiabix.com/online-test/electrical-engineering-test/143
iv. http://freevideolectures.com/Course/3085/Electrical-Machines-I
v. http://www.learn-about-electronics.com/AC-current-motors.html
vi. http://en.wikipedia.org/wiki/Electric_motor#Induction_motor
vii. http://dcacmotors.blogspot.in/2009/04/capacitor-start-single-phase-induction.html
viii. http://en.wikipedia.org/wiki/Electric_motor#Universal_motors
ix. http://en.wikipedia.org/wiki/AC_motor
x. http://www.engineersedge.com/motors/alternators_types.htm
xi. http://www.learn-about-electronics.com/Three-Phase_alternator.html
xii. http://www.tecowestinghouse.com/PDF/woundrotor.pdf
xiii. http://synchronousmotor.specaproduct.com/
xiv. http://www.engineersedge.com/motors/synchronous_motor.htm
xv. http://www.msbte.com/website/curriculum/Lab Manual of 5th Semester/ACMachines.pdf

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

SNo	Course Outcome	Pos										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Select a 3- phase induction motor for a given application.	-	3	3	2	-	-	-	-	-	-	3	-
2	Select a single phase induction motor for a given application	-	2	1	1	-	-	-	-	-	-	2	-
3	Synchronize an alternator with bus bar or with another alternator	-	2	3	1	-	-	-	-	-	-	3	-

4	Operate synchronous machine for improvement of power factor	-	3	2	1	-	-	-	-	-	-	3	-
5	Select the special motors for specific application	-	3	1	-	-	-	-	-	-	-	2	-

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	D.S.Bhalerao	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad
2	M.D.Kharad	Lecturer in Electrical Engineering, Govt. Polytechnic, Jalna

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE- Power Electronics(PET)

COURSE CODE 6E407

Diploma Programme in which this course is offered	Semester in which offered
Electrical Engineering	Fifth

1. RATIONALE

With the advancement of power electronics devices the conventional control and relays are now replaced by electronic control and relays, employing solid state power semiconductor devices. Essential theoretical and practical knowledge to use power electronics to control electrical machines in commercial and industrial sector will be achieved by this course. Diploma engineer will be able to use power electronics for controlling AC and DC power in various applications.

2. COMPETENCY

At the end of studying this course students will be able to

"Use Power Electronics for control of various a.c and d.c power electronics devices and machines "

2. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (PR)	PA (TW)	150
4	-	2	6	80	20	25@	25	
Duration of the Examination (Hrs)				3	1	--	--	

Legends : L-Lecture**; T-**Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT –** Progressive Test**, PA-** Progressive Assessment; **OR** – Oral Examination, **PR**-Practical Examination; **TW** - Term Work, # External, @ Internal, ~ Online.

3. COURSE OUTCOME

At the end of completion of this course students will be able to:

1. Use power semiconductor devices in different applications.
2. Maintain SCR Protection and Commutating Circuits**.**
3. Troubleshoot chopper circuits.
4. Maintain inverters and cycloconverter circuits
5. Maintain power electronic circuits used in various domestic and industrial

applications.

5. COURSE DETAILS

Unit	Major Learning Outcomes (in cognitive domain	Topics and Sub-topics
Unit – I Power Semi Conductor Devices and Controlled Rectifier	1a. Classify Thyristor family. 1c. Plot characteristics of various semiconductor devices. 1d. 1e. Compare different types of controlled rectifiers	1.1 Classification of Thyristor family. 1.2 Working, of SCR, Triggering methods 1.3 Working of IGBT ,GTO, MCT, DIAC and TRIAC 1.4 Single phase half wave and full wave controlled rectifiers using SCR with R and R-L Load 1.5 Effect of transformer reactance. 1.5 Three phase half wave, full wave or bridge rectifier. 1.6 Working of pulse transformer. 1.7 Principle of A.C. load control.
Unit– II SCR Protection and Commutatin g Circuits	2a. Justify the need of SCR protections. 2b. Use different protection circuits for SCR. 2c. Differentiate various types of commutation methods v 2e. Use SCR datasheets for the given parameters	2.1 Need of SCR protections : Over voltage and over current protection. 2.2 Snubber circuit, freewheeling diode, Thermistor, heat sink. 2.3 Turn off (commutation) method and types- Natural commutation, Forced commutation, current commutation, Voltage commutation. 2.4 Auxiliary SCR for commutation. 2.5 External pulse commutation. 2.6 Specifications of SCR: Voltage, current, Power, temperature, dv/dt and di/dt.

Unit– III Choppers	3a. Compare the different types of choppers 3c. Use of chopper circuit in different applications.	3.1 Function and working of choppers. 3.2 Step up and Step Down Chopper. 3.3. Types of chopper circuits: A type to D-type
Unit– IV Inverters and Cyclo Converter	4b. Classify inverters with sketches. 4d. Distinguish the working of series and parallel inverters using SCR. 4g. Compare various types of cyclo-converters.	4.1 Working principle of inverter 4.2 Classification of inverter- a) Phase and 3-phase bridge inverters, b) Line commutated and forced Commutated inverters Series and Parallel 4.3 Series and parallel inverter using SCR. 4.4 PWM method and PWM inverter. 4.6 Operating principle of cyclo converter. 4.7 Types of Cyclo-converters a) Single phase to single phase Cyclo converter, b) Single phase to Three phase bridge Cyclo converter.
Unit-V Other Industrial Applications of Power Electronic Devices	5a. Use different power electronic converter to control speed of AC/DC motor 5.1 Use different power electronic converter for given applications.	5.1 Speed control of D.C. Motor using armature voltage control. 5.2 Speed control of D.C. Motor using SCR chopper circuit. 5.3 Speed control of universal motor. 5.4 Different types of speed control methods for induction motor such as stator voltage control, frequency control, Power factor

		control method. 5.5 Heating control, Static circuit breaker and time delay circuits.

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit. No.	Unit Title	Teaching Hours	Distribution of theory marks			
			R Level	U level	A level	TOTAL
1	Semiconductor Devices And Control Rectifier	16	10	04	06	20
2	SCR Protection And Commutating Circuit	16	12	04	04	20
3	Choppers	12	07	04	04	15
4	Inverters And Cyclo Converters	12	07	04	04	15
5	Other Industrial Application	08	02	02	06	10
Total		64	38	18	24	80

7. LIST OF PRACTICAL/LABORATORY EXPERIMNETS /TUTORIALS

Sr. No.	Unit No.	Title Practical/ Lab. Work/Assignments/Tutorial	Approx Hours.
1	1	Observe specifications of given SCR.	2
2	1	Plot V-I Characteristics of SCR	2
3	1	Plot V- I Characteristics of DIAC	2
4	1	Compare the ratings and Special Packages of IGBT ,GTO , Using data sheet	2
5	1	Plot performance characteristics of TRIAC for AC load control	2
7	2	Plot output waveforms of Step down chopper circuits.	2
8	2	Plot output waveforms of Step up chopper circuits.	2

9	3	Simulate speed control of DC motor using appropriate chopper circuit	2
10	3	Simulate chopper circuit, observe and obtain the various wave forms.	4
11	4	Test series inverter using two SCRs.	4
12	4	Test Parallel inverter using two SCRs.2	4
13	5	Build Time delay relay circuit using UJT and SCR.	2
14	5	Test the Speed control of universal motor using SCR-UJT circuit	2
15	5	Test the Timer circuit using SCR.	2
16	5	Test the Light Dimmer circuit using DIAC and TRIAC	2
Total Hours (perform any practical worth 28 hours from above depending upon the availability of resources so that most units are covered)			36

8. SUGGESTED STUDENTS ACTIVITIES

Other than class room and laboratory activities following are the suggested guided co-curricular student's activities which need to be undertaken to facilitate the attainment of various course outcomes of this course. The students are required to maintain portfolio of their experiences which he/ she will submit at the end of the term.

a. Prepare a report on various types of drives used in nearby industries.
b. Prepare chart displaying various Power semiconductor devices and their symbols
c. Simulate various circuits in syllabus and take print out of various wave forms.
d. Maintain the various power electronics devices & equipments used in Laboratory.
e. Present dynamic animations prepared or collected from the internet to illustrate different converter circuits.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Improved Lecture methods-
b. Q & A technique.
c. Demonstration
d. Seminars
e. Activity based learning

10. SUGGESTED LEARNING RESOURCES

S. No.	Title Of Book	Author	Publication
1.	Power Electronics	Rashid, Muhammad H.	PHI Learning, New Delhi latest edition
2.	Power Electronics	Gupta B.R., Singhai V.	S.K. Kataria and sons, New Delhi
3.	Power Electronics	Singh M.D.K Khanchandani B.	Tata Mc. Graw Hill, New Delhi
4.	Power Electronics	Bimbhra P.S.	Khanna publisher, New Delhi latest edition
5.	Industries and Power Electronics	Rai H.C.	Umesh publication, New Delhi latest edition
6.	Fundamental Of Electric Drives	Dubey G. K.	Narosa publishing house, New Delhi latest edition
7.	Electric Drives Concept and Apllications	Subramanyam V.	Tata McGraw Hill, New Delhi latest edition

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED:

S. No.	Name Of Equipments	Brief Specifications
1	DIAC, TRAIC, SCR, IGBT, GTO and MCT - 5 Nos. each of current rating at least 20 amps or above	As per Industry Specification
2	Trainer kits for testing the V-I characteristics of the following -2 Nos. each a) DIAC b)TRIAC c)SCR d)Power transistor e) Power MOSFET f)IGBT g)GTO h)MCT	As per Industry Specification
3	Trainer kit to check the performance using R, RL and RLC Load of the following -2Nos. each a) 3-phase uncontrolled half wave rectifier b) 3-phase uncontrolled full wave rectifier	As per Industry Specification
4	Trainer kit to check the performance using R, RL and RLC Load of the following - 2 Nos. each: **a)** Fully controlled three phase half wave converter **b)** Fully controlled three phase Full wave converter	As per Industry Specification
5	Trainer kit to check the performance of Three-phase semi-converter using R, RL and RLC Load of the following - 2 Nos.	As per Industry Specification
6	Chopper Trainer kit to check the performance of the following for different types of loads - 2 Nos. each: a) IGBT Based Chopper Circuit b) Jones Chopper Trainer Circuit c) Morgan Chopper Trainer Circuit	As per Industry Specification
7	Trainer kit to check the performance for different types of loads of the following -2 Nos. each: a) Offline inverter	As per Industry Specification

	b) Online inverter	
8	Trainer kit to check the performance for different types of loads of the following -2 Nos. each a) Class A Load Commutation b) Class B Resonant Pulse Commutation c) Class C Complementary Commutation d) Class D Impulse or Auxiliary SCR commutation e) Class F Line or natural Commutation	As per Industry Specification
9	Electric DC Drive Trainer consisting of the following controlling schemes - set: a) Speed control of dc motor using single phase fully controlled converter b)Speed control of DC shunt motor using three phase fully controlled converter c)Armature anf field control of DC shunt motor d)Speed control of DC shunt motor using SCR dual converter e)Thyristor chopper for DC motor drive f)DC series motor controller using jones chopper	As per Industry Specification

12. LEARNING WEBSITE & SOFTWARE

i. www.nptel.iitm.ac.in
ii. www.youtube (lectures on Power electronics)
iii. www.howstuffworks.com
iv. www.howstuffworks.com
v. www.alldatasheet.com

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

CO	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Use power semiconductor devices in different applications.	2	3	2	-	-	-	-	-	-	-	-	-
2	Maintain SCR Protection and	2	2	2	-	-	-	-	-	-	-	-	-

	Commutating Circuits.												
3	Troubleshoot chopper circuits.	2	3	-	-	-	-	-	-	-	-	-	-
4	Maintain inverters and cyclo-converter circuits	3	3	2	1	-	-	-	-	-	-	-	-
5	Maintain power electronic circuits used in various domestic and industrial applications.	1	1	-	-	-	-	-	-	-	-	1	-

Name and Designation of Course Designer

Sr No	Name of the faculty members	Designation and Institute
1	S.R. Bhasme	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **Industrial Installation and Wiring (IIW)**

COURSE CODE **6E408**

PROGRAMME & SEMESTER

Diploma Program in which this course is offered	Semester in which offered
Electrical	Fifth

1. RATIONALE:

Industrial Electrical wiring, estimation and costing plays a major role in distributing the electrical energy in various industries. Electrical diploma holders has to work as technicians and supervisors, the knowledge of IE rules for different types of electrical installation is essential for installation and testing of various electrical wiring scheme in commercial and Industrial application. The subject develops the skill of planning, estimation- costing and installation of various electrical wiring in commercial and Industrial electrification.

2.COMPETENCY

At the end of studying this course students will be able to

"Prepare detail estimation of industrial and commercial wiring and implement safety practices as per IE rules."

TEACHING AND EXAMINATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (OR)	PA (TW)	175
4	-	2	6	80	20	50#	25	
Duration of the Examination (Hrs)				3	1	--	--	

Legends : L-Lecture**; T**-Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment; **OR** – Oral Examination, **PR**-Practical Examination; **TW** - Term Work, # External, @ Internal, ~ Online.

3. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Select the IE rules and implement the safety practices in industrial premises.
2. Use appropriate procedure for installation for different types of commercial and industrial equipments.
3. Compare benefits of various types of grounding in industrial installation.
4. Prepare detail estimate and costing of commercial and industrial electrical installations.
5. Compare different types of pumps and elevators.

4. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (in cognitive domain only)	Topics and Sub-topics
Unit I Introduction	1a. List the Tools required for commercial and Industrial Installation work. 1b. Select the IE rules for the given application.	1.1 Tools and its function required for commercial and Industrial Installation work. 1.2 Introduction to Indian Electricity rules relating to commercial and industrial installation. 1.3 Introduction to Indian Electricity rules relating to commercial and industrial earthing. 1.4 Introduction to Indian Electricity rules relating to commercial and industrial wiring. 1.5 Industrial Safety and its I.E. rules.
Unit II Commercial and industrial Installation	2a.Use the appropriate procedure of installation for different types of commercial and industrial equipments.	2.1 Types of electrical installation: Commercial and industrial installation, installation drawing and their interpretation. 2.2 Electrical installation of commercial and industrial complex. 2.3 Procedure for Installation of new sub-station, Industrial motors, transformer, power control centre (PCC) and Motor control centre (MCC), Distribution board and switch gear. 2.4 Requirements of different dimensions of foundation for 1) Static machinery 2) Rotating machinery, Factors which

		decide machine foundation and procedure of levelling and alignment, effect of misalignments.
Unit III Earthing	3a. Select grounding for given commercial and industrial installation. 3b.Compare different methods and benefits of grounding in electrical power distribution system.	3.1 Types of commercial and industrial grounding with its circuit diagram: 1) High resistance grounding (HRG) 2) Low resistance grounding (LRG) 3) Reactance Grounding (RG) 4) Ground fault neutralizer (GFN) 5) Solid grounding (SG). 6) Pipe in pipe earthing. 7) Resonant earthing. 3.2 Advantages and disadvantages of different grounding systems. 3.3 Meaning of terms: Grounded electrical system, bonded electrical system, ungrounded electrical system and ground fault currents. 3.4 Reasons for grounded and ungrounded systems. 3.5 Various benefits for grounding and bonding AC transmission and distributor power system.
Unit IV Estimation	4a. Compare different types commercial and industrial wiring and its different installation methods. 4b. Describe various design considerations used while designing commercial and industrial wiring system. 4c. Compare commercial and industrial wiring. 4d. Prepare estimate of industrial installations 4e. Prepare estimate of service connections for commercial and industrial installation.	4.1 Types of Commercial and industrial wiring and its installation methods. 4.2 Commercial and industrial Wiring systems: Motor circuit wiring, Design considerations- motor current, selection of cable, size of conduit, fuse rating, selection of starter, distribution board, main switch, location of motor, layout. 4.3 Difference between commercial and industrial wiring. 4.4 Estimation and costing of industrial power wiring. (Max. up to 4 motors only) with examples. 4.5 Estimation of service connections for commercial and industrial installation.

