

S.N	Course Code	Course Title	Course Type	Total IKS Hrs for Sem	Learning scheme					Credits	Assessment Scheme															Total Marks
					Actual Contact Hrs/Week			Self Learning (TW+ Assignment)	Notional Learning Hrs/Week		Paper Duration (Hrs)	Theory						Based on LL & TL				Based on Self Learning				
																		Practical								
					CL	TL	LL					FA TH		SA TH		Total		FA-PR		SA-PR		SLA				
												T1	T2		Min	Max	Min	Max	Max	Min	PR	OR	Min	Max	Min	
Max	Max	Max	n	Max	Min	Max	Min	Max	Min	PR	OR	Min	Max	Min												
1	SC23502	Engg. Mathematics	AEC	1	3	2	-	1	6	3	2.30	20	20	60	10	100	40	25	10	-	-	-	25	10	150	
2	SC23108	Applied Chemistry	DSC	2	3	-	2	1	6	3	2.30	20	20	60	10	100	40	25	10	25#	-	10	25	10	175	
3	EC 23110	Elements of Electronics Engg.	DSC	2	4	-	2	2	8	4	2.30	20	20	60	10	100	40	25	10	25#	-	10	25	10	175	
4	EE 23601	Electrical Material & Wiring	SEC	1	2	-	4	2	8	4		-	-	-	-	-	-	50	20		50#	20	25	10	125	
5	EE23103	Electrical Power Generation	DSC	2	4	-	-	2	6	3	2.30	20	20	60	10	100	40						25	10	125	
6	EE 23301	Environmental Studies	VEC	1	-	-	2		2	1		-	-	-	-	-	-	25	10	-	25@	10			50	
7	EE 23602	Computer Aided Electrical Drawing	SEC	-	-	-	2	2	4	2	-	-	-	-	-	-	-	-	-	50	-	20	50	20	100	
		Total		9	17	4	8	10	40	20	4	80	80	240	40	400		150		100	75	-	175		900	
Abbreviations : CL- Classroom Learning , TL- Tutorial Learning , LL- Laboratory Learning , FA - Formative Assessment , SA- Summative Assessment , TW- Tutorial Work , Assignment																										

Abbreviations : CL- Classroom Learning , TL- Tutorial Learning, LL-Laboratory Learning, FA - Formative Assessment , SA -Summative Assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends : @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination

Note :1. FA-TH represents two class tests of 20 marks each conducted during the semester.

2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.

3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.

4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 16 Weeks

5. 1 credit is equivalent to 30 Notional hrs.

6. * Self learning hours shall not be reflected in the Time Table.

7. Students must secure a minimum of 40 marks out of 100 for passing the course. It shall be mandatory to obtain a minimum of 10 marks out of 60 in the End Term Theory Examination separately.

Course Category : Discipline Specific Course Core (DSC) : 2, Discipline Specific Elective (DSE) : 0, Value Education Course (VEC) : 1, Intern./Apprenti./Project./Community (INP) : 0, Ability Enhancement Course (AEC) : 2, Skill Enhancement Course (SEC) : 2, Interdisciplinary Elective (IDE) : 0

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CDC Co-ordinator
G. P. Mumbai

Department coordinator
Curriculum Development, Dept. of Electrical Engg

Head of Department
Dept. of Electrical Engg

In charge
Curriculum Development Cell

Principal
Govt. Polytechnic, Mumbai

Programme : Diploma in EE / EC / IS / CE / ME / CO / IF/AI & ML / RT													
Course Code: SC23502						Course Title : ENGINEERING MATHEMATICS							
Compulsory / Optional: Compulsory													
Learning Scheme and Credits						Assessment Scheme							
CL	TL	LL	SLH	NLH	Credits	FA-TH		SA-TH (2Hrs.30 Min)	FA-PR	SA		SLA	Total
						T1	T2			PR	OR		
3	2	--	1	6	3	20	20	60	25	--	--	25	150

Total IKS Hrs. for course: 01 Hrs

Abbreviations: CL- ClassRoom Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, SLA- Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @\$ Internal Online Examination

Note:

1. FA-TH represents Total of two class tests of 20 marks each conducted during the term.
2. FA-PR represents Tutorial Term work of 25 Marks
3. SLA represents self learning Assessment of 25 Marks
4. SA-TH represents the end term examination of 60 Marks

I. Rationale

An Engineering Mathematics course, covering integration, definite integration, differential equations, numerical methods, and probability distribution, equips engineering students with essential problem-solving tools. It enables them to model and analyze complex systems, make informed decisions and address real-world engineering challenges effectively.

II. Industry / Employer Expected Outcome

Engineers applying Mathematics should proficiently solve complex real-world problems, enhancing decision-making, design and innovation with precision and efficiency.

III. Course Outcomes: Students will be able to achieve & demonstrate the following COs on completion of course based learning.

CO1	Solve the broad-based engineering problems of integration using suitable methods.
CO2	Use integration to find area, volume, mean value and root mean square value for given engineering related problems.
CO3	Apply the differential equation to find the solutions of given programme specific problems.
CO4	Apply numerical methods to solve programme specific problems.
CO5	Use probability distributions to solve elementary engineering problems.

Course Content Details:

Unit No.	Theory Learning Outcomes (TLO's) aligned to CO's.	Topics / Sub-topics
1	TLO 1.1 Solve the given simple problem(s) based on rules of integration. TLO 1.2 Evaluate the given simple integral(s) using substitution method. TLO 1.3 Integrate given simple functions using the integration by parts. TLO 1.4 Solve the given simple integral by partial fractions.	Unit-I Indefinite Integration 1.1 Simple Integration: Rules of integration and integration of 1.2 standard functions 1.3 Integration by substitution. 1.4 Integration by parts. 1.5 Integration by partial fractions
Course Outcome : CO1		Teaching Hours : 9
		Marks: 10
2	TLO 2.1 Solve given examples based on definite Integration. TLO 2.2 Use properties of definite integration to solve given problems. TLO 2.3 Utilize the concept of definite integration to find the following (a) Area under the curve (b) Area between given two curves (c) Volume of revolution (d) Mean value (e) Root mean square value	Unit- II Definite Integration and Applications 2.1 Definite Integration: Definition, rules of definite integration with simple examples 2.2 Properties of definite integral (without proof) and simple examples. 2.3 Applications of integration: area under the curve, area between given two curves, volume of revolution, mean value and root mean square value.
Course Outcome : CO2		Teaching Hours : 10
		Marks: 14
3	TLO 3.1 Find the order and degree of given Differential equations. TLO 3.2 Form simple differential equation for given elementary engineering problems. TLO 3.3 Solve given differential equations using the methods of Variable separable and Exact Differential Equation (Introduce the concept of partial differential equation). TLO 3.4 Solve given Linear Differential Equation. TLO 3.5 Solve given programme specific problems using the category of differential equation.	Unit-III Differential Equation 3.1 Concept of Differential Equation. 3.2 Order, degree and formation of Differential equations 3.3 Methods of solving differential equations: Variable separable form, Homogeneous D.E., Exact Differential Equation, Linear Differential Equation 3.4 Application of differential equations and related engineering problem(s).
Course Outcome : CO3		Teaching Hours : 10
		Marks: 14