Unit V Pumps and Elevators	5a. State the application of pumps in residential, industrial, sewage, Sump service. 5b. Classify different starters and motors used as drive for pumps. 5c. Select the elevators for proper application. 5d.List different types of motor used for elevators and its characteristics.	5.1Pumps- 5.1.1Types of pump, application of pumps- residential, industrial, sewage, Sump service 5.1.2Drives for pump-three phase induction motor, characteristics and starter used for pump. 5.1.3Automatic water level controller - block diagram and working 5.2Elevator:- 5.2.1 Study and principle elevator and its circuit diagram. 5.2.2Selection and installation – types of elevators, size and shape of car, elevators speed. 5.2.3Elevator Motors-type of motor and its characteristics 5.2.4Location of pent house

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Teaching Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL
1	Introduction	06	03	03	02	08
2	Commercial and Industrial Installation	16	08	08	04	20
3	Earthing	10	08	02	02	12
4	Estimation	20	10	06	08	24
5	Pumps and Elevators	12	08	04	04	16
	Total	64	29	23	28	80

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours

1	1	Draw different symbols used in commercial and industrial wiring.	06
2	2	Draw Layout of service connection and estimation report for commercial and industrial installation	06
3	3,4	Draw layout of industrial unit and prepare visit report for industrial unit.	06
4	3,4	Draw layout of commercial building and prepare visit report for commercial building.	06
5	4,5	Visit to newly constructed commercial building from electrical installation point of view.	08
6	6	Study the different types of pumps.	04
Total Hours (perform practical worth 28 hours so that most units are covered)			**36**

8. SUGGESTED STUDENTS ACTIVITIES

Following is the list of proposed student activities such as:

i. Prepare charts for Installation procedure for different commercial and industrial equipment's.
ii. Prepare journals based on practical performed in laboratory.
iii. Compare various earthing methods according to its applications.
iv. Guided Visit to newly constructed commercial building
v. Guided Visit to newly constructed Industrial complex.
vi. Prepare charts for different tools required for tools required for commercial and Industrial Installation work.
vii. Prepare an Assignment for solving problem on estimation and costing of industrial power wiring. (Max. up to 4 motors only).
viii. Prepare electrical estimates for the installation of factory unit in an industrial complex.
ix. Prepare estimate for the installation of an industrial complex with examples.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

10. (i) Arrange Guided visit to nearby induction motor manufacturer/testing facilities
11. (ii) Show video/animation films to explain functioning of induction motor/synchronous machines and their accessories.

12. SUGGESTED LEARNING RESOURCE

Sr.No.	Name of Book	Author	Publication
1	Electrical wiring estimation and costing	S.L. Uppal	Khanna
2	Estimation and costing	S.K. Bhattacharya	New Age International Publishers
3	Electrical Installation system 1	B.P. Patil	Nirali Publication
4	Electrical Installation system 2	B.P. Patil	Nirali Publication

13. **LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED** :

Not applicable

14. LEARNING WEBSITE & SOFTWARE

15. www.cercind.gov.in/Act-with-amendm
16. journals.plos.org/plosone/article/journal
17. https://www.earthing.com
18. http://m.youtube.com/earthing
19. www.electricaltechnology.org.in
20. https://www.thespruce.com/electrical wiring

21. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

Sr No	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Select the IE rules and implement the safety practices in industrial premises.	-	2	-	1	-	-	-	-	-	-	-	-

2	Prepare detail estimate and costing of commercial and industrial electrical installations.	-	3	3	-	-	-	-	-	-	2	-	-
3	Compare benefits of various types of grounding in industrial installation.	-	3	-	-	-	-	-	-	-	-	-	-
4	Use the different methods of wiring.	-	2	2	-	-	-	-	-	-	-	-	-
5	Compare different types of pump and elevators.	1	2	2	-	-	-	-	-	-	-	-	-

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	M.L.Bhagwat	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad
2	S J Ghorpade	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE- **SEMINAR (SMR)**

COURSE CODE **6E501**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Electrical	Fifth

1. RATIONALE

It is essential to upgrade knowledge of rapidly developing Electrical Technology with practical and communication aspect. This course will develop practical as well as creativity and overall personality development by means of presentation and model preparation.

2. COMPETENCY

The course content should be taught and implemented with the aim to develop required skills in the Diploma engineer so that they are able to acquire following competency:

"Present scientifically prepared technical paper/charts/models on some emerging technology related to Electrical Engineering."

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (Hours/Credits)			Total Credits (L+T+P)	Examination Scheme(Marks)				
				Theory		Practical		Total Marks
L	T	P	C	ESE	PT	ESE (OR)	PA (TW)	75
--	--	02	02	--	--	25#	50	
Duration of the Examination (Hrs)				--	--	--	--	

Legends : L-Lecture**; T-**Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, **OR** – Oral Examination, **PR**- Practical Examination ; **TW** - Term Work, # External, @ Internal, ~ Online.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Acquire knowledge of fast and rapid changing Electrical technology by self-learning.

2. Prepare models/charts/reports based on collected information.
3. Prepare presentation in proper format.
4. Show communication, interpersonal and presenting skills.
5. Handle questions after the presentation with confidence

5. DETAILED COURSE CONTENTS

There is no specific content in this course; however, teachers/students are supposed to follow following guidelines for technical seminar/model making:

1. Students will select topics on their own; the topics may be on any aspect of the Electrical technology but normally beyond the curriculum.
2. Student would organize preliminary presentations before faculty and other students, in which he/she would explain what is the topic or topics? Why they have chosen this? And what are they going to do in it? Based on this presentation guide would approve or help them in finalization of the topic and would give suggestions for further improvement. The presentation by one student/one group and discussion on this presentation would also be learning for other groups.
3. Faculty should ensure that though topic is challenging to students, it should be feasible and within capabilities of the group of students.
4. It is mandatory that each student will present individually a seminar/model on agreed topic. Student can make working/ demonstrative model and give presentation seminar on it.
5. In a session of three periods per week, Students are expected to present the progress of seminar/ model to the concerned faculty and take help them if required.
6. These three periods per week may also be used by faculty for arranging presentation by each student on a small topic (but different than their main topic) for 5 to 10 minute duration. This would give one more chance to each student for learning and presenting.
7. During the final seminar sessions each student (In case of group, max. of 4) is expected to prepare and present a topic on engineering/ technology, for duration of not less than 15 minutes.
8. The student has to submit a hard copy of the technical report, in the form of a title page, introduction, body chapters and a conclusion with references, running to not less than 20 pages; this will be evaluated by the faculty coordinator/guide. Original references are highly valued.
9. At end of the semester students would have to submit the posters/charts/ model/presentations.
10. For every group of students a faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance.
11. Students are encouraged to use various teaching aids such as over head projectors, power point presentation and demonstrative models.

6. SUGGESTED SPECIFICATION TABLE

There is no particular specification table for assessment; however, faculty should follow following guidelines for progressive assessment:

1. Innovativeness of the topic
2. Initiative and efforts taken in searching the topic
3. Amount and quality of material collected related to topic by searching library/internet/Electrical Industries etc.
4. Creativity and innovativeness in preparing models/charts etc.
5. Planning the activities and then pursuing that plan.
6. Persistence in the efforts and resourcefulness.
7. Team working as member of team and leader.
8. Communication skills.
9. Sharing of the load within the group.
10. Timely achievement of the targets.

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Not applicable

8. SUGGESTED STUDENTS ACTIVITIES

Following is the list of proposed student activities like:

a. Literature survey.
b. Collection and Study of data.
c. Group discussion.
d. Power point Presentation.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

1. Demonstration.
2. Assignment.
3. Guest lecturers from industry experts for contemporary practices of industries.

10. SUGGESTED LEARNING RESOURCE

1. Access to Library books/internet should be ensured
2. For project work faculty may liaison with the other institutes/organizations and Electrical industries in the city for providing access to students to their libraries and Learning resources.

3. Faculty should also liaison with other departments/institutes and Electrical Industries for providing access to students to their workshops/machines for fabrication of models/projects.

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED:

Not applicable

12. LEARNING WEBSITE & SOFTWARE

i.www.electricaltechnology.com
ii.ieee.explore.co.in

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

SN	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Gain knowledge of fast and rapid changing Electrical technology by self learning.		3	2						1		3	
2	Prepare models/charts/reports based on collected information.		2		2								
3	Prepare presentation in proper format.		2							2			
4	Show communication, interpersonal and presenting skills.					3		2		3			
5	Handle questions after the presentation with confidence	2	3	2						2			

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	Dr. Manzoor Ali	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE: VOCATIONAL TRAINING

COURSE CODE: 6E503

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Electrical	Fifth

1. RATIONALE

Electrical engineering technician program is mainly integrated with practical experiences. The diploma engineers are required to work in industry to manufacture and test components and parts, assemble electrical machinery/equipments, and in workshops for diagnose problems and repair machinery/equipments. The students need to have industry and workshop exposure, where they can experience real life equipment, materials, instruments and various kinds of machinery/equipments. This course has been designed for the students to have real life experiences to help them prepare for their career. The electrical sector needs skilled and managerial personnel who have technical expertise as well as entrepreneurial qualities to manage the growing electrical industry. The vocational training program will help in enhancing the knowledge and skills of the technicians.

2. COMPETENCY

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the following competencies

("Establish or relate theoretical knowledge with practical situations to enhance career and professional skills")

1. Identify the Industry in electrical engineering field and work in group.
2. Gain practical knowledge, new skills and be aware of current technologies.
3. Analyze problems and find/suggest possible solutions.
4. Maintain daily dairy to note the observations at the site /sections on daily basis.
5. Prepare a detailed report based on the learning experiences during vocational training.

3. TEACHING AND EXAMNATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (OR)	PA (TW)	100
-	-	4	4	--	--	50@	50	
Duration of the Examination (Hrs)				--	--	--	--	

Legends : L-Lecture**; T-**Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, OR – Oral Examination, TW - Term Work, # External, @ Internal

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Identify the various processes in industry and develop spirit of enquiry in group.

2. Collect data and write daily reports of the work in industry along with flow charts.

3. Understand arrangement and operations of machinery/equipments, raw material, different processes and finish product.

4. Apply problem solving techniques at different sections by the Engineer In-Charge.

5. Use different controls of machinery/equipments.

6. Prepare and present the report of Vocational Training work.

5. DETAILED COURSE CONTENTS

Following are the general guidelines for implementation of Vocational training

1 Student studying in Final year electrical engineering program is expected to work in a group 4-5 students for vocational training. Each group shall work parallel with a regular employed person of the permitted industry as a trainee or any specialized services for at least one week as decided by the department authorities under the guidance of faculty members. (Preferable, to be undertaken during previous semester break i.e at the end of IV Semester exam for 2 weeks duration).

2 Further vocational Training work is to be continued weekly and shall be the part of time table for completion of different activities in the further semester as per the curriculum.

3 Finally the students in group shall prepare the report of his vocational training under the guidance of the teaching staff members (Maximum 35 pages) which may consists of the following content. Student should deliver a seminar on his experiences during in plant training.

- Title page
- Certificate
- Preface
- Acknowledgement
- Index
- Introduction of industry
- Industry layout
- Hierarchy of industry/organization chart
- Products
- Raw materials
- Types of major equipments/instruments/machines used in industry with
- their specification, approximate cost and specific use
- Manufacturing/production process
- Faults and remedies
- Maintenance
- Safety features
- References
- Bibliography

4 Group of students and their guides continue this work of vocational training work for the Fifth semester.

5 **Preferable Period**: Vocational Training is to be undertaken during previous semester break i.e. in vacation after Fourth Semester examination or in vacation before start of Fifth semester for 2 weeks duration)

6 LIST OF PRACTICAL EXPERIENCES

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	A	**Term work** Identify the industry. Take concerns and depute the groups along with faculty members. Daily Visits for vocational training, Completion of training by maintaining daily dairy under guidance of Industry Engineer and faculty. (Following activities B-I to B IV may also be considered during this period)	**32* Hrs**- Minimum
2.	B- I	Literature survey and analysis of data collected in industry, various processes, controls and testing as per the daily dairy.	**08**
3	B-II	Preparing rough draft of report along with data, figures, circuit/single line diagrams.	**08**
4	B-III	Group discussion in presence of guide Give presentation - ppts / models / circuit diagram / single line diagram etc. in a group.	**08**
5	B-IV	Prepare Final report with all attachments. Spiral Binding of the vocational training work and term work completion.	**08**
Total Hours.			**32* + 32 = 64 hrs**

7 SUGGESTED STUDENTS ACTIVITIES

a) Aspects to be considered for Vocational training / report writing of it.

- Students would interact with the identified faculty of the department to suggest his choices for suitable industry.
- Students have to fill the forms duly sealed and signed by authorities along with training order letter and submit it to training officer in the industry on the first day of training.
- Student would carry with him/her the Identity card issued by institute during training period
- He/she will have to get all the necessary information from the training officer regarding schedule of the training, rules and regulations of the industry. Student is expected to follow these rules, regulations, procedures etc obediently.
- During the training period students has to keep record of all the useful information in Log book and maintain the daily diary.
- He/she has to prepare a detailed report and presentations at the end of the training.
- Prepare final report about the whole training for submitting to the department at the time of final presentation and viva.

B) Suggested Areas For The Seminar:

1. Synchronization or Paralleling of Generators
2. Analysis of Solar Thermal Power Generation
3. Modern Speed Control Technologies of AC Motors
4. Transformers: Basics and Types
5. Soft Starting of Motors with an Improved Power Factor
6. Applications of Fuel Cells
7. Energy Efficient Motors
8. Improved Direct Torque Control of Induction Motor with Dither Injection
9. Electrical AC and DC Drives
10. Modern Trends in Machine Design Technology
11. Variable Frequency Transformer Model Analysis by MATLAB
12. Home Automation System.
13. SCADA and Power System Automation
14. Distributed Control System for Industrial Automation
15. Process Dynamics, Control and Automation using LABVIEW
16. Irrigation Control System
17. PID Controllers for Industrial Process Control
18. Industrial Networking Using Various Field Buses
19. Closed Loop Control of Converter Fed Motor
20. Programmable Logic Controllers (PLC) vs. DCS

21. Real-Time Simulation of Power System
22. Substation Automation Communication Protocol
23. Power Quality Issues with Grid Connected Wind Energy Systems
24. Power Factor Improvement Methods
25. Need for Reactive Power Compensation
26. Automated Energy Meter Reading for Billing Purpose
27. Voltage and Power Stability of HVDC Systems
28. Power System Operation and Control
29. Performance of 400KV Line Insulators Under Pollution
30. LED Lighting for Energy Efficiency
31. Wireless Power Transfer through Coils
32. Smart Grid – Future Electric Grid
33. Load Scheduling and Load Shedding
34. FACT Devices in Power System Network
35. Power System Protection Equipments
36. Solar Photovoltaic: Basic & Applications
37. Nuclear Power Plants
38. Renewable Energy and Environment Protection
39. Electric Traction Systems

B) SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

Vocational Training Report Format

- Seminar report shall be in the print form on A-4 size white bond paper.
- Typing shall be in Times New Roman with spacing of 1.5 using one side of paper.
- Margins: Left = 37.5 mm Right, Top and Bottom = 25mm.
- Front page: Titles - TNR 18 bold, other – TNR 14 bold, with Institute Logo.
- Inner Pages: Titles –TNR – 14 Bold, other TNR 12.
- Page Nos: Should appear on the right hand top corner of each page starting after index page.
- Tables to be preferable in the Text format only.
- Sketches to be drawn on separate sheet / pages in black ink.
- The Last content in the index to be of references. Acknowledgement to be added in the report.

Binding: Spiral binding is preferred for the Vocational training report. The number of copies are to be prepared by the student are 7 nos. (If, 5 Students + Guide +Department Copy)

DAILY DAIRY FORMAT

GOVERNMENT POLYTECHNIC, AURANGABAD

Electrical Engineering Department

VOCATIONAL TRAINING DAILY DAIRY

Period of Vocational training (2 Weeks) : From : to:

Address of Industry:----------

DAY NO : Date:

OBSERVATIONS OF THE DAY

Signature of Student **Signature of Engineer In-charge**

Signature of Guide **Signature of Head of Dept.**

C) SUGGESTED LEARNING RESOURCE

Visit to institute library to find the related text books.

Title of Book	Author, Publication
As per area of industry selected for vocational training.	Refer books, I.S. Codes, Hand Books, Standard specifications, National and International journals.

11. Learning Websites

- www.google.com
- www.youtube.com

12. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

CO. NO.	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	No. of hours allocated in curriculum
CO 1	Identify the various processes in industry and develop spirit of enquiry in group.	--	3	--	3	--	--	--	---	--	--	2	2	04
CO 2	Collect data and write daily reports of the work in industry along with flow charts.	--	1	--	---	--	--	--	---	---	--	--	--	04
CO 3	Understand arrangement and operations of machinery/equipments, raw material, different processes and finish product.	--	3	--	--	--	--	--	2	--	--	3	3	08
CO 4	Apply problem solving techniques at different sections by the Engineer In-Charge.	---	--	3	3	---	---	--	1	--	--	2	2	08
CO 5	Use different controls of machinery/equipments.	--	2	3	--	--	--	---	--	--	--	2	2	04
CO 6	Prepare and present the report of Vocational Training	--	3	3	---	--	---	---	---	--	--	2	2	04

	work.													

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	Dr. Manzoor Ali	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **MICROPROCESSOR AND MICROCONTROLLER(MPM)**
COURSE CODE **6E507**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Electrical	Fifth

1. RATIONALE

In modern process industries and power stations , use of microprocessor, microcontroller and PLC is very common in order to control, monitor and process various parameters and data. Microprocessor and Microcontroller is specialized and essential field where the industries need highly skilled manpower. Hence this course is designed to develop skills to maintain microprocessor based system and programming practices for real time applications.

2. COMPETENCY

At the end of studying this course students will be able to

"Use and maintain various Microprocessor, Microcontroller and PLC based electrical systems"

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (OR)	PA (TW)	150
4	-	2	6	80	20	25#	25	
Duration of the Examination (Hrs)				3Hrs	1 Hr	--	--	

Legends : L-Lecture**; T**-Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment; **OR** – Oral Examination, **PR**-Practical Examination; **TW** - Term Work, # External, @ Internal, ~ Online.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

5. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Identify the semiconductor memories.
2. Distinguish between microcomputer, mainframe computer and microprocessor..
3. Maintain microprocessor-based systems.
4. Maintain microcontroller-based systems.
5. Identify and describe simple applications of microprocessor and microcontroller systems.
6. Maintain PLC-based systems and SCADA-based systems.

6. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (Cognitive Domain Only)	Topics And Sub-Topics
Unit– I Semiconductor Memories	1a.Compare different types of semiconductor memories	1.1 Introduction to semiconductor memories 1.2 RAM,ROM,PROM,EPROM, EEPROM 1.3 Dynamic RAM
Unit– II Introduction to Microprocessor	2a.Compare microcomputer sy stem , Mainframe computer and upper computer	2.1 Minicomputers, Mainframe and upper computer 2.2 Organization of microcomputers 2.3 Evaluation of Microprocessors
Unit – III Basics of Microprocessor	3a. List Advantages and disadvantages of microprocessor control 3b. Classify instruction set of 8085 microprocessor 3c. Develop Basic assembly language program using basic instruction for the given application.	3.1 Introduction to microprocessor 3.2 Advantages and disadvantages of microprocessor control section 3.3 Structure of micro processor, Generalized architecture of microprocessor, Functions of each block 3.4 Functional block diagram of 8085 microprocessor with pin diagram, logical block diagram of 8085 microprocessor-Registers, ALU, memory organization, decoder, serial control section, interrupt section, timing and control section 3.5 Assembly language Programming of 8085, Addressing Modes, Instruction classification, Instruction formats 3.6 Basic Assembly Language programming (only simple arithmetic operations-addition, subtraction).
Unit–IV Basics of Microcontroller	4a. Program the I/O ports for data transfer and interfacing external memory 4b. Program the timer and counter for required	4.1 Pin diagram of 8051 microcontroller 4.2 Internal RAM, ROM and Special function Registers in 8051chip 4.3 I/O ports 4.4 Counters and Timers 4.5 Interfacing with external memory

	time delay generation.	
UNIT –V Microprocessor and Microcontroller Applications	5a. Compare microcontrollers and microprocessors 5b. Use of microprocessor and microcontroller for switch and LEDs control , temperature control of furnace, Traffic light controller, SCR firing angle control.	5.1 Microcontrollers and microprocessors 5.2 Schematic diagram of memory chips decoder, memory interfacing. 5.3 Memory I/O data transfer scheme for 8255. 5.4 Interfacing of switches and LEDs 5.5 Simple applications of microprocessor and Microcontroller for temperature control of furnace, Traffic light control and SCR firing angle control using micro processor, Data acquisition system.
UNIT –VI Introduction to Programmable Logic Controller and SCADA	6a. Selection of PLC for the given application 6b. Identify the function of SCADA system	6.1 PLC:CPU, I/O modules, bus system, power supplies and remote I/Os, counter, timer 6.2 Different PLC's available in market 6.3 Selection of a PLC 6.4 SCADA- Concept and Application

7. 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 Memory System	04	03	03	00	06
II	Introduction to microprocessor	05	03	03	00	06
III	Basics of Microprocessor	15	07	07	10	24
IV	Basics of Microcontroller	15	07	07	10	24
V	Microprocessor and Microcontroller Applications	15	02	03	05	10
V I	Programmable Logic Controller and SCADA	10	03	04	03	10
	TOTAL	64	25	27	28	80

8. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	1	Study of Microprocessor kit.	02
2	1	Develop assembly language program for arithmetic addition of two numbers using μP 8085 kit.	02
3	1	Develop assembly language program for arithmetic subtraction of two numbers using μP 8085 kit.	02
4	1	Interface seven segment LED display with 8051 kit.	02
5	1	Interface LCD display with 8051 kit.	04
6	1	Control speed of stepper motor using 8051 kit.	04
7	2	Interface programmable device like 8255 with μP 8085	02
8	2	Interface switches and LEDs using μP 8085	02
9	3	Control temperature using the 8085 application module	02
10	3	Control Traffic light system using μP 8085	02
11	4	Use timer function of PLC for a typical application (Introduce delay).	02
12	5	Program for arranging the numbers in ascending orders	02
13	5	Program for arranging the numbers in descending orders	02
Total Hours(perform practical worth 28 hours so that most units are covered)			30

9. SUGGESTED STUDENTS ACTIVITIES

Other than class room and laboratory activities following are the suggested guided co-curricular student activities which need to be undertaken to facilitate the attainment of various course outcomes of this course. The students are required to maintain portfolio of their experiences which he/ she will submit at the end of the term.

a. Interface microprocessor and microcontroller with external devices for developing mini project.

b. Prepare flow chart and assembly language programming for basic arithmetic operations.

SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Improved Lecture methods-

b. Q & A technique.

c. Industrial visit to process industries.

d. Expert lecture

e. Programming practice on 8051, 8085 simulators

10. SUGGESTED LEARNING RESOURCE

S.No.	Name of Book	Author	Publication
1	Microprocessor Architecture, Programming and Applications with 8085	Gaonkar, Ramesh S.	Penram International Publishing (India) Pvt. Ltd. New Delhi (5th Edition
2	Fundamentals of Microprocessors and Microcontrollers	B Ram	Dhanpat Rai Publications, New Delhi
3	Microprocessors and Interfacing Programming and Hardware	Hall, Douglass V.	TMH publication, New Delhi, (latest Edition)
4	The 8051 Microcontroller Architecture, Programming and Applications	Ayala, Kenneth J.	Penram International Publishing (I) Pvt. Ltd. New Delhi
5	The 8051 Microcontroller and Embedded Systems using Assembly and C	Ali, Muhamad Mazidi, Janice Gillispie , Rolin D. Mckinleay	PHI Learning, New Delhi, (latest Edition)
6	Programmable Logic Controllers And Applications	Webb, John W Ronald Reis. A.	Prentice Hall of India, New Delhi, (latest Edition)

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED :

S. No.	Name of equipment	Brief specification
1.	Trainer kit of Synchro transmitter and receiver	As per Electronics industry specification
2.	Microprocessor 8085 kit	As per Electronics industry

		specification
3	Microcontroller 8051 kit	As per Electronics industry specification
4	8255 interfacing kit.	As per Electronics industry specification
5	PLC kit	As per Electronics industry specification

12. LEARNING WEBSITE & SOFTWARE

a. http://www.nptel.ac.in/
b. https://ocw.mit.edu/courses/find-by-topic/#cat=engineering&subcat=electricalengineering&spec=electronics
c. https://www.slideshare.net/

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

SNo	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Identify the semiconductor memories.	1	1	3									
2	Distinguish between microcomputer, mainframe computer and microprocessor .	1	3	1									
3	Maintain microprocessor based systems.	1	1										
4	Maintain microcontroller based systems.	3	3										
5	Identify and describe simple applications of microprocessor and microcontroller systems.	2	2	2									
6	Maintain PLC based system and SCADA based systems		1	1	2							1	

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	S. B. Choudhari	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **CONTROL SYSTEM ENGINEERING(CSE)**

COURSE CODE **6E508**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Electrical	Fifth

1. RATIONALE

With the advancement of technology, control techniques have been introduced in different area industry. This course enables the diploma electrical engineer to understand the facts, concepts, principles and applications of the control system and transfer function. After studying this course he/she will be able to perform the duties like supervising, controlling & maintaining the control systems.

2. COMPETENCY

At the end of studying this course students will be able to

"Supervise, control and maintain stable operation of control system."

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (OR)	PA (TW)	150
4	-	2	6	80	20	25#	25	
Duration of the Examination (Hrs)				3	1	--	--	

Legends : L-Lecture**; T**-Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C**- Credits**; ESE-** End Semester Examination**; PT –** Progressive Test**, PA-** Progressive Assessment; **OR** – Oral Examination, **PR**-Practical Examination; **TW** - Term Work, # External, @ Internal, ~ Online.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Identify different types of control systems.

2. Determine transfer function of electrical networks.
3. Determine the time response of control system &analyze the time response specifications.
4. Develop mathematical model of various physical systems to arrive at transfer function.
5. Determine stability of control system.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (in cognitive domain only)	Topics and Sub-topics
Unit– I Introduction to Control System	1a. Differentiate between Open and closed loop control system. 1b. Differentiate between AC and Dc servomechanism. 1c. Apply block diagram reduction technique	1.1 Need for control system 1.2. Open loop and closed loop control systems. 1.3. Significance of feedback 1.4. Effect of feedback on System gain, stability, Noise and sensitivity. 1.5. Servomechanism: DC Closed loop control system. AC Closed loop control system. 1.6. Block diagram of a control system 1.7. Block diagram reduction techniques.
Unit– II Laplace Transform and Transfer function	2a. Use Laplace transforms to find transfer function of control system. 2b. Determine the poles and zeros of Laplace transform from transfer function	2.1 Transformation from time domain function to S- domain function and vice versa. 2.2. Basic Laplace transform theorem 2.3. Transfer Function 2.4. Poles and zeros of Transfer function and its relationship with impulse response 2.5. Transfer function of open and Closed loop control system. 2.6. Transfer function of electrical networks: R-L, R-C, L-C and R-L-C networks.
Unit– III Time Response Analysis of Control System	3a. Distinguish between different input test signals. 3b. Distinguish between type and order of control system with examples. 3c. Determine Time response of first and second order control system using different test signals. 3d. Differentiate between critical, under damped, un-damped and over damped control systems	3.1 Input test signals: Step, Ramp, Parabolic and Impulse signal. 3.2. Type and order of control system. 3.3. Time response of a first order control system. Unit-impulse, Unit-Step and Unit-Ramp Response. 3.4. Time response analysis of a second order control system subjected to unit-step input. 3.5. Critical, under damped, un-damped and over damped system.

	3e. Calculate different performance parameters for time response.	3.6. Rise time, Peak time, Peak overshoot, Settling time and Steady state error and their significance.
Unit – IV Mathematical Models of Physical system	4a. Prepare a mathematical model for different physical systems.	4.1 Mathematical model for various electrical networks, Separately exited D.C. Generator, error detectors, synchros.
Unit – V Stability Analysis of Control system	5a. Apply Routh – Hurwitz criterion to find out absolute stability and Relative stability	5.1 Stability, Relative and absolute stability. Need of stability in control system. 5.2. Necessary conditions for the stability. 5.3. Routh-Hurwitz criterion: Absolute stability, Relative stability.

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Teaching Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL
1	Introduction to Control Systems	16	06	06	12	20
2	Laplace Transform and Transfer Function	10	02	03	05	12
3	Time Response Analysis of Control System	18	04	06	10	22
4	Mathematical Models of Physical system	12	03	03	10	14
5	Stability Analysis of Control system	08	04	06	00	12
Total		64	19	24	35	80

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	1	Test the performance of open loop and closed loop control system with suitable example.	2
2	1	Test the performance of servomechanism.	4
3	3	Plot the output time response of a first order system.	2
4	3	Plot the output time response of a second order system.	2
5	3	Determine the performance of time response specifications for a second order system.	4
6	3	Test the performance of type 0 control system.	2
7	3	Test the performance of type 1 control system.	2
8	3	Test the performance of type 2 control system.	2
9	4	Prepare Mathematical Model for AC and DC Servo motors.	4
10	4	Prepare Mathematical Model for Different Electrical Networks.	4
Total (All practical's are compulsory)			28

8. SUGGESTED STUDENTS ACTIVITIES

Other than class room and laboratory activities following are the suggested guided co-curricular students activities which need to be undertaken to facilitate the attainment of various course outcomes of this course. The students are required to maintain portfolio of their experiences which he/ she will submit at the end of the term.

a. Prepare chart for open loop and closed loop control system
b. Prepare chart which represent different rules for block diagram reduction.
c. Prepare model for servomechanism.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Expert lecture
b. Online learning
c. Activity based learning

10. SUGGESTED LEARNING RESOURCE

S.No.	Name of Book	Author	Publication
1	Linear control system	Manke B.S.	Khanna publication, New Delhi. Latest edition
2	Modern control engineering	Ogata K.	PHI Learning, New Delhi. Latest edition
3	Control system engineering	Nagrath J. J., Gopal M.	New Age Publications, New Delhi. Latest edition
4	Control Engineering	Bandopadhyay M. N.	PHI Learning, New Delhi. Latest edition
5	Control system analysis and design	Agrawal K.K.	Khanna publication, New Delhi. Latest edition

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED :

S. No.	Name of equipment	Brief specification
1.	Function generator	As per electronics industry specification
2.	D.C. Power supply	As per electronics industry specification
4	Type 0, 1 and 2 control system KIT.	As per electronics industry specification
5	MATLAB latest version.	As per electronics industry specification
6	Servomechanism	As per electronics industry specification

12. LEARNING WEBSITE & SOFTWARE

a. www.mathworks.in/
b. www.elearningtrendcontrols.com/
c. http://csd.newcastle.edu.au/
d. http://www.controleng.com/

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

SNo	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Identify different types of control systems.	1	3		1								1
2	Determine transfer function of electrical networks.		2	1	1								
3	Determine the time response of control system &analyze the time response specifications	2	3	1								1	1
4	Develop mathematical model of various physical systems to arrive at transfer function.	1	1				1						1
5	Determine stability of control system		2	1	1		1						

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	L.B.Nehte	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad
2	V.R.Jadhav	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

PCOURSE TITLE- HIGH VOLTAGE ENGINEERING

COURSE CODE 6E509

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Electrical	Fifth

1. RATIONALE

High Voltages are used for wide variety of applications covering the power systems, industry & research laboratories. Diploma engineer has to measure high voltage and conduct high voltage tests on various appliances used in various fields. This course is included in diversified level.

2. COMPETENCY

At the end of studying this course students will be able to

"Measure high voltage and conduct high voltage tests."

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (OR)	PA (TW)	150
04	--	02	06	80	20	25#	25	
Duration of the Examination (Hrs)				3	1	--	--	

Legends : L-Lecture**; T-**Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, OR – Oral Examination, TW - Term Work, # External, @ Internal

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Compare breakdown mechanism in different medium.
2. Analyze the breakdown mechanism in liquid, solid and gaseous dielectrics.