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Engineering Mathematics(SC23502)

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P-23scheme

4 TLO 4.1 Find roots of algebraic equations by using appropriate methods. TLO 4.2 Solve the system of equations in three unknowns by using given methods. TLO 4.3 Apply the concept of numerical integration to solve given engineering problems. TLO 4.4 Solve problems using Yuktibhāṣa iterative methods for finding approximate square root. (IKS) Course Outcome : CO4	Unit-IV: Numerical Methods and Numerical Integrations 4.1 Solution of algebraic equations: Bisection method, Regula falsi method and Newton—Raphson method. 4.2 Solution of simultaneous equations containing three Unknowns by Gauss elimination method. 4.3 Solution of simultaneous equations containing three Unknowns by iterative methods: Gauss Seidal and Jacobi's method. 4.4 Numerical Integration: Trapezoidal rule, Simpson's 1/3rd rule, Simpson's 3/8 th rule. (Without proof) 4.5 Yuktibhāṣa iterative methods for finding approximate square root. (IKS) Teaching Hours : 8 Marks: 12
5 TLO 5.1 Solve given problems based on repeated trials using Binomial distribution. TLO 5.2 Solve given problems when number of trials are large and probability is very small. TLO 5.3 Utilize the concept of normal distribution to solve related engineering problems. Course Outcome : CO5	Unit-V: Probability Distribution 5.1 Binomial distribution. 5.2 Poisson's distribution. 5.3 Normal distribution. Teaching Hours : 8 Marks: 10

IV. Laboratory Learning Outcome and Aligned Practical / Tutorial Experiences.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO1.1 Solve simple problems of Integration by substitution	1	Integration by substitution	2	CO1
LLO2.1 Solve integration using by parts	2	Integration by parts	2	CO1
LLO3.1 Solve integration by Partial fractions	3	Integration by partial fractions.	2	CO1
LLO4.1 Solve examples on Definite Integral Based on given methods.	4	Definite Integral based on given methods.	2	CO2
LLO5.1 Solve problems on properties of Definite integral.	5	Properties of definite integral	2	CO2
LLO6.1 Solve given problems for finding The area under the curve, area between two curves and volume of revolution.	6	Area under the curve, area between two curves and volume of revolution.	2	CO2
LLO7.1 Solve examples on mean value and Root mean square value.	7	Mean value and root mean square value.	2	CO2

LLO8.1 Solve examples on order, degree And formation of differential equation.	8	Order, degree and formation of differential equation.	2	CO3
LLO9.1 Solve first order first degree D.E. Using variable separable method and homogeneous method.	9	Variable separable method and homogeneous method.	2	CO3
LLO10.1 Solve first order first degree D.E. Using exact differential equation and linear differential equation.	10	Exact differential equation and linear differential equation.	2	CO3
LLO11.1 Solve engineering application Problems using differential equation.	11	Applications of differential equations.	2	CO3
LLO12.1 Solve problems on Bisection Method and Regula falsi method.	12	Bisection Method and Regula Falsi Method	2	CO4
LLO13.1 Solve problems on Newton-Raphson method and Gauss elimination method.	13	Newton-Raphson method and Gauss elimination method.	2	CO4
LLO14.1 Solve problems on Jacobi's method and Gauss Seidal Method.	14	Jacobi's method and Gauss Seidal Method.	2	CO4
LLO 15.1 Solve examples on Trapezoidal rule, Simpson's 1/3rd rule and Simpson's 3/8 th rule.	15	Trapezoidal rule, Simpson's 1/3rd rule And Simpson's 3/8th rule.	2	CO4
LLO16.1 Solve problems on Bisection method, Regula falsi method, Newton- Raphson method using spread sheet .	16	Bisection method, Regula falsi method, Newton-Raphson method problems using spreadsheet.	2	CO4
LLO17.1 Use Yukti bhasa iterative methods For finding approximate value of square root and cube root. (IKS)	17	Yukti bhasa iterative methods for Finding approximate value of square root and cube root. (IKS)	2	CO4
LLO18.1 Solve engineering problems using Binomial distribution.	18	Binomial Distribution	2	CO5
LLO19.1 Solve engineering problems using Poisson distribution.	19	Poisson Distribution	2	CO5
LLO20.1 Solve engineering problems using Binomial distribution.	20	Normal Distribution	2	CO5

Note: 1. Take any 10-12 tutorials out of 20 and ensured that all the units are covered. 2. Take tutorial in the batch size of 20 to 30 students. 3. Give students at least 10 problems to solve in each tutorial.

Suggested Micro Project / Assignment/ Activities for Specific Learning / Skills Development (Self Learning):

- Choose a real world problem and formulate a differential equation to model it.
- Solve the formulated differential equation and interpret the solution in the context of the problem
- Collect examples based on real world applications of Integration
- Collect examples based on real world applications of Definite Integration

- Consider a fair six-sided die. Define a discrete random variable X as the number obtained when rolling the die. Construct the probability distribution table for X
 - Collect examples based on real world applications of Newton Raphson Method.
 - Collect examples based on real world applications of Binomial Distribution.
 - Collect examples based on real world applications of Poisson Distribution.
 - Collect examples based on real world applications of Normal Distribution.
 - Collect examples based on real world applications of Differential Equations
 - Collect examples based on real world applications of Gauss Seidal Method.
 - Collect examples based on real world applications of Gauss Jacobi's Method
- Attempt any 5-7 Assignment, out of the given list

V. Specification Table:

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Indefinite Integration	2	4	4	10
2	Definite Integration and Applications	2	4	8	14
3	Differential Equation	2	4	8	14
4	Numerical Methods and Numerical Integrations	2	4	6	12
5	Probability Distribution	2	4	4	10
Total		10	20	30	60

VI. Assessment Methodologies/Tools**Formative assessment (Assessment for Learning)**

- TH- Progressive /Periodic Test test each of 20 Marks
- TL - Continuous Assessment of Tutorials for 25 Marks
- SL - Continuous Assessment of Self Learning for 25 Marks

Summative Assessment (Assessment of Learning)

- TH - Term End examination of 60 Marks

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	1		-	1		1			
CO2	3	1			1		1			