3. Distinguish different methods of generation of high DC, AC and impulse voltages.
4. Measure high DC, AC and impulse voltages.
5. Conduct the high voltage tests on insulators, bushings, circuit breakers and cables.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (Cognitive Domain Only)	Topics And Sub-Topics
Unit - I Introduction	1a. Differentiate between the mechanism for different dielectric medium	1.1 Electric field stresses 1.2 Gas/Vacuum as insulator 1.3 Liquid breakdown 1.4 Solid breakdown 1.5 Surge voltages & their distribution with control
Unit - II Conduction and Breakdown in Gases, Liquids and Solids	2a. Explain ionization processes ionization by collision 2b. Explain ionization by photo ionization 2c. Explain Cavitation & bubble theory 2d. Explain Breakdowns in solid dielectrics in practice 2e. Explain Chemical & electrochemical deterioration & Breakdown 2f. Explain Breakdown due to treeing & tracking 2g. Explain Breakdown due to internal discharges	2.1 Introduction 2.2 Ionization processes – a) Ionization by collision b) Photo Ionization c) Secondary Ionization processes 2.3 Townsend's Criterion for Breakdown 2.4 Streamer theory of breakdown in gases 2.5 Pure liquids and Commercial liquids a) Conduction and breakdown in pure liquids b) Conduction and breakdown in commercial liquids c) Types of mechanism for breakdown in commercial liquids (only types) 2.6 Breakdowns in Solid dielectric in practice a) Chemical & electrochemical deterioration & breakdown b) Breakdown due to treeing & tracking c) Breakdown due to internal discharges
Unit - III Generation of High Voltages	3a. List and compare different methods for generation of high voltages	3.1 Necessity of generation of high voltages 3.2 Generation of high D,C. voltages a) Half & full wave rectifier circuits b) Voltage doublers circuit c) Cockcroft – Walton voltage multiplier circuit

		3.3 Generation of high A.C. voltages a) Cascade transformers b) Resonant transformers 3.4 Generation & Necessity of impulse voltages, standard impulse wave shape 3.5 Multistage impulse generator – Marx circuit
Unit - IV Measurement of high voltages	4a. Measurement of high voltages by different methods	4.1 Measurement of high D.C. voltages a) Resistance potential divider b) Electrostatic voltmeter c) Generating voltmeter 4.2 Measurement of high A.C. voltages a) Capacitive voltage transformer b) Peak voltage measurement with sphere gaps
Unit - V High Voltage Testing of Electrical Apparatus	5a. Testing of electrical apparatus for high voltage withstanding capacity by different methods	5.1 Testing of insulators a) Definitions: Disruptive discharge voltage, Withstand voltage, 50% flashover voltage, 100% flashover voltage, Creepage distance, A.C. test voltage, Impulse voltage b) Tests on insulator – power frequency test, dry & wet flashover tests, wet & dry withstand test. c) Impulse test: Impulse withstand voltage test, Impulse flashover test, pollution testing 5.2 Testing of bushing: Power factor-Voltage test, Partial discharge test, Momentary withstand test, One minute withstand test, Visible discharge test at power frequency 5.3 Impulse Voltage tests: Full wave withstand test chopped wave withstand & switching surge test 5.4 Testing of Circuit breakers 5.5 Short circuit tests a) Direct tests

		b) Synthetic tests 5.6 Testing of cables: Measurement of Partial discharges

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Teaching Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL
1	Introduction	09	4	4	4	12
2	Conduction and Breakdown in Gases, Liquids and Solids	14	4	8	6	18
3	Generation of High Voltages	14	4	8	6	18
4	Measurement of high voltages	09	2	4	6	12
5	High Voltage Testing of Electrical Apparatus	18	4	8	8	20

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	1	Study of Ionization processes.	2
2	2	Study of conduction & break down in liquid dielectric.	4
3	2	Study of conduction & break down in solid dielectric.	4
4	2	Study of H.V. D.C. generator.	4
5	2	Study of H.V. A.C. generator.	4
6	3	Study of impulse generator.	2
7	4	Study of generating voltmeters.	4
8	5	Study of measurements of voltage with sphere gap	4

		Total	28

8. SUGGESTED STUDENTS ACTIVITIES

Following is the list of proposed student activities such as:

a. Visit to EHV substation
b. Prepare a chart of test on insulators, cables, circuit breaker etc

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Improved Lecture methods-
b. Q & A technique.
c. Demonstration
d. Seminars
e. Activity based learning
f. Expert Lecture
g. Tutorial
h. Group Discussion

10. SUGGESTED LEARNING RESOURCE

S.No.	Name of Book	Author	Publication
1	High Voltage Engineering	M. S. Naidu, V.Kamaraju	Tata McGraw-Hill Publishing Company Limited
2.	An Introduction to High Voltage Engineering 2nd edition	Subir Ray	PHI Learning

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED :

S. No.	Name of equipment	Brief specification
1.	Digital Multimeter	4 ½ digit hand held 9 V batteries operated, DC Voltage: 0 to 0.001

		mV – 1000 V, AC Voltage: 0 to 0.01 mV – 1000 V, AC Current: 0 to 100 nA – 10 A, DC Current: 0 to 100 nA – 10 A
2.	Digital Tachometer	Hand held, battery operated, 5 digit display contact Type, 60 to 50000 r.p.m.
3	Oil Testing Kit	Mains Supply : 230V AC ±10%, 50Hz Single Phase Variac : 230V/ 0-270V High Voltage Source : 80kV, 20mA Voltmeter : 0 to 100kV
4	Megger	Insulation Testing:250V:500V:1000V: 1000 MΩ range, Auto-ranging, Auto

12. LEARNING WEBSITE & SOFTWARE

a. http://cercind.gov.in/ElectSupplyAct1948.pdf
b. ii. www.lce.com/pdfs/The-PMPdM-Program-124.pdf
c. iii. www.iapa.ca/pdf/prevent.pdf
d. iv. http://cercind.gov.in/ElectSupplyAct1948.pdf
e. v.www.pfeiffereng.com/Principals%20of%20Electrical%20Grounding.pdf

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

SNo	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Compare breakdown mechanism in different medium	-	3	-		-	-	-	-	-	-	-	
2	Analyze the breakdown mechanism in liquid, solid and gaseous	2	3	1		-	-	-	-	-	-	-	-

	dielectrics												
3	Distinguish different methods of generation of high DC, AC and impulse voltages	1	3	1	-	-	-	-	-	-	-		
4	Measure high DC, AC and impulse voltages	-	3	2	-	-	-	-	-	-	-	-	
5	Conduct the high voltage tests on insulators, bushings, circuit breakers and cables	-	3	3	-	-	-	-	-	-	-	-	-

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	D.S.Bhalerao	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad
2	Mrs M.V.Kunte	Lecturer in Electrical Engineering, Govt. Polytechnic, Dhule

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE SWITCHGEAR AND PROTECTION(SGP)

COURSE CODE 6E403

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Electrical	Sixth

1. RATIONALE

Inspite of all care and precautions taken in the design installation and operation of power system and power equipments abnormal conditions do occurs in the system . It is essential that the diploma pass out students should study switchgear and protection to develop skills of operating various controls and carry-out remedial measures for faults/abnormalities of machines/,equipments in power system . This course / ultimately help students to maintain reliability of electric supply .It is a applied course for diploma students.

2. COMPETENCY

At the end of studying this course students will be able to

"Maintain various switchgear and protection equipments in power systems."

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (PR)	PA (TW)	150
4	-	2	6	80	20	25@	25	
Duration of the Examination (Hrs)				--	--	--	--	

Legends : L-Lecture**; T**-Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment; **OR** – Oral Examination, **PR**-Practical Examination; **TW** - Term Work, # External, @ Internal, ~ Online.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Identify and analyze various types of faults in Power system
2. Identify and use of different types of circuit breakers in power system.
3. Select relays for given power system.
4. Apply protection scheme for transmission line.
5. Protect transformer, motor and bus bar.
6. Protect power system against over voltages.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (in cognitive domain only)	Topics and Sub-topics
Unit– I Elements of Protection	1a. Compare various types of faults and abnormalities occurring in a power system. 1b. Calculate short circuit KVA for symmetrical fault. 1c. Compare methods of neutral Grounding. 1d.Classify backup protection	1.1 Normal and abnormal operation of power system 1.2 Types of faults and causes of faults 1.3 Short circuit KVA calculation for symmetrical faults(simple numerical) 1.4 Use of current limiting reactors, types and their arrangements 1.5 Functions of protective system and elements of protective system. 1.6 Back- up protection, methods of back up protection 1.7 Neutral Grounding 1.7.1 Necessity and importance of neutral grounding, advantages of neutral grounding 1.7.2 Methods of neutral grounding and their application. 1.7.3 Comparison between different methods of grounding
Unit– II Circuit Interrupting Devices	2a.Compare different circuit interrupting devices 2b. Determine characteristics of fuse and circuit breakers. 2c. Compare arc quenching in A.C. and D.C. Circuit Breaker.	2.1 Fuse 2.1.1 Fuse element materials and their desirable properties 2.1.2 Construction, working, characteristics, application and specification of semi enclosed Rewirable and HRC fuses 2.2 Isolator- Construction, working of vertical break and horizontal break isolator with their applications 2.3 Circuit breaker 2.3.1 Arc formation process in C.B. 2.3.2 Methods of arc quenching (High

		resistance method and Low resistance or current zero method) 2.3.3 Concept of Arc voltage, Re striking voltage & Recovery voltage 2.3.4 Circuit breaker rating- (Breaking capacity, Making capacity, Short time rating) 2.3.5 HT CBs-Concept, working principle, construction, specifications and applications of MOCB, sulphur hexa fluoride (SF6), vacuum circuit breaker 2.3.6 LT CBs-working, specifications and applications of air circuit breaker, MCB, MCCB, ELCB 2.3.7 Various technical terms and specifications of CB
Unit– III Protective Relays	3a.Select the relay for given power system. 3b. Compare different types of relays. 3c.Test different types of relays.	3.1 Concept of the term protective relay 3.2 Fundamental requirements (qualities) – selectivity, speed, sensitivity, reliability, simplicity, economy 3.3 Basic relay terminology- Relay time, pick up current, plug setting multiplier, time setting multiplier 3.4 Classification of relays based on principle of operation/applications 3.5 Electromagnetic attraction relays-operation of attracted armature type, solenoid type and balanced beam type relays 3.6 Electromagnetic induction type-operation of shaded pole and watt-hour meter type relays 3.7 Induction type over current relay (non-directional) and induction type directional power relay 3.8 Distance (impedance) relay (operation) 3.9 Differential relay- operation of current differential relay and voltage differential relay 3.10 Need, advantages and limitations of static relay 3.11 Operation of static over current relay

		with block diagram 3.12 Operation of thermal relay 3.13 Principle and working of Microprocessor based relay 3.14 Introduction to Numerical relay.
Unit – IV Protection of Transmission Line and Feeder	4a. Compare various protection scheme of transmission line. 4b. Compare various protection schemes for feeder and Bus bar.	4.1 Protection of Bus bars and transmission line 4.1.1 Bus bar protection – operation of differential protection and fault bus protection 4.1.2 Transmission line protection- over current protection, distance protection and differential pilot wire protection
Unit – V Protection of Alternator, Transformer and Motor	5a. Compare various protection schemes for transformer ,motor and alternator. . 5b. Classify faults and abnormalities in alternator, transformer and motor..	5.1 Protection of alternator 5.1.1 Abnormalities and faults 5.1.2 Differential protection 5.1.3 Balanced earth fault protection 5.1.4 Stator Inter turn protection 5.1.5 Field failure protection 5.2 Protection of Transformer 5.2.1 Abnormalities and faults 5.2.2 Differential and biased differential protection 5.2.3 Earth fault or leakage protection 5.2.4 Restricted earth fault protection 5.2.5 Buchholz relay 5.3 Protection of motor 5.3.1 Abnormalities of faults 5.3.2 Short circuit protection 5.3.3 Overload protection 5.3.4 Under voltage protection 5.3.5 Reverse phase protection
Unit – VI Over Voltage Protection	6a. List causes of over voltage. 6b. Determine the characteristics of Lightning Arrestor. 6c. Compare different types of Lightening arrestor.	6.1 Over voltage and causes of over voltages 6.2 Voltage surge 6.3 Lighting stroke and protection against lighting 6.4 Types of L.A. – Rod gap, Horn gap, Expulsion, Multi gap, Thyrite type L.A. 6.5 Surge absorber 6.7 Volt- time characteristics & insulation coordination

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Teaching Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL
1	Elements of Protection	09	04	02	02	08
2	Circuit interrupting Devices	11	05	08	05	18
3	Protective Relays	14	05	08	05	18
4	Protection of Transmission Line and feeder	14	04	08	04	16
5	Protection of Alternator, Transformer and Motor	11	04	06	04	14
6	Over Voltage Protection	05	03	03	00	06
Total		64	25	35	20	80

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	1	Survey of different switchgear equipment used in electrical power system and study of their technical specifications. (Market survey/ web based search/ visit)	04
2	2	Identify various switchgear equipment available in the lab and write its specification and symbols.	04
3	2	Plot current (i) Vs. time (t) characteristics of a fuse (Kitkat/HRC)	02
4	2	Identify parts of various circuit breakers and their specification	02
5	2	Demonstration of working of MCB, MCCB and identification of different parts and their function.	02
6	3	Test ELECTROMECHANICAL IDMT overload relay and plot Time-Current characteristic	02
7	3	Demonstrate operation of a protection system used for a three phase transformer.	04
8	3	Demonstrate operation of a protection system used for a three phase induction motor.	04
9	4	Interpret various protective scheme used for transmission lines and feeders (from Blue print and visit).	04

10	4	Draw schematic diagram of protective schemes for HV OR EHV V Substation nearby area. (after visit)	04
11	5	Interpret the protection scheme for an alternator in power station (from Blue print and visit).	04
12	6	Collect data for different types and specifications of lightening arrestor.	02
Total Hours (perform practical worth 28 Hrs so that most units are covered)			38

8. SUGGESTED STUDENTS ACTIVITIES

Other than class room and laboratory activities following are the suggested guided co-curricular students activities which need to be undertaken to facilitate the attainment of various course outcomes of this course. The students are required to maintain portfolio of their experiences which he/ she will submit at the end of the term.

a. Prepare line diagram of substation (any one of /33/11 kV)
b. Prepare chart of basic elements of protective system.
c. List different types of relays, circuit breakers and collect literature from dealers/Manufactures/users and their websites (such as SEIMENS, BHEL, GE, L&T, Crompton, Power Grid Corporation etc)
d. Prepare display chart for various types of fuse.
e. Download the video of functioning of HVDC circuit breaker, Lightning arrester.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Show video/animation film to demonstrate the working principles, constructional features, testing and maintenance of different types of relays and circuit breakers
b. Arrange expert lectures by engineers of power distribution companies/suppliers of protection and switchgear equipments.
c. Arrange a visit to nearby substation and manufacturer site of protection panel
d. Arrange a visit to a relay testing laboratory.

10. SUGGESTED LEARNING RESOURCE

S.No.	Name of Book	Author	Publication
1	Fundamentals of Power System Protection	Paithankar Y. G.and Bhide S. R	PHI, New Delhi (Latest Edition)
2	Power System Protection and Switchgear	Ram B and Vishwakarma D. N.	TMH, New Delhi (Latest Edition)

3	Electrical Power System	Mehta V. K.	S. Chand Publications (Latest Edition)
4	Switchgear and Protection	Rao S. S.	Khanna Publications, New Delhi (Latest Edition)
5	Electrical Power Systems	Rao S. S and Uppal S. L	Khanna Publications (Latest Edition
6	Switchgear and Protection	Gupta J. B.	Katariya Pub. New Delhi (Latest Edition
7	Power system Protection and Switchgear	Ravindranath B. and M. Chander	Wiley Eastern Ltd, Delhi. (Latest Edition)
8	Art and Science of Protective relaying	Wadhwa. C. L.	C.R.Mason, John Wiley, New Delhi

11. **LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED** :

S. No.	Name of equipment	Brief specification
1.	HRC fuse and relay testing kit	As per specification
2.	IDMT type over current and earth fault relay	1A/5A
4	Electronic type over current relay	1A/5A, auxillary supply 230V a. c.
5	Protection panel for 3 phase induction motor	As per specification
6	Model of VCB	As per specification

12. LEARNING WEBSITE & SOFTWARE

i. www.nptel.iitm.ac.in
ii. http://electrical-engineering-portal.com/download-center/electrical-software
iii. http://electrical-engineering-portal.com/testing-commissioning-current-transformer#2

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

SNo	Course Outcome	Pos										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Identify and analyse various types of faults in Power system	-	3	-	-	-	-	-	-	-	-	-	-
2	Identify and use of different types of circuit breakers in power system.	-	3	-	-	-	-	-	-	-		-	-
3	Interpret working of different types of relays in power system.	-	3	-	-	-	-	-	-	-	-	-	-
4	Analyze the protection of transmission line and feeder from various faults	-	2	1	-	-	-	-	-	-	-	-	2
5	Protect transformer, motor and bus bar	-	2	1	-	-	-	-	-	-	-	-	2
6	Protect power system against over voltages	-	2	1	-	-	-	-	-	-	-	-	1

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	S.D.Pardeshi	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **TESTING AND MAINTENANCE OF ELECTRICAL MACHINE (TME)**

COURSE CODE **6E405**

PROGRAMME & SEMESTER

Diploma Program in which this course is offered	Semester in which offered
Electrical	Sixth

1. RATIONALE

Electrical Power system network is a combination of transformers, circuit breakers and other allied equipments which require installation, commissioning, testing and regular maintenance to prevent permanent break down. This course will enable the student to understand the concepts, principles and acquire basic skills of testing, preventive and breakdown maintenance of electrical equipments in power system.

2. COMPETENCY

At the end of studying this course students will be able to

"Undertake commissioning, testing and maintenance of various electrical machines in power system".

TEACHING AND EXAMINATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (PR)	PA (TW)	175
4	-	2	6	80	20	50#	25	
Duration of the Examination (Hrs)				3	1	--	--	

Legends : L-Lecture**; T**-Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment; **OR** – Oral Examination, **PR**-Practical Examination; **TW** - Term Work, # External, @ Internal, ~ Online.

3. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Interpret concept of testing & maintenance of electrical equipment as per I.S.
2. Carry out testing & maintenance of electrical equipment as per I.S
3. Measure the insulation resistance & know the methods of improving insulation resistance if required.
4. Carry out maintenance of electrical machines
5. Locate common troubles, analyze & set it right in case of various electrical machines.
6. State the precautions to be taken and importance of safety precautions.

4. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (in cognitive domain only)	Topics and Sub-topics
Unit – I General introduction	1a.Distinguish routine, preventive and breakdown maintenance 1b.List the Objectives of testing. 1c.Catgarise the testing	1.1 Maintenance of electrical equipment, Functions of the Maintenance Department. 1.2 Reasons of failure of electrical equipment. 1.3 Types of maintenance- routine, preventive, breakdown maintenance 1.4 Factors affecting preventive maintenance schedule. 1.5 Procedure for developing preventive maintenance schedule. 1.6 Objectives of testing 1.7 Categories of testing 1.8 Concept of tolerance Significance of ISS in maintenance of equipment.
Unit-II Commissioning and Testing	2a.Compare various commissioning tests on electrical machines 2b. Test before commissioning the given electrical machine 2c.Compare direct and indirect testing method. 2d.List the properties of good transformer oil. 2f. Test the transformer oil.	2.1Tests before commissioning of electrical equipment-Electrical and Mechanical test 2.2 Preparations before commissioning of power transformer 2.3 Reasons for gradual loading 2.4 Comparison between Direct and indirect testing method. 2.5 Testing of D.C motor- Brake test, Swinburne's test, Hopkinson test 2.6 Testing of 3 phase induction motor-No load test, Blocked rotor test, Full load test, Reduced voltage running up test 2.7 Testing of single phase induction motor- No load test, Blocked rotor test 2.8Testing of transformer- Back to back test, Polarity test.

		2.9 Properties of good transformer oil. 2.10 Testing of oil as per 1992-1978 Dielectric test, crackle test, acidity test, flash point test, sludge test
Unit III Insulation	3a.Classify the insulating material. 3b.Determine the insulation resistance of electrical equipment/machines 3c. List the various factor affecting the insulation resistance 3d.Measure the temperature of internal parts and winding of given machine.	3.1 Classification of Insulating materials as per I.S.8504 3.2 Factors affecting life of the insulating material. 3.3 Measurement of insulation-resistance. 3.4 Method of cleaning insulation -covered with loose dry dust, sticky dirt, oily, viscous films. 3.5 Procedure for varnishing insulation, hot-dip method, vacuum impregnation. 3.6 Method of external/internal heating. 3.7 Methods of measuring temperature of internal parts and winding of machine
Unit IV Maintenance	4a.Prepare maintenance schedule of different equipment 4b. State the probable faults due to poor maintenance in various electrical 4c.State the use of different tools of maintenance 4d Protect electrical equipment during periods of inactivity.	4.1 Maintenance schedule of transformer below 1000Kva 4.2 Maintenance schedule- D.C machine, 3-phase induction motor, alternator Synchronous machines as per IS 4884-1968 Switchgear and control equipments as per IS3072-1975 Storage batteries as per IS 4237-1967 4.3 Probable faults due to poor maintenance in transformer, induction motor, overhead lines and battery 4.4 Use of Instruments and tools for trouble shooting- bearing puller, filler gauge, dial indicator, spirit level, growler. 4.5 Protection of electrical equipment's during periods of in activity.
Unit– V Trouble shooting	5a.State various internal and external faults and troubles in various electrical equipment and machines 5b. Prepare trouble shooting chart for various electrical equipment& machines	5.1Condition for normal performance of electrical equipment's. 5.2Causes of faults in electrical equipment(Internal and external) 5.3Common troubles in electrical equipment –DC Machines, AC Machines, Transformers, circuit backer 5.4 Need of trouble shooting chart 5.5 Trouble shooting chart for DC Motor, DC Generator, Transformer, Synchronous Motor, Induction Motor, Circuit-breaker

Unit VI Electrical Accidents and Safety	6a.List the causes of electrical accidents 6b. Describe the procedure for shutting down of substation and power lines 6c. Use of different types of fire extinguisher.	6.1 Causes of electrical accidents 6.2 Factors affecting the severity of electrical shock 6.3 Actions to be taken when a person gets attached to live part 6.4 Safety regulations and safety measures 6.5 Indian electricity supply act 1948-1956 6.6 Factory act 1948 6.7 Sub-station shut down Procedure 6.8 certificate of (i)requisition for shut down (ii) Permit to work and (iii) Line clear certificate 6.9 Instruction for the safety of persons working on a job with a permit to work 6.10 Fire extinguishers-Fixed installation and portable devices

5. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Teaching Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL
1	General introduction	06	06	06	-	12
2	Commissioning and Testing	12	02	04	06	14
3	Insulation	12	06	04	08	14
4	Maintenance	12	04	04	04	14
5	Trouble shooting	10	04	06	06	16
6	Electrical Accidents and Safety	12	02	04	04	10
	Total	64	24	28	28	80

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

6. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	2	Perform polarity test on single phase transformer.	2
2	2	Prepare test reports of an electrical machine after commissioning.	2
3	2	To Perform Swinburne's test, on DC shunt motor for finding efficiency	2
4	2	To perform reduced voltage running of test on three phase Induction Motor	2
5	2	Perform dielectric test on insulating oil.	2
6	2	Measure insulation resistance of a winding/cables/wiring installation.	2
7	3	Prepare maintenance schedule for power transformer.	2
8	3	Prepare maintenance schedule for three phase induction motor.	2
9	4	Prepare a Trouble shooting chart for Three phase and single phase induction motor.	4
10	4	Prepare a trouble shooting chart for D.C. Machine.	4
11	5	Measure earth resistance of installation of building/domestic wiring and appliances by different methods	4
12	5	prepare trouble shooting and rectifying the troubles in transformer	2
13	5	Interpret IE rules pertaining to safety	2
14	6	Show the action to be taken when a person comes in contact with a live wire.	4
15	6	Undertake drill operation for using fire extinguisher for safety against fire.	2
Total Hours(Perform any 10 practical's worth 28 hours so that most units are covered)			34

7. SUGGESTED STUDENTS ACTIVITIES

Following is the list of proposed student activities such as:

a. Prepare journals based on practical performed in laboratory.
b. Solving numerical from different books for practice
c. List various instruments and tools used for trouble shooting

d. Find troubleshooting techniques and steps to troubleshoot various electrical equipment and machines
e. Prepare trouble shooting chart for various electrical equipments
f. Site visit for commissioning of Transformer

8. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Show video/animation film to demonstrate maintenance of machine.
b. Arrange a visit to nearby industry/substation to observe testing, maintenance and troubleshooting of various electrical equipment and machines.
c. Use Flash/Animations to demonstrate testing of various electrical equipment and devices.
d. Arrange expert lectures of the professional engineers involved in maintenance and testing of heavy power equipments/machines
e. Give Mini projects to students

9. SUGGESTED LEARNING RESOURCE

Sr.No.	Name of Book	Author	Publication
1	Testing Commissioning operation and maintenance of Electrical Equipments.	Rao. S	Khanna Publication (Lates edition), New Delhi
2	Installation, commissioning and maintenance of Electrical equipment	Singh Tarlok	S.K.Kataria and Sons, New Delhi, Second edition-2012
3	Electrical power system	Wadhwa C.L.	New Age international Publications, New Delhi
4	Testing Commissioning operation and maintenance of Electrical Equipments.	B.P.Patil	

10. **LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED** :

S. No.	Name of equipment	Brief specification
1.	Digital Multimeter	4 ½ digit hand held 9 V batteries operated, DC Voltage: 0 to 0.001 mV – 1000 V, AC Voltage: 0 to 0.01 mV – 1000 V, AC Current: 0 to 100 nA – 10 A, DC Current: 0 to 100 nA – 10 A,
2.	Digital Tachometer	Hand held, battery operated, 5 digit display contact Type, 60 to 50000 r.p.m.,
3.	Oil testing kit.	Mains Supply : 230V AC ±10%, 50Hz Single Phase Variac : 230V/ 0-270V High Voltage Source : 80kV, 20mA Voltmeter : 0 to 100kV
4.	Megger	Insulation Testing:250V:500V:1000V: 1000 MΩ range, Auto-ranging, Auto

11. LEARNING WEBSITE & SOFTWARE

a. ii. www.lce.com/pdfs/The-PMPdM-Program-124.pdf
b. iii. www.iapa.ca/pdf/prevent.pdf
c. iv. http://cercind.gov.in/ElectSupplyAct1948.pdf
d. v.www.pfeiffereng.com/Principals%20of%20Electrical%20Grounding.pdf

12. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

Sr No	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Interpret concept of testing maintenance of electri equipment as per I.S.	3			1						1	-	-
2	Carry out testing & maintenance of electrical equipment as per I.S		1	2	1	1					2	-	-
3	Measure the insulation resistance & know the methods of improving insulation resistance if required.		3	2								-	-
4	Carry out maintenance of electrical machines		3	1	2							-	-
5	Locate common troubles, analyze & set it right in case of various electrical machines.		1	1	2							-	-
6	State the precautions to be taken and importance of safety precautions.					3							

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	M V.Kunte	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad
2	S J Ghorpade	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE- **PROJECT (PRJ)**

COURSE CODE **6E502**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Electrical	Sixth

1. **RATIONALE**

This course is intended to understand facts, concepts and techniques of electrical equipments in order to troubleshoot and repair. The student will able to develop skill of cost estimation, procurement, fabrication and manufacturing of various components used in electrical field. This will help the student to acquire skills and attitudes so as to do the function of supervisor in industry and also can start his/her own small scale enterprise.

2. **COMPETENCY**

The course content should be taught and implemented with the aim to develop required skills in the Diploma engineer so that they are able to acquire following competency:

"Identify the problem and apply innovative, creative and logical approach for problem solving."

3. **TEACHING AND EXAMINATION SCHEME**

Teaching Scheme (Hours/Credits)			Total Credits (L+T+P)	Examination Scheme(Marks)				
				Theory		Practical		Total Marks
L	T	P	C	ESE	PT	ESE (OR)	PA (TW)	150
--	--	04	04	--	--	50#	100	
Duration of the Examination (Hrs)				--	--	--	--	

Legends : L-Lecture**; T**-Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, **OR** – Oral Examination, **PR**- Practical Examination ; **TW** - Term Work, # External, @ Internal, ~ Online.

4. **COURSE OUTCOMES**

At the end of studying this course students will be able to: -

1. Plan and identify materials, processes and other resources optimally.
2. Develop innovative and creative ideas.
3. Develop leadership, interpersonal skill and team work.
4. Develop sense of environmental responsibility.
5. Purchase raw material/standard parts.
6. Interpret the drawings, manufacture, assemble, inspect & if necessary modify the parts/unit/assembly of the project work.
7. Acquire knowledge latest changes in technology

5. DETAILED COURSE CONTENTS

Student should carry out one project during the term related to area specified below.

S.No.	Areas For Selection
1	Modern traction systems, Advance electric drives
2	Power system
3	Power quality
4	EHV & HVDC Transmission
5	Energy efficient machines/ New Trends in Machines
6	New trends in switchgear
7	Energy conservation, power quality
8	Non conventional sources of energy
9	Energy Audit
10	Electrical Safety
11	Any other topic related to electrical engineering

A. Group Formation:

1 The department Head / In charge should make sure that the project groups are formed within **one week** of the beginning of academic term and assign a faculty as project guide.
2 The student may be asked to work individually or in groups of maximum **five** students.
3 The group can decide the leader and distribute work and prepare the group management structure.

B. Finalization of Project Title:

1 The students are expected to take up a project with the guidance of a Project Guide from the institute / Industry Expert / Sponsored by industry, Institute, society, self.
2 The project shall be as far as possible industrial project useful to society.
3 The students can seek help from TPO / HOD / Guide
4 The group of students / Project guide / authority shall see the viability / feasibility of project over the duration available with the students and capabilities and setup available

C. Note:

1 The group / student shall prepare Project Diary with Name of Project, Name of Students in group, their attendance, and daily progress and get assessed from guide from time to time during project hours.
2 Each student shall maintain individual progressive assessment sheet and get assessed from guide from time to time during project hours.
3 The title of the project should be finalized within **two weeks** after the group formation and a synopsis of the project should be submitted to the HOD & guide
4 The format of the synopsis shall be as follows: The synopsis should include project title, aim, and block diagram, list of components required and working
5 Head of department will sign once in a month

6. SUGGESTED SPECIFICATION TABLE

There is no particular specification table for assessment; however, faculty should follow following guidelines for progressive assessment:

Unit No.	Title of Unit	Teaching Hours
I	Literature survey, Project identification	12
II	Design	36
III	Implementation	24
IV	Testing and installation	12
V	Report writing and presentation	12
	TOTAL	96

7. PROJECT EVALUATION SCHEME

Evaluation of project should be made as per following guidelines

Sr. No.	Evaluation	Weight age
I	Literature survey, Project identification	5%
II	Design	35%
III	Implementation	35%

IV	Testing and installation	10%
V	Report writing and presentation	15%
	TOTAL	100%

Guideline for formatting of Project Report: Prepare project report with MS Office with following guidelines

Page :A4 (ON ONE SIDE)
Margin :TOP 15mm
:BOTTOM 15mm
:RIGHT 15mm
:LEFT 30mm
Font :Arial
Size :12 bold, content 12
: Spacing 18 points
Header : Title of the project
:Page number on top right
Footer :Academic Year, short name of institute

8. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Not applicable

9. SUGGESTED STUDENTS ACTIVITIES

As mentioned in Sr. No. 6

10. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

1. Seminar/Symposium
2. Group discussion/Debate
3. Expert lectures of resource persons from industries/research organizations.
4. Arranging Industrial visit.
5. Project Exhibition
6. Mock presentation of project

11. SUGGESTED LEARNING RESOURCE

S. No.	Name of the Magazine
1	IEEE Transactions/Journals
2	Electrical India
3	IEEMA Journal
4	Elecrama
5	Technorama
6	Urja
7	Industrial Automation
8	Electronics for You
9	Electronics Projects
10	Computer World
11	Chip

12. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED:

1. Computer
2. Cathode ray Oscilloscope (CRO)
3. Soldering station with drill machine
4. PCB formulation kit
5. Clip on meter/ multi-meter/ power supplies.
6. IC tester/ continuity tester/ Component tester
7. Autotransformer
8. Other equipments as per the need of the project
9. Simulation tools

13. LEARNING WEBSITE & SOFTWARE

a. www.nptel.iitm.ac.in
b. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-867-machine learning-fall-2006/
c. http://www.indiabix.com/online-test/electrical-engineering-test/143
d. http://freevideolectures.com/Course/3085/Electrical-Machines-I

14. **MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)**

SN	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Plan and identify materials, processes and other resources optimally.	-	-	-	-	2	-	-	3	-	-	-	-
2	Develop innovative and creative ideas.	-	-	2	2	-	-	-	-	-	-	3	-
3	Develop leadership, interpersonal skill and team work.	-	-	-	-	2	2	3	-	-	-	-	-
4	Develop sense of environmental responsibility.	-	-	-	-	-	3	2	-	-	-	-	-
5	Purchase raw material/standard parts.	-	2	-	2	-	-	-	2	-	-	-	-
6	Interpret the drawings, manufacture, assemble, inspect & if necessary modify the parts/unit/assembly of the project work.	2	3	3	2	-	-	-	-	-	-	-	-
7.	Acquire knowledge latest changes in technology	-	2	-	-	-	-	-	-	-	2	3	-

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	Dr. Manzoor Ali	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE- **ELECTRICAL POWER SYSTEM(EPS)**

COURSE CODE **6E504**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Electrical	Sixth

1. RATIONALE

Implementation of activities related to transmission and distribution of power is a major role of electrical engineer. They should apply load flow studies, active and reactive power control strategies to ensure stable and optimized power system operation. Hence, this course is designed to develop skills and concepts in diploma engineers to maintain and operate electrical power system. This course is designed at diversified level.