CO3	3	2	1	1	1	1	1			
CO4	2	3	2	2	1	1	1			
CO5	2	2	1	1	2	1	2			

Legends: - High:03, Medium:02, Low:01, No Mapping: --

VII. Suggested Learning Materials / Books

Sr.No	Author	Title	Publisher
1	Grewal B.S.	Higher Engineering Mathematics	Khanna publication New Delhi, 2013 ISBN: 8174091955
2	Dutta. D	A text book of Engineering Mathematics	New age publication New Delhi, 2006 ISBN: 978-81-224-1689-3
3	Kreyszig, Ervin	Advance Engineering Mathematics	Wiley publication New Delhi 2016 ISBN: 978-81-265-5423-2
4	Das H.K.	Advance Engineering Mathematics	S Chand publication New Delhi 2008 ISBN: 9788121903455
5	S.S. Sastry	Introductory Methods of Numerical Analysis	PHI Learning Private Limited, New Delhi. ISBN-978-81-203-4592-8
6	C.S. Seshadri	Studies in the History of Indian Mathematics	Hindustan Book Agency (India) P19 Green Park Extension New Delhi. ISBN 978-93- 80250-06-9
7	Marvin L. Bittinger David J.E. Tenenbaum Scott A. Sargent	Calculus and Its Applications	Addison-Wesley 10th Edition ISBN-13: 978-0-321-69433-1
8	Gareth James, Daniela Witten, Trevor Hastie Robert and Tibshirani	An Introduction to Statistical Learning with Applications in R	Springer New York Heidelberg Dordrecht London ISBN 978-1-4614-7137-0 ISBN 978-1-4614-7138-7 (eBook)

VIII. Learning Websites & Portals

Sr.No	Link / Portal	Description
1	https://www.wolframalpha.com/	Solving mathematical problems, performing calculations, and visualizing mathematical concepts.
2	http://www.sosmath.com/	Free resources and tutorials
3	http://mathworld.wolfram.com/	Extensive math encyclopedia with detailed explanations of mathematical concepts
4	https://www.mathsisfun.com/	Explanations and interactive lessons covering various math topics, from basic arithmetic to advanced

5	http://tutorial.math.lamar.edu/	Comprehensive set of notes and tutorials covering a wide range of mathematics topics, including calculus
6	https://www.purplemath.com/	Purple math is a great resource for students seeking help with algebra and other foundational math
7	https://www.brilliant.org/	Interactive learning in Mathematics
8	https://www.edx.org/	Offers a variety of courses
9	https://www.coursera.org/	Coursera offers online courses in applied mathematics from universities and institutions around the
10	https://ocw.mit.edu/index.htm	The Massachusetts Institute of Technology (MIT) offers free access to course materials for a wide range

IX. Academic Consultation Committee/Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organization
1	Mr. Santosh Bhandekar	Lecturer in Mathematics	Government Polytechnic, Osmanabad
2	Mr. Abhijit S. Patil	Lecturer in Mathematics	Government Polytechnic, Mumbai
3	Mr. Vinod S. Patil	Lecturer in Mathematics	Government Polytechnic, Mumbai

A/S. Patil
Coordinator,
Curriculum Development,
Department of Electrical Engineering
Science & Humanities

K.P.
I/C, Curriculum Development Cell

Alharab
Head of Department
Department of Electrical Engineering
Science & Humanities

M.
Principal

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K.P.
CDC Co-ordinator
G. P. Mumbai

Programme: Diploma in Electrical Engineering													
Course Code: SC23108						Course Title: Applied Chemistry							
Compulsory / Optional: Compulsory													
Learning Scheme and Credits						Assessment Scheme							
CL	TL	LL	SLH	NLH	Credits	FA-TH		SA-TH (3Hrs.)	FA-PR	SA		SLA	Total
						UT1	UT2			PR	OR		
3	-	2	1	6	3	20	20	60	25	25#	-	25	175

Total IKS Hrs. for course: 2 Hrs.

Abbreviations: CL- Classroom Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, SLA- Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @\$ Internal Online Examination

Note:

1. FA-TH represents an class tests marks each conducted during the term.
2. SA-TH represents the end term examination.

I. Rationale

Diploma engineers have to deal with various materials and equipment. This course is designed with fundamental information to help the diploma engineering students to apply the basic concepts and principles of chemistry to solve broad-based engineering problems. The basic concepts and principles of science related to engineering materials will help in understanding the technology courses where emphasis is on the applications of these in various technology domain applications.

II. Industry / Employer Expected Outcome

This course is to be taught and implemented with the aim to develop in the student, the course outcomes (COs) leading to the attainment of following industry identified outcome expected from this course:

Apply principles of chemistry to solve broad based relevant engineering problems.

III. Course Outcomes: Students will be able to achieve & demonstrate the following COs on completion of course based learning

CO1	Explain the structure, properties and behavior of molecules and compounds based on the types of chemical compound.
CO2	Apply the concepts of electrochemistry in engineering field.
CO3	Explain construction and applications of cells and batteries in engineering field.
CO4	Apply methods of prevention of corrosion for environmental and safety concerns.
CO5	Select suitable Alloy, Lubricants, material for a particular use effectively.

Course Content Details:

Unit No.	Theory Learning Outcomes (TLO)	Topics / Sub-topics
1	TLO1.1 Explain the Indian chemistry TLO1.2 Explain the properties of given material based on the bond formation. TLO 1.3 Describe the molecular structure of given solid, liquid and gases. TLO 1.4 Describe the crystal structure of the given solids and Explain Properties of metallic solid.	Unit-I Atomic Structure and Chemical bonding 1.1 Indian Chemistry: -Philosophy of atom by Acharya Kanad. 1.2 Introduction of atom, Molecules, Fundamental Particles, Proton, Neutron, Electron. Their mass, charge, location. And symbol Bohr's theory, Postulates, Structure of modern atom. Atomic number and atomic mass number. Atomic weight Numerical based on atomic number & atomic mass number. Electronic configuration of element up to 30 elements 1.3 Electronic theory of valency: Assumptions, Chemical bonds: Types and characteristics of electrovalent bond, covalent bond, coordinate bond, hydrogen bond, and metallic bond. 1.4 Molecular arrangement in solid, liquid and gases. Structure of solids: crystalline and amorphous solids Properties of metallic solid, Unit cell: simple cubic, body center cubic (BCC), face center cubic (FCC), hexagonal close pack crystals. Course Outcome: CO1 Teaching Hours:8hrs. Marks: 10
2	TLO 2.1 Explain various terms involved in electrolysis. TLO2.2 Describe mechanism of electrolysis of <chem>CuSO4</chem> solution by using Cu and Pt rods TLO 2.3 Solve numerical based on Faraday's first and second law of electrolysis. TLO2.4 Apply the concept of electrolysis in various uses.	Unit-II Electrochemistry 2.1 Definition of Electrochemistry, Electrolytes: Definition, Types. Differences between Atom and ion. Definition of ionization & electrolytic dissociation, Arrhenius theory, Degree of ionization with factors affecting it. 2.2 Terms related to Electrolysis, Mechanism of electrolysis. Examples of: mechanism of Electrolysis of <chem>CuSO4</chem> by using Cu electrodes. 2.3 Faradays First law and its mathematical derivation. Faradays second law & its mathematical derivation, Numerical based on laws of Faraday. 2.4 Application of Electrolysis: Electroplating, Electro refining. Course Outcome: CO2 Teaching Hours :9 hrs. Marks: 12