2. COMPETENCY

The course content should be taught and implemented with the aim to develop required skills in the students so that they are able to acquire following competency:

"Apply different techniques used to ensure power system stability, balance power flow and economic load dispatch."

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (Hours/Credits)			Total Credits (L+T+P)	Examination Scheme(Marks)				
				Theory		Practical		Total Marks
L	T	P	C	ESE	PT	ESE (PR)	PA (TW)	175
04	--	02	06	80	20	50@	25	
Duration of the Examination (Hrs)				3	1	--	--	

Legends : L-Lecture**; T**-Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, **OR** – Oral Examination, **PR**- Practical Examination ; **TW** - Term Work, # External, @ Internal, ~ Online.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Use per unit system to calculate fault current for a given power system.
2. Analyze methods for active and reactive power control.
3. Select the method for economic load dispatch and unit commitment.
4. Maintain the power system stability using different methods.
5. Calculate different load variables from load flow analysis.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (cognitive domain only)	Topics and Sub-topics
Unit – I Representation of Power System	1a. Calculate the p.u. values of power system parameters. 1b. Select bases values and determine the base impedance of single and three phase circuits	1.1 Single phase representation of balanced three phase networks 1.2 The single line diagram and impedance of reactance diagram 1.3 Per unit (PU) systems and related examples 1.4 Advantages and disadvantages of per unit system 1.5 Selections of bases and determination of base impedance when Per unit system applied to single phase circuits Per unit system extended to three phase circuits
Unit-II Active and Reactive Power Control (Voltage Control) Methods	2a. Compare different conventional methods to control reactive power 2b. Explain the different methods of voltage and frequency control	2.1 Necessity of maintaining constant Transmission line voltages and frequency 2.2 Real and Reactive Power Transfer in long distance transmission lines 2.3 Conventional methods to control real and reactive power AGC, Transformer tap changer control, Phase shifting transformers, Synchronous machine Excitation Control 2.4Methods of voltage control: Excitation control, Tirril regulator, Browen Boveri regulator, Tap changing transformer method:- Off- Load tap changing method,On- Load tap changing method 2.5 Automatic voltage and frequency

		control of single area system
Unit– III Economic Load Dispatch and Unit Commitment	3a. Select the criteria for economical dispatch of power 3b. Plan to implement the optimal unit commitment (UC) under various conditions. 3c. Apply Load forecasting techniques.	3.1Methods of loading turbo generators 3.2 Economical dispatch of power - Incremental transmission loss 3.3 Optimal unit commitment(UC) 3.4 Interconnected systems – introduction, advantages and disadvantages 3.5 Functions of load dispatching center:- SCADA system – configuration and functions 3.6 Load forecasting Short, Medium and Long load forecasting, extra polation and co-relation
Unit–IV Power System Stability	4a. Distinguish steady state, dynamic and transient stability.	4.1Turbine speed governing system:- Introduction to system stability 4.2Steady state stability and transient stability:- Power angle diagram
UNIT –V Load flow Analysis	5a. Justify the need for load flow analysis in interconnected power system: 5b.Calculate the Bus admittance matrix for given power system.	5.1. Load flow Analysis in interconnected power system: 5.2. Different types of buses.(Bus classification) Bus admittance matrix 5.3. Numerical for 3 bus system including bus reference

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Title of Unit	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Representation of Power System	10	04	02	06	12
2	Active and Reactive Power Control (Voltage Control) Methods	16	06	06	10	22
3	Economic Load Dispatch and Unit Commitment	16	04	06	10	20
4	Power System Stability	10	04	06	02	12
5	Load flow Analysis	12	04	06	04	14
TOTAL		64	22	26	32	80

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit No.	Title Practical/ Lab. Work/ Assignments/ Tutorials (outcomes in Psychomotor Domain)	Approx Hours. required
1	1	Develop a simple programme to calculate the p.u. values of a power system using MATLAB software.	04
3	2	Improve the power factor of a given load.	04
2	3	Solve the unit commitment problem for a given power system	02
4	3	Observe tariffs of different consumers and write a report on different Tariff structures.	04
5	4	Analyze the steady state stability of the given power system.	04
6	5	Construct the Y –Bus matrix of the given power System	04
7	5	Perform Load flow study of a given power system.	04
8	5	Develop a simple programme to form the Y –Bus of the given power System	04
Total Hours (perform practical worth 28 hours so that most units are covered)			**30**

8. SUGGESTED STUDENTS ACTIVITIES

Following is the list of proposed student activities like:

a. Visit high voltage substation.
b. Prepare a report on India's power grids, their power capacities and methods employed to ensure stability even after connecting them with each other.
c. Prepare flow chart for the load flow studies
d. Visit to power plant.
e. Collect research papers on any topic related to given subject presented in conferences or published in journals / magazines & write brief report on it.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

a. Arrange Visit to State Load Dispatch centre (SLDC)
b. Provide as many simulation exercises to students as possible
c. Arrange expert lecture by some engineers working at load dispatch centers/Power transmission companies.
d. Discuss some case studies of black outs/grid failures due to power system instability.

10. SUGGESTED LEARNING RESOURCE

S. No.	Name of Book	Author	Publication
1	Modern power system analysis	Kothari D. P. and Nagrath I. J.	Tata McGraw-Hill Publication New Delhi 2014 or latest
2	Electrical power system Design	Deshpande M. V.	Tata McGraw-Hill Publication New Delhi 2014 or latest
3	Electrical power system	Wadhwa C.L.	New Age international Publications New Delhi 2014 or latest
4	A course in Electrical Power	Gupta J.B.	S.K.Kataria and Sons New Delhi 2014 or latest
5	Power system analysis and Design	Gupta B. R.	S.Chand and Co. Ltd. New Delhi 2014 or latest

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED:

Computer is required to run software like MATLAB/ETAP etc.

12. LEARNING WEBSITE & SOFTWARE

a. MATLAB software latest version with relevant tool boxes
b. ETAP software latest version with relevant tool boxes
c. www.powergridindia.com
d. www.wrldc.com
e. www.gseb.com

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

S. No.	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	1	2
1	Use per unit system to calculate fault current for a given power system.	-	2	2	-	-	-	-	-	-	-	-	-
2	Analyze methods for active and reactive power control.	-	3	-	-	-	-	-	-	-	-	-	3
3	Select the method for economic load dispatch and unit commitment.	2	3	1	-	-	-	-	-	-	-	-	-
4	Maintain the power system stability using different methods.	-	3	-	-	-	-	-	-	-	-	-	-
5	Calculate different load variables from load flow analysis.	-	2	2	-	-	-	-	-	-	-	-	-

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	Dr. Manzoor Ali	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE- **ENERGY CONSERVATION AND AUDIT(ECA)**

COURSE CODE **6E505**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Electrical	Sixth

1. RATIONALE

Energy is the absolutely necessary component for the economic development of any country. Energy Conservation is important due to the limited amount of fossil fuels , impact of excessive energy use on environment and for sustainable development ,This diversified course will enable **Diploma Engineer** to understand the need of energy audit for Energy Conservation , management and optimization of existing processes and different technologies used in energy conservation in various equipments.

2. COMPETENCY

At the end of studying this course students will be able to

"Plan the effective and efficient use of Electrical Energy in different applications."

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (Hours/Credits)			Total Credits (L+T+P)	Examination Scheme(Marks)				
				Theory		Practical		Total Marks
L	T	P	C	ESE	PT	ESE (OR)	PA (TW)	150
04	--	02	06	80	20	25@	25	
Duration of the Examination (Hrs)				3	1	--	--	

Legends : L-Lecture**; T-**Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, **OR** – Oral Examination, **PR**- Practical Examination ; **TW** - Term Work, # External, @ Internal, ~ Online.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Identify the demand supply gap of energy in Indian scenario.

2. Carry out preliminary energy audit in an organization
3. Select appropriate energy conservation methods to reduce energy loss in lighting.
4. Select Energy conservation techniques for improving the performance of induction motor and transformer.
5. Identify methods of energy conservation in transmission and distribution system.
6. Employ the method of maintaining Power factor and Load factor equal to unity.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (Cognitive Domain Only)	Topics and Sub-topics
Unit – I Energy Conservation	1a.Identify the scope of Energy Conservation in context of present energy scenario in India.	1.1-Present Energy Scenario. 1.2-Definition and need of Energy Conservation and Energy Audit. 1.3-Salient features of Electricity act 2003.
Unit –II Energy Audit	2a.Draw energy flow diagram of different system. 2b.Prepare internal energy audit checklist. 2c.Select instruments for energy audit for various parameters. 2d.Prepare questionnaire for Energy audit. 2e.Calculate simple payback period.	2.1 Procedure for EnergyAudit 2.2 Use of ABC analysis in Energy audit procedure. 2.3 Energy flow diagram and its significance. 2.4 Internal Energy audit checklist For Electrical section , motor, lighting Section, building . 2.5 Instruments for energy audit. 2.6 Questionnaire for Energy audit. 2.7 Calculation of simple payback period.
Unit-III Energy conservation in different systems .	3a.Suggest the methods to improve Energy efficiency in different system .	3.1 Recommended luminance level. 3.2 Energy Conservation techniques in lighting system- *By replacing Lamp sources. *Using energy efficient luminaries. *Using light controlled gears. *By installation of separate transformer / servo stabilizer for lighting. *Periodic survey and adequate maintenance programs. 3.3 Energy Conservation in Furnace. 3.4 Energy Conservation in Boilers. 3.5 Energy Conservation in Air -conditioning System. 3.6 Energy conservation in Compressors. 3.7 Cogeneration – Types and advantages.

Unit– IV Energy Conservation in motor and transformer.	4a. Suggest suitable method of energy conservation in Induction motor and transformer. 4b.Compare standard induction motor with energy efficient motor. 4c.Select suitable energy efficient technology for given application	4.1 Need for energy conservation in induction motor. 4.2 Various energy conservation techniques in Induction motor. *By improving Power quality. *By motor survey. *By minimizing the idle and Redundant running of motor. *By operating in star mode. *By rewinding of motor. *By improving mechanical power transmission. 4.3 Energy Efficient motor, Comparison with Standard induction motor. 4.4 Energy Efficient Technologies– Variable Frequency drive , Soft starter, Automatic Power Factor Correction Panel. 4.5 Need for Energy conservation in transformer. 4.6 Amorphous core Transformer. 4.7 Dry Type Transformer.
Unit–V Energy Conservation in Transmission and Distribution.	5a.Identify different losses in transmission and distribution system. 5b.Identify opportunities for Energy conservation in transmission and distribution system.	5.1 Scenario of transmission and distribution losses at state level. 5.2 Types of losses in transmission and distribution system(commercial and technical losses) 5.3 Energy conservation techniques in transmission and distribution system related to technical losses. *By reducing I2R losses. *By compensating reactive power flow. *By optimizing distribution voltage *By balancing phase currents.s 5.4 Energy conservation techniques related to commercial losses.
Unit –VI Tariff and Energy Conservation	6a.Reduce energy bill by selecting suitable tariff. 6b.Reduce energy bill by improving Power factor and load factor .	6.1 Application of Tariff system to reduce Energy Bill. 6.2 Effect of improvement in power factor on Energy bill. 6.3 Effect of Improvement in load factor on Energy bill.

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Teaching Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL
1	Energy Conservation	04	02	02	--	04
2	Energy audit	12	02	06	06	14
3	Energy Conservation In Lighting & Other Systems	14	--	10	08	18
4	Energy Conservation In Electrical Machines	14	--	10	08	18
5	Energy Conservation In Transmission And Distribution	14	--	12	06	18
6	Tariff And Energy Conservation	06	--	08	--	08
Total		64	04	48	28	80

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	01	Collect the information about Electricity Act 2003.	02
2	02	Prepare a questionnaire , carry out walk through audit and Prepare audit report for Residence / small scale industry / commercial complex /hospital / Restaurant etc	10
3	03	Collect of information by market survey and prepare report on energy efficient luminaries .	04
4	04	Compare the performance of Electromagnetic choke with Electronic ballast .	04
5	05	Prepare a visit report on any organization where energy conservation program is implemented (Hospitals,workshops, institutes, commercial building, residential building)	08
6	06	Collect an information about standard tariff rates	04
Total Hours(perform practical worth 28 hours so that most units are covered)			32

8. SUGGESTED STUDENTS ACTIVITIES

Following is the list of proposed student activities like:

a. Prepare charts showing an importance of Energy conservation.

b. Prepare various slogans for increasing awareness about Energy conservation .
c. Arrange an exhibition on energy conservation on different topics.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

a. Arrange expert lecture on Energy Conservation.
b. Arrange group discussion on methods to improve energy efficiency in the institute.

10. SUGGESTED LEARNING RESOURCE

S.No.	Name of Book	Author	Publication
1	Energy conservation and management	K.V.Sharma	--
2	Energy Conservation – Awareness and Opportunities	Somana Ganapathy V.sivaReddy	Arihant prakashan
3	India - The Energy Sector	P.H.Henderson	University Press
4	Manuals on energy conservation and audit	Bureau of Energy Efficiency	Bureau of Energy Efficiency

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED:

Sr. No	Name of the Equipment	Brief specification
1	Tubelight setup with electromagnetic choke and electronic ballast.	40 W.
2	Ammeter, Wattmeter	0-1 A. (ac), 0-250 W.

12. LEARNING WEBSITE & SOFTWARE

a. www.beeindia.gov.in
b. www.energymanagertraining.com
c. www.em-ea.org
d. www.mnre.gov.in
e. www.powermin.nic.in
f. www.mahasldc.in

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

SN	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Identify the demand supply gap of energy in Indian scenario.	1	1	-	-	1	-	-	-	-	-		
2	Carry out preliminary energy audit in an organization	-	1	1	1	-	1	-	-	-	1		
3	Select appropriate energy conservation methods to reduce energy loss in lighting.	-	1	1	1	1	1	-	-	-	-	-	1
4	Select Energy conservation techniques for improving the performance of induction motor and transformer	-	1	1	1	1	-	-	-	-	1	1	-
5	Identify methods of energy conservation in transmission and distribution system.	-	2	1	-	1	-	-	-	-	2	-	1
6	Employ the method of maintaining Power factor and Load factor equal to unity	-	1	1	-	1	-	-	-	-	-	-	1

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	A.A.Ghate	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **THYRISTORISED CONTROLLED DRIVES(TCD)**

COURSE CODE **6E510**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Electrical	Sixth

1. RATIONALE

This course enables to develop the basics of electric drives and maintain different types of DC/AC drives in industries. Industrial and domestic loads demands precise and smooth variable speed control. The development of compact thyristor power converters has made this possible by smooth speed control of both AC and DC motors which are employed for several applications such as DC/AC drives, Vehicles and renewable energy. The competency in this area is highly required in diploma pass outs working in most of the industries since these industries employ large number of motors and drives and their smooth operation and maintenance requires lot of competent man power. Thus this course is useful for students who want to work in industries.