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3	TLO 3.1 Explain the terminologies related to cells and batteries. TLO 3.2 Distinguish between primary and secondary cell. TLO 3.3 Describe the construction and working of dry cell and Daniel cell TLO 3.4 Describe the construction and working acid storage cell, Nickel-Cadmium cell.	Unit-III Cells And Batteries 3.1 Conductor: Definition, types (metallic, electrolytic), Difference between them. Ohms law, Charging and discharging of cells, Closed circuit voltage, Open circuit voltage, Electrochemical couple, Separator, Electromotive force (E.M.F) 3.2 Cells: Definition, types (Electrolytic and Electrochemical), difference between them. Classification of Electrochemical cell (primary and Secondary) Definition and Difference between them .Primary cells: Lachlance cell, Drycell, Danielcell 3.3 Secondary cell: Lead acid storage cell or battery, Nickel cadmium cell or battery Lead acid storage battery: construction, working, charging and discharging, electrical characteristics, methods of charging storage batteries, indication of fully charged battery, Maintenance of Lead acid batteries, application of Lead acid storage batteries. Course Outcome: CO3 Teaching Hours :9 hrs. Marks: 12
4	TLO 4.1 Explain the various type of corrosion TLO 4.2 Describe the mechanism of different types of corrosion. TLO 4.3 Identify the different factors affecting rate of corrosion for the given type of material TLO 4.4 Select the protective measures to prevent the corrosion in the given corrosive medium.	Unit-IV Corrosion 4.1 Definition of corrosion. Types of corrosion. Atmospheric & Electrochemical Corrosion. 4.2 Mechanism of atmospheric corrosion, types of oxide film formed, (stable, unstable, volatile, with examples). 4.3 Electrochemical corrosion/immersed corrosion Definition. Example. Factors Affecting, Atmospheric & Electrochemical Corrosion. 4.4 Protection of metals from Corrosion: -By protective coatings a) organic coating (Paints and Varnishes), b) inorganic coating (Metallic Coating). Different methods of Protective metallic coatings. A) Hot dipping (Galvanizing & Tinning) B) Sherardizing C) Metal Spraying Course Outcome: CO4 Teaching Hours :9hrs. Marks: 12

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5	TLO 5.1 Explain purposes and preparation methods of making the given alloy. TLO 5.2 Explain non-engineering material. TLO 5.3 Explain plastic, their types, and its compounding. TLO 5.4 Explain rubber, their types, and synthesis.	Unit-V: Metals and Non metal 6.1 Metals & their characteristics, (hardness, ductility, malleability, toughness, brittleness, tensile strength, weldability, casting, forging, soldering) Definition of alloy: purposes of preparation of Alloy. Preparation of binary alloy by fusion method. Classification of alloy: Ferrous and non-ferrous Alloy 6.2 Non-Metallic: Definition of non-metallic engineering materials 6.3 Plastic: Definition, example Polymerization: definition different Types of Polymerization addition and condensation Addition polymerization: definition formation of polyethylene, Condensation-polymerization: definition and examples, formation of nylon-66 Types of plastic: thermos-softening, thermo-setting plastics, Differences between them. Compounding of plastic, Materials needed for it (pigments, fillers, Plasticizers accelerators etc.), Properties and engineering applications. 6.4 Rubber: Definition of rubber (elastomer). Natural rubber: Basic unit in natural rubber (isoprene), Occurrence & Processing of Latex. Drawbacks of natural Rubber, Vulcanization: Definition. process, Chemical reactions Synthetic rubber: Importance, Example Buna-S, Buna-N, Butyl rubber, Thiokol, Neoprene) Properties of rubber: Elasticity, Tack, Rebound abrasion resistance Uses of rubber Course Outcome: CO5 Marks: 14 Teaching Hours :10 hrs.
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IV. Laboratory Learning Outcome and Aligned Practical / Tutorial Experiences.

Sr No	Laboratory Learning Outcomes	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
1	LLO 1.1 Follow safety rules in chemistry laboratory.	Introduction to chemistry laboratory instruments and glassware	2	CO1
2	LLO 2.1 Identify cation and anion in given ionic solutions by performing selective test	Identification of cation in given ionic solutions. (Cu^{++} , Fe^{++} , Fe^{+++} , Cr^{+++} , Mn^{++} , Ni^{++} , Zn^{++} , Ca^{++} , Ba^{++} , Mg^{++} , NH_4^+)	2	CO1
3	LLO 3.1 Identify cation and anion in given ionic solutions by performing selective test	Identification of anion in given ionic solutions. Cl^- , Br^- , I^- , CO_3 , SO_4 , NO_3	2	CO1
4	LLO 4.1 Prepare solution of copper sulphate of 1N. LLO 4.2 Determine electrochemical equivalent of copper.	Determination of electrochemical equivalent of copper by using Cu - electrodes	2	CO2

5	LLO5.1 Prepare weak acid, weak base and strong acid, strong base. LLO5.2 Calibrate the conductivity meter. LLO5.3 Determine the conductivity of various sample solution.	Determination of conductivity of different electrolytes by using conductivity meter.	2	CO2
6	LLO6.1. Prepare Electrolyte Solution and Setup Daniel Cell. LLO6.2. Determine the voltage generated from chemical reaction of Daniel cell	Determination of the voltage generated from chemical reaction using Daniel Cell.	2	CO3
7	LLO 7.1 Understand the function of component of acid storage cell.	Explain component of acid storage cell, determine the strength of acid used in cell	2	CO3
8	LLO 8.1 Determine the extent of corrosion of iron or aluminum rod in acidic and basic media LLO8.2. Compare the corrosion behavior of Aluminum / Iron in acidic and basic media	Determination of rate of corrosion at different temperatures for Aluminum iron rod in acidic and Basic medium and plot a graph of rate of corrosion.	2	CO4
9	LLO 9.1. Explain acidic and Basic solution. LLO 9.2. Determine pH of given sample solution.	To find out pH of different solutions using Lovi bond comparator, pH paper, pH meter.	2	CO4
10	LLO 10.1. Explain Redox reaction.. LLO 10.1. Determine the percentage of Iron from Hematite ore by Redox titration.	Standardization of KMnO_4 solution using standard oxalic acid and Determine the percentage of iron present in given Hematite ore by KMnO_4 solution	2	CO5
11	LLO 11.1. Explain complexometric titration. LLO 11.1. Determine the percentage of Copper from copper ore.	Determine the percentage of copper in given copper ore.	2	CO5
12	LLO 12.1. Explain Role of Calcium in Cement. LLO 12.2. Determine the percentage of calcium in given cement sample.	Preparation of phenol formaldehyde/ Bakelite plastic	2	CO5

Note: if any

V. Suggested Micro Project / Assignment/ Activities for Specific Learning / Skills Development (Self Learning): Assignment

1. Describe modern atomic structure.
2. Named four quantum numbers and their functions.
3. Write any four postulates of Bohrs atomic theory.
4. Explain covalent bond, ionic bond, coordinate bond, hydrogen bond.
5. Explain Corrosion with suitable example.
6. Demonstrate Mechanism of wet corrosion by waterline corrosion

7. Named the various factors affecting rate of corrosion.
8. Explain galvanizing and tinning.
9. Describe electrochemistry.
10. Explain mechanism of electrochemistry of copper sulphate using active electrode.
11. Explain faradays first and second law of electrolysis with mathematical expression.
12. Describe construction and working of dry cell.
13. Describe construction and working of acid storage cell
14. Distinguish between primary cell and secondary cell.
15. Explain classification of corrosion.
16. Explain various alloys and their application.
17. List various properties of metal
18. Describe plastics.
19. Explain addition and condensation polymer.
20. Describe natural rubber and its constituents.

VI. Specification Table:

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Atomic Structure and Chemical bonding	2	4	4	10
2	Electrochemistry	2	4	6	12
3	Cell and Batteries	2	4	6	12
4	Corrosion	2	4	6	12
5	Engineering Material	4	6	4	14
Total		12	22	26	60

VII. Assessment Methodologies/Tools**Formative assessment (Assessment for Learning)**

- Rubrics for continuous assessment based on process and product related performance indicators (TH 40 marks + 25 PR)
- Two-unit tests of 20 marks of each and total of two-unit tests 40.
- For laboratory learning 25 marks
- End semester assessment of 60 marks through end semester examination.
- Summative Assessment (Assessment of Learning)
- End semester assessment of 25 marks for laboratory learning marks)
- End term examination, Viva-voce, Workshop performance (60 TH + 25 PR marks)

VIII. Suggested COs - POs Matrix Form

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3		1							
CO2	3	1					1	1		
CO3	3						1			
CO4	3		1		1		1	1		
CO5	3		1		1		1	1		1
Legends: - High:03, Medium:02, Low:01, No Mapping: --										

IX. Suggested Learning Materials / Books

Sr.No	Author	Title	Publisher
1	NCERT	NCERT XI and XII text book	NCERT ISBN 81-7450-648-9 (Part I) 81-7450-716-7 (Part II)
2	Jain and Jain	Engineering Chemistry	Dhanpat rai Publishing ISBN New Delhi, 2010, ISBN:8174505083
3	Dr. S. S. Dara, Dr. S.S. Umare	Engineering Chemistry	S. Chand publication 1986, ISBN:978-81-219-0359-2
4	Anju Rawley, Devdatta V. Saraf	Applied Chemistry with Lab Manual	KhannaBookPublishingCo.(P)Ltd.NewDelhi,2021,ISBN-978-93-91505-44-8
5	V. P. Mehta,	Polytechnic Chemistry	Jain Brothers, Delhi ISBN:978-81-8360-093-X

X. Learning Websites & Portals

Sr.No	Link/ Portal	Description
1	www.chem1.com	Chemistry instruction and education
2	www.onlinelibrary.wiley.com	Materials and corrosion
3	www.chemtube3d.com	Atomic structure and engineering material

4	www.chemistryclassroom.com	Chemical bonding
5	www.sciencejoywagon.com/	Electrochemistry
6	www.cheml.com	Chemistry instruction and education
7	www.chemistry.org	Virtual Labs, simulation
8	www.swayam.gov.in	Chemistry for engineer

XI. Academic Consultation Committee/Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organization
1	Mrs. Leena Khadke	Lecturer In Chemistry	Govt. Polytechnic Thane
2	Mrs. Sneha Suvarna	Lecturer In Chemistry	SBM Polytechnic Mumbai
3	Mr. Santosh Mulye	Lecturer In Chemistry	VES Polytechnic Mumbai
4	Mr. Pravin Meshram	Lecturer In Chemistry	Govt. Polytechnic Mumbai

[Signature]
Coordinator,
Curriculum Development,
Department of Science Engineering
& Humanities

[Signature]
I/C, Curriculum Development Cell

[Signature]
Head of Department
Department of _____ Engineering

[Signature]
Principal

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[Signature]
CDC Co-ordinator
G. P. Mumbai

Programme : Diploma in Electrical Engineering (Sandwich Pattern)													
Course Code: EC 23110						Course Title: Elements of Electronics Engineering							
Compulsory / Optional: Compulsory													
Learning Scheme and Credits						Assessment Scheme							
CL	TL	LL	SLH	NLH	Credits	FA-TH		SA-TH (2:30 Hrs.)	FA- PR	SA		SLA	Total
						T1	T2			PR	OR		
4	-	2	2	8	4	20	20	60	25	25#	-	25	175

Total IKS Hrs. for course: 2

Abbreviations: CL- Class Room Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, SLA- Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @\$ Internal Online Examination

Note:

1. FA-TH represents an average of two class tests of 20 marks each conducted during the term.
2. SA-TH represents the end term examination.

I. Rationale

It is necessary for the students of electronics and related branches to study and apply the basic principles, analyze and troubleshoot simple subsystems. To acquire this level of understanding, the basic knowledge of electronic devices and circuits is essential. This course is one of the core subjects which are deals with construction, working principle, application of active components.

II. Industry / Employer Expected Outcome

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

- 1) To know the basic elements of electronics engineering

Identify different types of Diodes and their application.

To understand the working of different types, Transistor fundamentals and its Biasing technique, working of regulated power supply.

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CDC Co-ordinator
G. P. Mumbai

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of Electronics Engineering (EC23110)

P-23 scheme

III. Course Outcomes: Students will be able to achieve & demonstrate the following COs on completion of course based learning

CO 1	Describe the Fundamentals of Diode
CO 2	Identify different types of Diodes and their applications
CO 3	Illustrate the Transistor fundamentals and its Biasing techniques (BJT AND FET)
CO 4	Interpret the working of regulated power supply
CO 5	Interpret the Number system, Combinational circuits

Course Content Details:

Unit No.	Theory Learning Outcomes (TLO)	Topics / Sub-topics
1	TLO1.1 State Different types of Semiconductor and their materials Classify component on the basis of energy band theory and effect of Temperature. TLO1.2 List Different types of Semiconductor and their materials TLO 1.3 Describe Forward and Reverse Biasing of diode TLO 1.4 Draw and explain V-I characteristics of PN junction diode. TLO1.5 State the applications of following diodes: PN junction, Zener, LED, Photodiode.	Topic Title: Semiconductor Diode 1.1 Classification of component on the basis of energy band theory and effect of Temperature. 1.2 Different types of Semiconductor and their materials. P-type and N-type Semiconductors, Symbol, Construction, working principle, Forward and Reverse Biasing, V-I Characteristics and applications of following diodes: PN junction, Zener, LED, Photodiode. Course Outcome: CO 1, CO 2 Teaching Hours : 10 hrs Marks:12(R-4, U-4, A-4)
2	TLO2.1 Enlist Types of rectifier, TLO2.2 Compare half wave rectifier and full wave rectifier with respect to: (i) PIV (ii) Ripple frequency (iii) TUF (iv) Efficiency TLO2.3 State Parameters of rectifier: Average DC value of current and voltage, ripple factor, ripple frequency, PIV of diode, TUF, efficiency. TLO2.4 List Types of Filters. TLO2.5 With the help of circuit diagram and waveform Describe working of Shunt Capacitor, series Inductor, and π filter.	Topic Title: Diode Application 2.1 Types of rectifier : Circuit, waveform and working of Half Wave, Full Wave Rectifier (Bridge and Center tapped). 2.2 Parameters of rectifier: Average DC value of current and voltage, ripple factor, ripple frequency, PIV of diode, TUF, efficiency of rectifier. (Only formulae, No derivation) 2.3 Types of Filters: Waveform and working of Shunt Capacitor, series Inductor, and π filter. Course Outcome: CO2 Teaching Hours: 14 hrs Marks:14(R- 4,U-6,A-4)
3	TLO3.1 Draw symbol of NPN and PNP transistors. TLO3.2 Describe construction and working of PNP and NPN transistors TLO3.3 Explain Working and characteristics of transistors in CE mode. TLO3.4 Compare CB, CE, CC	Topic Title: Transistor Fundamentals 3.1 Construction and working of PNP and NPN transistors. 3.2 Transistor configuration: CB, CE, CC. 3.3 Working and characteristics of transistors in CE mode.