2. COMPETENCY

At the end of studying this course students will be able to

"Operate and maintain different types of DC and AC electrical machine drives in the industry"

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE(OR)	PA (TW)	150
4	-	2	6	80	20	25#	25	
Duration of the Examination (Hrs)				3	1	--	--	

Legends : L-Lecture**; T**-Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment;**OR** – Oral Examination, **PR**-Practical Examination; **TW** - Term Work, # External, @ Internal, ~ Online.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Select a drive for a particular application based on power rating.
2. Select a drive based on mechanical characteristics for a particular drive application.
3. Operate and maintain solid state drives for speed control of DC machines.
4. Operate & maintain solid state drives for speed control 3 phase induction motor.
5. Operate & maintain solid state drivesfor speed control of 3 phase Synchronous motor.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (in cognitive domain only)	Topics and Sub-topics
Unit – I Basics of Electrical Drives	1a. Explain the working of an electrical drive with the help of a neat block diagram. 1b. Select electric drives for a given Application. 1d. Use heating and cooling curve For finding temperature rise in a drive. 1e. Determine power rating for different load curves by equivalent current, torque and power methods 1f. Select a motor on the basis of duty cycles of motors.	1.1 Electric drive, types, AC v/s DC drives, choice of electric drives 1.2 Parts of electrical drive-Source, power modulator, electric motor and control Unit. 1.3 Selection of electric drive for applications: agricultural pumps, steel mills, paper mills, rolling mills, spinning mills, cement industries, chemical industries, refineries, shipping, power stations and Automobiles 1.4 Heating and cooling curve 1.5 Motor duty class, classification–continuous, short time, intermittent periodic 1.6 Motor power rating for continuous, short time and intermittent duty, equivalent current, torque and power methods for fluctuating and intermittent loads.
Unit– II Dynamics of Electrical Drives	2a. Explain the nature of speed torque characteristic of various types of loads and drive motors with the help of neat sketch. 2b. Explain the multi quadrant operation of electrical drive. Describe different methods of braking used in any electric drive. 2d. Describe the basic concept of various control loops used in electrical drives.	2.1 Steady state load Torque speed Characteristics 2.2 Multi quadrant operation of drives 2.3 Types of Braking-(a) Plugging, (b) dynamic/rheostat braking and (c) Regenerative braking. 2.4 Starters-Typical control circuits for shunt and series motors, Three phase squirrel cage and slip ring induction Motors 2.5 Close loop control of drives i. Current limit control

		ii. Close loop torque control iii. Close loop speed control iv. Close loop speed control of multi motor drive
Unit– III DC Drives	3a. Use conventional speed control technique(s) of DC motors. 3c. Describe the speed control of chopper controlled DC drives.	3.1 Speed control of DC series and shunt Motors – armature and field control. 3.2 Solid state speed control of single phase and 3 phase DC drives with the following: i. Half wave converter ii. Semi converter iii. Full converter iv. Dual converter 3.3 Solid state speed control of separately excited shunt and series motor drives 3.4 Chopper controlled drives
Unit– IV AC Drives - Three Phase Induction Motor Drive	4a. Explain speed control methods of a 3 phase induction motor. 4b.Explain the working of various 3 phase induction motor drives for precise variable speed control.	4.1 Basic principle of 3 Phase induction motor drive. 4.2 Solid state control of 3 phase induction motor: i. Stator voltage control 3 Phase AC voltage controllers and soft start. ii. Stator variable frequency control-voltage source inverter- PWM drives and current source inverter drives, cycloconverter fed IM drive. iii. Stator voltage and frequency control-Basics of V/f drive, scalar and vector or field oriented control of drives, V/F flux control drive. iv. Static rotor resistance control.
Unit– V AC Drives - Three Phase Synchronous Motor Drive	5a. Explain the principle of two modes of variable frequency control in 3 phase synchronous motor. 5b. Explain the working of self-controlled synchronous motor drive employing load commutated thyristor inverter for high speed and high power applications. 5c. Describe the working of a cycloconverter fed Synchronous motor.	5.1 Control of synchronous motor - Synchronous mode and Self mode. 5.2 Self-controlled synchronous motor drive employing load commutated thyristor inverter, closed loop Control 5.3 Self-controlled synchronous motor drive employing cycloconverter

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Teaching Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL
1	Basics of Electrical Drives	10	04	06	04	14
2	Dynamics of Electrical Drives	10	04	06	04	14
3	DC Drives	16	04	06	08	18
4	AC Drives–3Phase Induction Motor Drives	16	04	06	08	18
5	AC drives – 3 Phase Synchronous Motor Drives	12	04	04	08	16
Total		64	20	28	32	80

Legends:*R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr.No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	3	Control the speed of DC motor using single phase full converter.	4
2	3	Control the speed of DC motor using three phase half wave Converter.	2
3	4	Test the performance of closed loop speed control of 3 phase induction motor using stator voltage control.	2
4	4	Test the performance of 3 phase induction motor V/f drive	4
5	4	Test the performance of vector control drive	4
6	4	Test the performance of 3- Ø induction motor using VSI drive.	4
7	4	Test the performance of Cycloconverter fed induction Motor drive.	4
8	5	Test the performance of a self-controlled synchronous motor drive employing Cycloconverter	4
Total (All practical's are compulsory)			28

8. SUGGESTED STUDENTS ACTIVITIES

Other than class room and laboratory activities following are the suggested guided co-curricularstudent's activities which need to be undertaken to facilitate the attainment of various course outcomes of this course. The students are required to maintain portfolio of their experiences which he/ she will submit at the end of the term.

a. Prepare journals based on practical performed in laboratory.
b. Visit websites of suppliers of electric drives and do a comparative study of different drives provided by different companies.
c. List various motor controlling parameters and find how they affect the performance of motor and drives.
d. Find troubleshooting techniques and steps to troubleshoot DC drives.
e. Find practical applications of AC drives in home appliances and list various Parameters of those applications.
f. Make comparative table for various drives based on its application and maximum power ratings.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Show video/animation film to demonstrate the working principles, constructional features, testing and maintenance of different types of DC motor drives.
b. Arrange expert lectures by engineers working in electric drive companies.
c. Arrange a visit to nearby manufacturer of electrical drives.
d. Use flash/animations to explain the working of different control devices.
e. Give mini projects to students.

10. SUGGESTED LEARNING RESOURCE

S.No.	Name of Book	Author	Publication
1.	Fundamentals of Electrical Drives	Dubey, Gopal K.	Narosa Publishing House New Delhi, 2nd Edition
2.	Power Electronics	Bimbhra, P.S.	Khanna Publishers, New Delhi 5th Edition
3.	Power Electronics	Singh M.D., Khanchandani K.B.	Tata McGraw-Hill Education New Delhi
4.	Variable Speed Drives and Power Electronics	Barnes, Malcolm	Newnes, Elsevier ,2003
5.	Power Electronics:	Muhammad,	Pearson, New Delhi,

	Circuits, Devices and application	Rashid H.	2003,3rd Edition or latest

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED:

S. No.	Name of equipment	Brief specification
1	Digital Multimeter	4½ digit hand held 9 V batteries operated, DC Voltage: 0 to 1.1 mV – 1000 V, AC Voltage: 0 to 0.01 mV – 1000 V, AC Current: 0 to 100 nA – 10 A, DC Current: 0 to 100 nA – 10 A
2	Digital Tachometer	Hand held, battery operated, 5 digit display contact type, 60 to 50000 r.p.m.
3	Four channel Digital Oscilloscope	Bandwidth :200MHz, Power supply:230V ± 10% tolerance,50 Hz AC supply
4	Various Trainer Board for DC and AC Drives	I) 3 phase induction motor for V/f control II) Microcontroller based Slip ring induction motor speed control using Static Kramer Drive III) DC shunt motor speed control using 3 phase fully controlled converter
5	Any one simulation software (Open source software	Scilab/Matlab and Simulink toolbox, CASPOC

12. LEARNING WEBSITE & SOFTWARE

a. http://nptel.iitm.ac.in/video.php?subjectId=108108077
b. http://www.edumedia-sciences.com/en/a575-speed-controler-for-dc-motor
c. http://www.engineeringtv.com/video/Texas-InstrumentsBrushlessDC
d. http://www.scribd.com/doc/6883802/AdjustableSpeedDrivesTutorial
e. SEQUEL (open source)
f. PSIM ORCAD

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs)WITH COURSE OUTCOMES (COs)

SNo	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Select a drive for a particular application based on power rating.	-	2	1	-	-	-	-	-	-	-	1	1
2	Select a drive based on mechanical characteristics for a particular drive application		2	2	-	-	-	-	-	-	-	-	-
3	Operate and maintain solid state drives for speed control of DC machines.	-	-	-	-	-	-	-	-	-	3	-	-
4	Operate & maintain solid state drives for speed control 3 phase induction motor.		3	3	-	-	-	-	-	-	-	-	-
5	Operate & maintain solid state drivesfor speed control of 3 phase Synchronous motor.	-	-	-	3	-	-	-	-	-	-	-	

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	S.R.Bhasme	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS)

(Chairman PBOS)

COURSE TITLE **ELECTRIC TRACTION(ETR)**

COURSE CODE **6E511**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Electrical	Sixth

1. RATIONALE

The country is leading towards the railway electrification metro and monorail system. The diploma engineer is required to know about the electric traction scheme and its latest trends. This course is offered to highlight the current and future trends in traction systems, auxiliary equipment, electric locomotives, control of traction motors and future-trends. After studying this course the diploma engineer will be able to maintain the traction systems, auxiliary equipment, electric locomotives and traction motors.

2. COMPETENCY

At the end of studying this course students will be able to

"Operate and maintain electric traction systems efficiently"

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (OR)	PA (TW)	50
4	-	2	6	80	20	25#	25	
Duration of the Examination (Hrs)				3	1	--	--	

Legends : L-Lecture**; T**-Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment; **OR** – Oral Examination, **PR**-Practical Examination; **TW** - Term Work, # External, @ Internal, ~ Online.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Distinguish different traction systems and latest trends in traction systems.
2. Differentiate services of traction system based on speed time curve.
3. Control different types of traction motors.
4. Identify and use various traction system auxiliaries.
5. Interpret the distribution system of a traction system.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (in cognitive domain only)	Topics and Sub-topics
Unit– I **Traction Systems and Latest Trends**	1a. Compare types of traction systems and their significance. 1b. Select a traction system for a given application.	1.1 Present scenario of Indian Railways – High speed traction, Metro 1.2 Latest trends in traction-Metro, Monorail, Magnetic levitation Vehicle 1.3 Steam, diesel, diesel-electric, Battery and electric traction systems 1.4 General arrangement of D.C, A.C. Single phase, Three Phase, Composite systems 1.5 Choice of traction system - Diesel-Electric or Electric
Unit– II **Mechanics of Train Movement**	2a. Draw the speed time curve related to different traction system. 2b. Solve numerical based on speed time curve. 2c. Calculate specific energy consumption. 2d. State the factors affecting Specific energy consumption.	2.1 Analysis of speed time curves for main line, suburban and urban services 2.2 Simplified speed time curves. 2.3 Relationship between principal quantities in speed time curves 2.4 Requirement of tractive effort 2.5 Specific energy consumption and Factors affecting it.
Unit– III **Traction Motors and Their Control**	3a. State the desirable features of traction motors. 3b.Compare D.C. series motor with D.C. Shunt motor for traction purpose 3c. Compare different traction motors. 3d. Apply various control methods applied to traction motors. 3e. Differentiate between different method of electric braking.	3.1 Features of traction motors. 3.2 Significance of D.C. series motor as traction motor. 3.3 A. C. Traction motors-Single Phase Induction motor, Three Phase Induction motor, Linear Induction Motor 3.4 Comparison between different traction motors 3.5 Series-parallel control 3.6 Open circuit, Shunt and bridge transition 3.7 Pulse Width Modulation control of Induction Motors. 3.8 Types of electric braking system.

Unit – IV **Electric Locomotives and Auxiliary Equipment**	4a. Classify electric locomotive. 4b. Compare different current collecting equipment. 4c. Identify different control and auxiliary equipment used in the locomotive.	4.1 Important features of electric locomotives. 4.2 Different types of locomotives 4.3 Current collecting equipment 4.3.1Trolley Collector 4.3.2 Bow Collector 4.3.3Pantograph Collector 4.4 Coach wiring and lighting devices 4.5 Power conversion and transmission systems 4.6 Control and auxiliary equipment.
Unit – V **Feeding and Distribution System.**	5a. Classify traction substations. 5b. Compare different methods of feeding the traction sub- station.	5.1 Distribution systems pertaining to traction (distributions and feeders) 5.2 Traction sub-station requirements and selection 5.3 Method of feeding the traction sub-station

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Teaching Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL
1	Traction Systems and Latest Trends	07	04	06	00	10
2	Mechanics of Train Movement	15	04	06	08	18
3	Traction Motors and Their Control	20	06	08	10	24
4	Electric Locomotives and Auxiliary equipment	16	06	06	08	20
5	Feeding and Distribution System	06	02	02	04	08
	TOTAL	64	22	28	30	80

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	1	Investigate the various traction systems in Indian railways.	4
2	1	Prepare a report on various latest trends in electric traction systems.	2
3	2	Solve numerical on speed time curves.	2
4	2	Solve numerical on specific energy consumption.	2
5	3	Calculate energy saving by series parallel control of D. C. Motor (for two and four motors).	2
6	3	Justify the use of D. C. Series motor as traction motor.	2
7	3	Investigate the energy recovered using regenerative braking.	2
8	4	Prepare a report on train lighting system.	2
9	4	Study of layout of D. C. locomotive and diesel locomotive.	2
10	4	Study of power diagram of A.C. locomotive and its equipment.	2
11	5	Study of major equipments in AC traction substations.	2
12	6	Use electronic control of traction motor.	2
13	6	Study the working of high speed train. (With the help of Animation)	2
Total (All practical's are compulsory)			28

8. SUGGESTED STUDENTS ACTIVITIES

Other than class room and laboratory activities following are the suggested guided co-curricular student's activities which need to be undertaken to facilitate the attainment of various course outcomes of this course. The students are required to maintain portfolio of their experiences which he/ she will submit at the end of the term.

a. Prepare charts for construction of various Traction Motors and Their Control
b. Prepare a report on current collector of bow and pantograph type current collector, showing complete arrangements of Pantograph its location and electric wiring system with locomotive.
c. Guided Visit a electric-traction substation
d. Prepare a report after visiting an electric-traction substation

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Expert Lecture

b. Field Visit

10. SUGGESTED LEARNING RESOURCE

S.No.	Name of Book	Author	Publication
1	Modern Electric Traction	H. Partab	Dhanpat Rai and Sons, New Delhi
2	Electric Traction	J. Upadhyay S. N. Mahendra	Allied Publishers Ltd., Dhanpat Rai and Sons, New Delhi
3	Electric Traction	A.T. Dover	Mac millan, Dhanpat Rai and Sons, New Delhi
4	Electric Traction Hand Book	R. B. Brooks.	Sir Isaac Pitman and sons ltd. London.

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED :

S. No.	Name of equipment	Brief specification
1.	DC Series Motor, Three Phase Induction Motor	As per electrical industry specification
2.	Electric drive panel for DC Series and Induction motor showing different types of electric braking	As per electrical industry specification

12. LEARNING WEBSITE & SOFTWARE

a. http://www.irieen.com (Indian Railways Institute of Electrical Engineering, Nasik Road)
b. http://www.wr.railnet.gov.in/bctweb/ELECTRICAL.htm
c. http://www.scrailway.gov.in
d. http://www.railway-technical.com/etracp.shtml
e. http://www.irfca.org/faq/faq-elec.html
f. http://en.wikipedia.org/wiki/Railway_electrification_system
g. http://en.wikipedia.org/wiki/Traction_substation
h. http://www.irfca.org/faq/faq-elec2.html
i. http://en.wikipedia.org/wiki/Electric_locomotive
j. http://www.irfca.org/faq/faq-loco2e.html
k. http://www.railway-technical.com/elec-loco-bloc.shtml

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

SNo	Course Outcome	Pos										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Distinguish different traction systems and latest trends in traction systems.	-	2	-	-	-	-	-	-	-	-	-	1
2	Differentiate services of traction system based on speed time curve.	-	3	-	-	-	-	-	-	-	-	-	-
3	Control different types of traction motors.	-	3	-	-	-	-	-	-	-	-	3	-
4	Identify and use various traction system auxiliaries.	-	3	-	-	-	-	-	-	-	-	1	2
5	Interpret the distribution system of a traction system.	-	2	-	-	-	-	-	-	-	-	-	2

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	S. G. Shaha	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad
2	P. M. Raut	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **INDUSTRIAL AUTOMATION(INA)**

COURSE CODE **6E512**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Electrical	Sixth

1. RATIONALE

To ensure trouble free working of industrial System and to deal with day-to-day Operations control and maintenance of various controllers used in industrial automated system it is necessary to be well conversant with the various technical aspects of commonly used control components and control actions in respect of their working and performance. With the basic knowledge of industrial control components, student will be able to implement innovative ideas of automation and application of PLC wherever necessary.