	configuration of BJT with respect to following points: (i) Input impedance (ii) Output impedance (iii) Current gain (iv) Voltage gain TLO3.5 State need of biasing of BJT. List types of biasing.	3.4 BJT Biasing: DC load line, Operating point, stabilization, Concept of thermal runaway. Types of biasing: circuit and analysis of Fixed bias, base bias with Emitter feedback, Voltage divider bias. 3.5 Transistor as Switch and Single stage CE amplifier.(circuit diagram and working) Course Outcome: CO 3 Teaching Hours:12hrs Marks:12 (R- 4,U-8,A-0)
4	TLO4.1 Explain working of FET for given application. TLO 4.2 Explain given type of FET biasing method. TLO4.3 Explain working of given type of MOSFET. TLO 4.4 Differentiate the working principle of FET and MOSFET on basis of transfer characteristics.	Topic Title: Field Effect Transistor 4.1 Symbol, Construction, working and characteristics of JFET (N-channel and P-channel) and MOSFET (Depletion and enhancement Type) 4.2 FET Biasing: Source self bias, Drain to source bias. 4.3 Applications of FET Comparison of FET with BJT. Course Outcome: CO 3 Teaching Hours:08 Marks: 08 (R-4,U-4,A-0)
5	TLO5.1 Define load regulation and line regulation. TLO5.2 Draw circuit of zener diode as a voltage regulator. TLO5.3 Draw block diagram of DC regulated power supply and explain function of each block with waveform. TLO5.4 State the need of regulator.	Topic Title: Regulated Power Supply 5.1 Block diagram of DC regulated power supply. 5.2 Definition of load regulation and line regulation. 5.3 Zener diode as voltage regulator. 5.4 IC 7805 Voltage Regulator : Working and Applications Course Outcome: CO 4 Teaching Hours:04 Marks:04 (R-0,U-2,A-2)
6	TLO6.1 Conversion of one number System to another system: Binary numbers, Octal numbers, Decimal number Hexadecimal numbers TLO6.2 Draw Truth table, equation, symbol of AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR gate TLO6.3 State Types of triggering: Edge, level	Topic Title: Digital Electronics 6.1 – Number Systems: a) Binary numbers, Octal numbers, Decimal number Hexadecimal numbers: Conversion of one number System to another system (including Fractional number) 6.2 Logic Gates and Families: a) AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR gate: Truth table, equation, symbol, IC numbers, Block diagram of logic IC's (Students must be made aware of pin diagram of logic gates) (pin diagram should not be asked for exam) b) NOR & NAND as Universal gate. Course Outcome: CO 5 TeachingHours:12 Marks:10(R-2,U-4,A-4)

IV. Laboratory Learning Outcome and Aligned Practical / Tutorial Experiences. (Any 10)

- a) One write-up on each unit (altogether five in number) that summarizes the whole chapter and presents all the important points/material on it.
- b) 10 MCQs (twenty questions each) at the start of each tutorial based on the topic of previous tutorial unit

Sr No	Laboratory outcomes	Laboratory Experiments	Number of hrs.	Relevant COs
1	Plot the V-I characteristic of semiconductor P-N diode	To plot the V-I characteristic of semiconductor P-N diode. Find out static, dynamic resistance and knee voltage of P-N diode.	2	CO1
2	Plot the V-I characteristic of Zener diode	To plot the V-I characteristic of Zener diode	2	CO2
3	Plot the V-I characteristic of LED diode	To plot the V-I characteristic of LED diode	2	CO2
4	Plot the V-I characteristic of Photodiode.	To plot the V-I characteristic of Photodiode	2	CO2
5	Test half wave rectifier with C Filter	To construct and test half wave rectifier with C Filter	4	CO2
6	Test full wave rectifier with LC filter	To construct and test full wave rectifier with LC filter	4	CO2
7	Test Bridge wave rectifier with π filter	To construct and test Bridge wave rectifier with π filter	4	CO2
8	Plot i/p and o/p characteristics of BJT and find out input resistance and o/p resistance of BJT in CE Mode	To plot i/p and o/p characteristics of BJT and find out input resistance and o/p resistance of BJT in CE Mode	4	CO3
9	Calculate rise time and fall time.	To construct and test transistor as a switch and calculate rise time and fall time.	2	CO3
10	Plot the characteristic of FET	To plot the characteristic of FET	2	CO3
11	Find out load and line regulation	To construct and test Zener regulator. Find out load and line regulation	2	CO4
12	Verify truth table of all gates	Verify truth table of all gates	2	CO5

V. Suggested Micro Project / Assignment/ Activities for Specific Learning / Skills Development (Self Learning): (Minimum 5)

1. Collect information of different diodes and their specifications.
2. Prepare a chart of comparison of P-N junction diode, Zener diode, LED and photo-diode.
3. Build simple circuit using diode and observe its output. (use LED/P-N junction diode/ Zener Diode).
4. Collect datasheet of LED, P-N junction diode, Zener Diode.
5. Collect datasheet of transistors (BC547, 2N4403, 2N5457, IRF3205)
6. Design variable DC power supply (0-12 V)
7. Collect datasheet of 7805 IC Voltage Regulator

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X. Suggested Learning Materials / Books

Sr. No.	Book Title	Author	Publication
1	Electronic Devices and Circuit: An Introduction	Mottershead Allen	PHILearning, NewDelhi
2	Electronic Devices and Circuit Theory	Boylestead Robert, Louis Neshelsky	PearsonEducation, 10 th edition
3	Electronics Principles	Malvino, Albert Paul, David	McGraw Hill Education
4	Principles of Electronics	Mehta V.K., Mehta Rohit	S. Chand and Company
5	A textbook of Applied Electronics	Sedha R. S.	S.Chand
6	Modern Digital Electronics	R.P.Jain	TataMcGraw Hill

X. Learning Websites & Portals

Sr.No	Link / Portal	Description
1	www.youtube.com/	
2	https://www.elprocus.com/category/projects/eee-projects	
3	https://www.electronics-tutorials.ws	Steps to Building a Project on Breadboard Circuit Binary numbers, diodes, filters, Logic gates, Transistors

XI. Academic Consultation Committee/Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organization
1	Mrs. Salunke Suvarna	Sr. Controls engineer	Vanderlande industries software pvt ltd. Pune
2	Mrs. Chavhan Monali	Lecturer	G. P. Vikramgadhi
3	Ms. T.Y. Padavi	Lecturer in Electronics Engineering	G.P.Mumbai
4	Miss. M.B. Shirsat	Lecturer in Electrical Engineering	G.P.Mumbai

VI. Specification Table:

Unit No	Topic Title	Distribution of Theory Marks			Total Marks
		R Level	U Level	A Level	
1	Semiconductor Diode	4	4	4	12
2	Diode Application	4	6	4	14
3	Transistor Fundamentals	4	8	0	12
4	Field Effect Transistor	4	4	0	8
5	Regulated Power Supply	0	2	2	4
6	Digital Electronics	2	4	4	10
Total		16	30	14	60

VII. Assessment Methodologies/Tools

Formative assessment (Assessment for Learning)

- Rubrics for continuous assessment based on process and product related performance indicators (25 marks)

Summative Assessment (Assessment of Learning)

End term examination, Viva-voce, Workshop performance (25 marks)

VIII. Suggested COs - POs Matrix Form

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	-	--	-	-	--	-	-	-	-
CO2	2	2	2	-	-	--	2	1	-	--
CO3	2	2	--	1	-	--	1	-	-	--
CO4	1	-	1	1	-	-	2	2	-	2
CO5	3	-	2	-	-	-	2	1	-	1
Legends: - High:03, Medium:02, Low:01, No Mapping: --										

Government Polytechnic, Mumbai

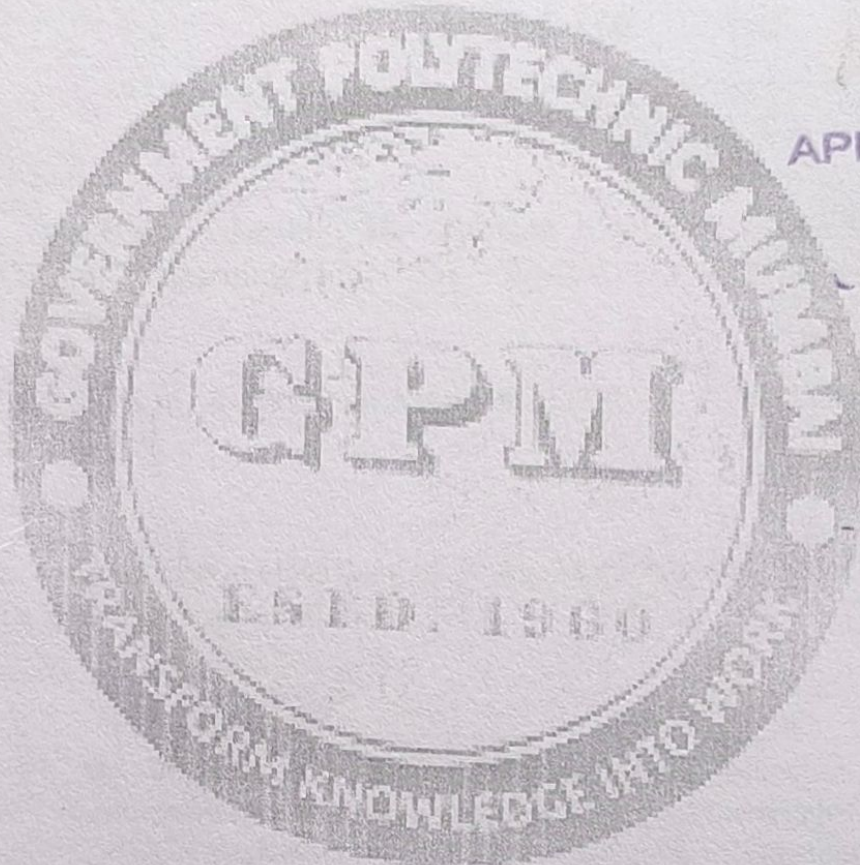
Electrical Engineering Department

Coordinator,
Curriculum Development,
Department of Electrical Engineering

Head of Department
Department of Electrical Engineering

I/C, Curriculum Development Cell

Principal



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DC Co-ordinator
G. P. Mumbai

Programme :Diploma in Electrical Engineering (Sandwich Pattern)													
Course Code: EE23103						Course Title :Electrical Power Generation							
Compulsory / Optional: Compulsory													
Learning Scheme and Credits						Assessment Scheme							
CL	TL	LL	SLH	NLH	Credits	FA-TH		SA-TH (2.30Hrs.)	FA-PR	SA		SLA	Total
						T1	T2			PR	OR		
4	-	-	2	6	3	20	20	60	-			25	125

Total IKS Hrs. for course: 2

Abbreviations: CL- ClassRoom Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, SLA- Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @\$ Internal Online Examination

Note:

1. FA-TH represents an average of two class tests of 20 marks each conducted during the term.
2. SA-TH represents the end term examination.

I. Rationale :Electrical Engineering Diploma holders employed in the field of power generation mostly work in thermal or hydro power stations. With a lot of focus on non-conventional energy sources they are being employed in this sector also. So they have to be exposed to the concepts and procedures involved in these generating stations and must have indepth understanding of theoretical aspects as well as need to know the various processes of energy conversion, equipment necessary for these processes, their function and safety process. The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences.

II. Industry / Employer Expected Outcome: The aim of this course is to help the student to attain the following industry identified outcome through various teaching learning experiences: 1) To know the layout of power plants, major equipment, their inter-relationship and working. 2) To have the skill of operating and maintaining various equipment in power plants following all the safety regulations.

III. Course Outcomes: Students will be able to achieve & demonstrate the following COs after completing of course based learning

CO1	Understand and explain various types of power generation systems.
CO2	Elaborate the working of power plants.
CO3	Develop the skill of supervision and maintenance of various generating equipment.
CO4	Apply the safety practices in power plants.