2. COMPETENCY

At the end of studying this course students will be able to

"Supervise various operations and implement innovative ideas of Industrial Automation system."

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (OR)	PA (TW)	150
4	-	2	6	80	20	25#	25	
Duration of the Examination (Hrs)				3	1	--	--	

Legends : L-Lecture**; T**-Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C**- Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment; **OR** – Oral Examination, **PR**-Practical Examination; **TW** - Term Work, # External, @ Internal, ~ Online.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Identify various industrial control components and analyze its working.
2. Design simple schemes for control by using principles of machine control.
3. Analyze the working of basic control actions (viz. ON-OFF, P+I+D).
4. Use of PLC for implementing simple industrial control applications.
5. Analyze the different types of controller.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (in cognitive domain only)	Topics and Sub-topics
Unit– I Industrial Control Components	1a.Use input devices such as push button, limit switches etc. in industrial machine control 1b.Use output devices such as relays, contactors, solenoid valves etc. as 1c.Differentiate 2 wire & 3 wire controls 1d.Differentiate power and control wiring	1.1 Input devices (Basic working and schematic diagrams with functions) 1.1.1 Definition of control devices such as Push buttons, selector switches. 1.1.2 Solenoid valves, Limit switches and its types 1.1.3 Pressure, temperature, flow, float actuated switches 1.1.4 Reed switches, photoelectric, hall effect, inductive, capacitive proximity switches 1.1.5 Two wire and three wire control. 1.2 Output devices, Actuators (Basic working and schematic diagrams with function) 1.2.1 Concepts of NO/NC contacts 1.2.2 Electromagnetic Relays, contactors and their ratings, 1.2.3 Solid state Relays 1.2.4 Latching Relays, Bimetallic Thermal Over-load Relay, Time Delay Relays (Timers), Electronic Overload Relay 1.2.5 Pneumatic cylinders 1.2.6 Concepts of Power and control wiring diagrams, main and auxiliary Contacts. 1.2.7 Interlocking of contactor circuits using push buttons, NC contacts and Limit switches. 1.3 Schematic of symbols used in industrial control circuits.

Unit– II Industrial Machine Power and Control Circuits (contactor based)	2a. Prepare power and control circuit diagrams for starters of induction Motors and describe briefly the working. 2b. Prepare power and control circuit diagrams for double winding motors and describe briefly the working. 2c. Prepare plugging and braking circuits (control and power) for 3 phase induction motors and describe briefly the working. 2d. Identify applications for servo motors.	2.1 DOL starters for 3 phase induction motors 2.1.1 Power and control circuit diagrams of forward- stop- reverse type. 2.1.2 Power and control circuit diagrams of forward and random reversing type. 2.2 Star delta starters & Auto transformer starters for 3 phase induction motors. 2.2.1 Power and control circuit diagrams of semi automatic type. 2.2.2 Power and control circuit diagrams of automatic type using timer 2.2.3 Power and control circuit diagrams for motors using autotransformer type starters 2.3 Starters for slip ring induction motors 2.3.1 Power and control circuit diagrams for Definite Time Limit Starter 2.3.2 Power and control circuit diagrams for Current Limit Acceleration Starter. 2.3.3 Power and control circuit diagrams for Secondary Frequency acceleration Starter 2.4 Plugging and dynamic braking of Induction motors 2.4.1 Control and power circuits for simple plugging of motor 2.4.2 Dynamic Braking - D.C. injection braking power & control diagrams 2.5 Introduction to AC/DC Servo motors 2.5.1 Basics of construction of servo motors 2.5.2 Principle of working 2.5.3 Application areas in brief
Unit– III Introduction to PLC	3a. Draw generalized block diagram of a PLC 3b. Draw simple block diagrams & state functions of different I/O modules. 3c. Know types and use of Memory in the PLC.	3.1 Introduction to PLC 3.1.1 Block diagram and working of Programmable Logic Controller 3.1.2 PLC Advantages and disadvantages. 3.1.3 Proximity sensors /switches; inductive and capacitive types: description with simple block diagrams; areas of applications. 3.1.4 Opto-isolators, optical sensors. 3.2 PLC modules 3.2.1 Digital I/O Modules and their ratings 3.2.2 Analog I/O Modules and their ratings 3.2.3 Timer/counter Modules

		3.2.4 Memory: ROM: types (Mask ROM, PROM, EPROM, EEPROM) and RAM. 3.2.5 Functions of the above memory units. 3.2.6 PLC power supplies block diagram and function of each block.
Unit – IV Basic Components of PLC.	4a. Draw ladder diagrams for simple logic operations 4b. Use timers, counters in ladder diagrams 4c. Draw ladder diagrams for induction motor starters.	4.1 Ladder diagrams 4.1.1 Typical PLC inputs. 4.1.2 Typical PLC Outputs. 4.1.3 One contact, one coil circuit 4.1.4 Standard start-stop-seal circuit 4.1.5 Ladder diagrams for simple logic operations(NOT, AND, OR, EXOR) 4.1.6 On delay timer, off delay timer 4.1.7 Ladder diagrams for DOL, Star-delta (automatic) starters. 4.1.8 Up and down counter
Unit – V Control Actions	5a. Describe in brief different control actions with their merits.	5.1 Process control actions (block diagrams with very brief functioning descriptions) 5.1.1 Proportional Controllers 5.1.2 Integral Controllers 5.1.3 Proportional-Integral Controllers 5.1.4 Derivative Controllers 5.1.5Proportional-Integral-Derivative Controllers

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Teaching Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL
1	Industrial Control Components	10	5	5	10	20
2	Industrial Machine Power and Control Circuits (contactor based)	12	4	6	10	20
3	Introduction to PLC	10	4	6	5	15
4	Basic Components of PLC.	12	5	5	5	15
5	Control Actions	10	4	4	2	10
	TOTAL	54	22	26	32	80

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	1	Draw Symbols used in electromagnetic control circuit diagrams.	02
2	2	Construction & Operation of contactors.	02
3	1	Operation of different types of switches, relays used in motor control circuits (pushbuttons, limit switches, relays with at least 2 NO and 01 NC contacts)	04
4	2	Operation of Direct-On-Line (DOL) starter (connections: power and control diagrams)	02
5	2	Operation of Direct-On-Line (DOL) starter with Reversing Control (connections: power and control diagrams)	02
6	2	Semi-automatic & Fully Automatic Star-Delta Starter. (connections: power and control diagrams)	04
7	2	Operations of motor control circuit of an electric oven (if available) else trace simple power& control circuits of available equipment in workshop or elsewhere in institute.	04
8	3,4	Components of PLC: draw symbolic representation of at least 20 components used to create ladder diagrams.	04
9	3,4	Create ladder diagrams for simple process - machine systems in presence of teacher in the laboratory (any three)	04
Total (All practical's are compulsory)			28

8. SUGGESTED STUDENTS ACTIVITIES

Other than class room and laboratory activities following are the suggested guided co-curricular student's activities which need to be undertaken to facilitate the attainment of various course outcomes of this course. The students are required to maintain portfolio of their experiences which he/ she will submit at the end of the term.

a. Prepare simple control circuit by using different control components.
b. Prepare a internet survey report for different PLC available for applications
c. Prepare a chart showing different input and output devices.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Expert Lecture
b. Online Learning

10. SUGGESTED LEARNING RESOURCE

S.No.	Name of Book	Author	Publication
1	Handbook of Electric Motor Controls	Eshwar U. S.	Tata McGraw Hill
2	Control of Electrical Machines	Bhattacharya &Singh	New Age International Publishers
3	Programmable Logic Controllers principles and applications	Webb & Reis	Prentice Hall India
4	Industrial electronics and control (including Programmable Logic Controller) [3rd edition only, not earlier one]	Biswanath Paul	Prentice Hall India
5	Programmable Controllers Theory and Implementation	Bryan & Bryan	An Industrial Text Company Publication
6	Handbook of Electric Motor Controls	Eshwar U. S.	Tata McGraw Hill

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED :

S. No.	Name of equipment	Brief specification
1.	Contactors, Relays, Different Switches	As Per Electrical Industry Specifications
2.	D.O.L Starters, Automatic star-delta starter	As Per Electrical Industry Specifications
4	PLC Trainer's Kit	As Per Electrical Industry Specifications

12. LEARNING WEBSITE & SOFTWARE

a. https://en.wikipedia.org/wiki/Automation
b. https://www.electrical4u.com/industrial-automation/

c. http://nptel.ac.in/courses/108105062/
d. https://en.wikipedia.org/wiki/Programmable_logic_controller
e. https://www.engineersgarage.com/articles/plc-programmable-logic-controller

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

SNo	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Identify various industrial control components and analyze it's working.	-	3	-	-	-	-	-	-	-	-	2	-
2	Design simple schemes for control by using principles of machine control	-	3	-	-	-	-	-	-	-	-	2	-
3	Analyze the working of basic control actions (viz. ON-OFF, P+I+D).	-	3	-	2	-	-	-	-	-	-	-	-
4	Use of PLC for implementing simple industrial control applications.	-	3	-	2	-	-	-	-	-	-	1	-
5	Analyze the different types of controller.	-	3	-	2	-	-	-	-	-	-	-	-

Course Curriculum Design Committee

Sr No	Name of the Faculty members	Designation and Institute
1	P. M. Raut	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **INDUSTRIAL SAFETY(INS)**

COURSE CODE **6E513**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Electrical	Sixth

1. RATIONALE

A safety to human being working in industries / on site etc. is must hence various protective devices are provided to safeguard them from the hazards. The safety acts and regulations are prepared and are imposed on the Industries to follow the rules. This course deals with the various industrial hazards and precautions to avoid them and develop the attitudes and abilities to use / provide the Protective devices and educate the various acts to the technicians. This course is being introduced at diversified level.

2. COMPETENCY

At the end of studying this course students will be able to

"Apply various safety practices used in industries."

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (OR)	PA (TW)	150
4	-	2	6	80	20	25#	25	
Duration of the Examination (Hrs)				--	--	--	--	

Legends : L-Lecture**; T-**Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment; **OR** – Oral Examination, **PR**-Practical Examination; **TW** - Term Work, # External, @ Internal, ~ Online.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Analyse the various safety practices used in the industries.

2. Select various factory acts and implement in industry.
3. Use various safety devices for safety purpose.
4. Develop good house keeping practices in the industry.
5. Compute consequences of industrial accidents and reporting procedure.
6. Develop the awareness of health and environment at work place.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (in cognitive domain only)	Topics and Sub-topics
Unit– I Safety in m/c operation and guarding	1a. Use Safety precaution during working of different machines. 1b. List of Periodic checks. 1c. Apply the concept of preventive maintenance	1.1 Principle of m/c guarding, types of guards their design and selection. Guarding of different types of machinery, built in safety devices, maintenance and repair of guards. 1.2 Safety in the use of turning, boring, milling, shaping, planning, grinding, power pressing and forging. Preventive maintenance, periodic checks for safe operations.
Unit– II Plant design, housekeeping and tools	2a. Coordinate preventive maintenance and housekeeping. 2b. Use of color code in housekeeping 2c. Apply Skills of prevention and control of accidents.	2.1 Role of preventive maintenance in plant design &housekeeping. Typical accidents due to poor housekeeping.Use of colour as an aid for good housekeeping. Importance standards& codes of practice for plant and equipment. Inspections and checklist. Benefits of good housekeeping. Marking of aisles space and other locations. 2.2 Main causes of accidents. Detectable causes of tool failure,safe use of various types of hand tools used for uttingoperation, prevention and control of accidents.
Unit– III Industrial lighting, ventilation and noise	3a. List of national standards for good ventilation heat regulation. 3b. Evaluate the effect of noise on the human being and control.	3.1 Purpose of lighting and good illumination. Phenomena of lighting safety & principles. Principles of good illumination. Maintenance, standards relating to lighting and color. 3.2 Purpose of ventilation and heat regulation. National Standards for of practice for industrial ventilation. 3.3 The effect of noise on human being Measurement and

		Evaluation of noise. Practical aspects of control of noise.
Unit – IV Electrical hazards	4a.Select criteria for use of electrical equipments in hazardous atmosphere	4.1 Hazards of Electrical energy safe limits of voltage, amperage and distance from lines. Overload & short circuits protection. Earthing standards, protection against voltage fluctuation, Types of protection for electrical equipment in hazardous Atmosphere. Classification and criteria for the selection, Installation, maintenance and use.
Unit – V Material handing safety	5a. Apply the concept of material handling. 5b. Apply maintenance required for industrial handling machines.	5.1 Safe working load for all mechanical material handling equipment's, Safety in design and construction, operation inspection and maintenance of industrial truck, cranes and conveyors, safe use of accessories for manual handling of Material.
Unit – VI Safety health and environment Management	6a. State importance of occupational health and safety 6b. Form industrial waste management committee.	6.1 Principles of safety management, Industry safety committee, structure and function Bureau of Indian standards on safety and health. ILO and EPA standards. Human factors contributing to accidents. Status and future goal of computer utilization in safety health and environment services in industries, B B S analysis occupational Health & Safety 6.2 Industrial waste Management 6.3 Safety of Hazardous Material 6.4 ISO 14000

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Teaching Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL
1	Safety in machine operation and guarding	16	04	06	06	16
2	Plan Design,Houskeeping and Tools	08	02	03	03	08
3	Industrial Lighting, Ventilation and Noise	08	02	05	05	12
4	Electrical Hazards	08	02	05	05	12
5	Material handling Safety	08	02	05	05	12
6	Safety health and environment Management	16	04	08	08	20
Total		64	16	32	32	80

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	1	Prepare a report after visiting Automobile Industry	08
2	2	Prepare a report after visiting Textile Industry	08
3	3	Prepare a report after visiting Chemical Industry	08
4	4	Prepare a report after attending seminar on Industrial Safety	06
5	5	Prepare a report after attending Expert lecture on industrial safety.	02
Total (All practical's are compulsory)			32

8. SUGGESTED STUDENTS ACTIVITIES

Other than class room and laboratory activities following are the suggested guided co-curricular students activities which need to be undertaken to facilitate the attainment of various course outcomes of this course. The students are required to maintain portfolio of their experiences which he/ she will submit at the end of the term.

a. Industrial survey for understanding the safety norms.
b. Poster exhibition by students for acknowledgement of safety.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Demonstration method
b. Activity based learning
c. Field Visit
d. Expert lecture.

10. SUGGESTED LEARNING RESOURCE

S.No.	Name of Book	Author	Publication
1	Industrial Safety & Environment	Amitkumar Gupta	Laxmi Publication
2	Industrial safety, Health & Environment Management Systems	R. K. Jain & Sunil S. Rao	Khanna Publication
3	Electrical Safety	Dr. Nagpal	Standard Publishers
4	National Electrical Code 2002 Handbook	National Fire Prevention Association (NFPA)	Delmar Thomson Learning
5	Industrial Organization & Management	Dr. O. P. Khanna	S. Chand Co.

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED :

Not Applicable

12. LEARNING WEBSITE & SOFTWARE

a. https://www.wshc/macine_2015
b. http://ehs.unl.edu/sop/sgen_machine
c. https://www.planndesign.com/collection
d. https://www.osha.gov/grant_materials
e. https://www.platinumelectricians.com.au
f. https://www.safetyinfo.com/material handling

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

SNo	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Analyse the various safety practices used in the industries.	-	3	-	-	-	-	-	-	-	-	-	-
2	Select various factory acts and implement in industry.	-	-	2	-	-	-	-	-	-	2	-	-
3	Use various safety devices for safety purpose.	-	1	1	-	1	-	-	-	-	-	-	-
4	Develop good house keeping practices in the industry.	-	-	-	-	-	-	-	-	-	3	-	-
5	Compute consequences of industrial accidents and reporting procedure.	-	-	-	-	-	-	-	2	-	-	-	-
6	Develop the awareness of health and environment at work place.	-	-	-	-	-	2	2	2	-	1	-	-

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	B.S.Sanap	Lecturer in Electrical Engineering, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)