Electrical Power Generation (EE23103)

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P-23 scheme

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Course Content Details:

Unit No.	Learning Outcome	Topics / Sub-topics
1	TLO1.1 Describe the layout of the electric power generating process with labeled block diagram of the specified thermal power plant. TLO1.2 List the major properties of the fuels that is used in the specified thermal power generating plant TLO1.3 Explain with sketches the functions of the specified auxiliaries of a thermal power station TLO1.4 Describe Specified safe practice with respect to specified thermal power plants.	Coal based Thermal Power Plants: 1.1 Energy conversion process in thermal power plant. 1.2 Layout and working of a typical thermal power plant. 1.3 Properties of conventional fuels(coal) used in the energy conversion 1.4 Major Equipment used in thermal power plants with their functions. 1.5 Types of Boilers: Fire Tube Boilers and water tube boilers 1.6 Introduction to Super Critical Technology Thermal power plants 1.7 Safe Practices in thermal power plants 1.8 Thermal power plants with capacity in Maharashtra Course Outcome : CO1,CO2,CO3,CO4 Teaching Hours :10 Marks: 10
2	TLO2.1 Explain energy conversion process with block diagrams TLO2.2 Identify the appropriate site for a Nuclear Power station. TLO2.3 Explain the working of nuclear power station. TLO2.4 Describe various types of reactors TLO2.5 State special precautions required for Nuclear power station.	Nuclear Power Plant 2.1 Energy conversion principle in nuclear power plant. 2.2 Atomic fusion and fission action, commonly used nuclear fuels 2.3 Layout and working of a typical nuclear power plant 2.3 Major Equipment used in nuclear power plants and their function only 2.4 Disposal of nuclear waste and nuclear shielding 2.5 Safe Practices in nuclear power plant 2.6 Nuclear power plants with capacity at national and state level Demonstration of video of working of nuclear power plant Course Outcome: CO1,CO2,CO3,CO4 Teaching Hours : 8 Marks : 8

3	TLO3.1 Explain hydro energy conversion process with block diagrams TLO3.2 Identify the appropriate site for a hydro-power station. TLO3.3 Classify the different types of hydro-PowerStation. TLO3.4 State the functions of the major equipment and auxiliaries of a hydro-power station TLO3.5 Solve the numerical to calculate the available Power in Hydro plant.	Hydro Power Plants 3.1 Energy conversion process in hydro power plant 3.2 Layout and working of a typical hydro power plant 3.3 Major Equipment used in hydro power plants and their function only 3.4 Classification of hydro power plant and type of water turbine: High, medium and low head 3.5 Safe Practices in hydro power plants 3.6 Pumped Storage Hydro Power Plants 3.7 Hydro power plants with capacity in Maharashtra Demonstration of video of working of hydro power plant Course Outcome: CO1,CO2,CO3,CO4 Teaching Hours : 12hrs Marks: 12hrs
4	TLO4.1 Explain the energy conversion process with block diagram. TLO4.2 Identify the most efficient positioning of solar panels at a particular location. TLO4.3 State the functions of auxiliaries of solar power plant. TLO4.4 State the shape practices to be followed in solar plant.	Solar Power Plants 4.1 Solar Map of India: Global solar power radiation. 4.2 Energy conversion process of solar power plant 4.3 Solar Power Technology: Direct and indirect conversion to electrical energy. 4.3.1 Indirect Conversion – High temperature Concentrated Solar Power (CSP) Tower plants, Its layout and working. Functions of each component depicted in layout 4.3.2 Types of solar power collectors- Flat collectors, parabolic trough, parabolic dish, Fresnel reflectors, heliostat 4.4 Direct conversion – Brief introduction to photo voltaic cell, 4.4.1 Grid connected and battery storage Solar Photovoltaic (PV) power plant, layout, and working 4.4.2 Major Equipment used in PV solar power plants and their function only 4.4.3 Types PV System- Central Power station system, distributed system, stand alone, grid interactive, hybrid system, small system

		for consumer application 4.5 Safe Practices in solar power plants 4.6 Major Solar power plants with capacity at national and state level Demonstration of video of solar power plants Course Outcome: CO1,CO2,CO3,CO4 Teaching Hours : 10 Marks: 10
5	TLO5.1 List the wind flow patterns in various seasons. TLO5.2 Explain energy conversion process with block diagram in wind power plant. TLO5.3 Identify the suitable site for wind power plant in a selected geographical area. TLO5.4 Explain with sketch the function of major auxiliaries in wind power plant.	Wind Power Plants 5.1 Wind Map of India: Wind data and its unit of measurements, electrical power output 5.2 Types of wind turbine - Horizontal axis (HAWT) and Vertical axis wind turbine, main components of HAWT(only) 5.3 Salient Features of electric generators used in large wind power plants: 5.4 Names of different wind generators 5.5 General block diagram of wind energy conversion system 5.6 Safe Practices in wind power plants 5.7 Wind power plants with capacity in Maharashtra Demonstration of video of wind power plant Course Outcome: CO1,CO2,CO3,CO4 Teaching Hours : 10 Marks: 10
6	TLO6.1 Explain energy conversion principle in biomass power plant. TLO6.2 Draw and explain the function of various sections of bio mass power plant. TLO6.3 Preparation of model/ working model of different types of power plant.	Biomass-Power Plants And Activity 6.1 Energy conversion process of biomass-based power plant 6.2 Methods of biomass conversion technology 6.3 Biomass gasification process, gasification plants-schematic diagrams of downdraft, updraft, cross draft 6.4 Safe Practices in bio-mass based power plants 6.5 Prepare a model of thermal power plant. 6.5 Prepare a model of hydro power plant. 6.5 Prepare a working model of wind power plant. Demonstration of video biomass power plant Course Outcome: CO1,CO2,CO3,CO4 Teaching Hours : 10 Marks: 10

I. Suggested Micro Project / Assignment/ Activities for Specific Learning / Skills Development (Self Learning): (Minimum 5)

1. Draw the layout of thermal power plant/hydro power plant.
2. Collect information of various hydro power stations with their details located in Maharashtra.

3. Collect information of various thermal power stations with their details located in Maharashtra..
4. Make a market survey and collect detailed information about the solar panels available along with their specification, cost and manufacturers.
5. Prepare a report on the wind power harnessing scenario in India.
6. Visit/Watch a video of bio mass power plant unit and prepare report of the same.

II. Specification Table:

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Coal based Thermal Power Plants	2	4	4	10
2	Nuclear Power Plant	2	4	2	8
3	Hydro Power Plants	4	4	4	12
4	Solar Power Plants	2	4	4	10
5	Wind Power Plants	2	4	4	10
6	Biomass Power Plants And Activity	4	4	2	10
Total		16	24	20	60

III. Assessment Methodologies/Tools

IV. Suggested COs - POs Matrix Form

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CO1	3	3	—	2	2	—	3	3	1	2
CO2	3	3	—	2	2	—	3	3	1	—
CO3	3	3	—	2	2	—	3	3	1	—
CO4	3	3	—	2	2	—	3	3	1	—
Legends: - High:03, Medium:02, Low:01, No Mapping: --										

V. Suggested Learning Materials / Books

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Power Plant Engineering	Nag. P. K. McGraw Hill, New Delhi, 4 th Edition, 2017	978-9339204044
2	Electrical Power Generation	Tanmoy Deb, Khanna Publishing House, Delhi (Ed. 2018)	9789386173379
3	Generation of Electrical Energy	Gupta, B.R. S. Chand & Co. New Delhi, 2014	9788121901024
4	Non-Conventional Energy Resources	B. H. Khan, McGraw Hill, New Delhi, Third Edition, 2016	9789352601882, 9352601882
5	Solar Photovoltaic: Fundamentals, Technologies and Applications	Solanki, Chetan Singh PHI Learning, New Delhi Third edition, 2015	9788120351110
6	Wind Turbines	Hau, Erich, Springer-Verlag, Berlin Heidelberg, Germany	978-3-642- 27150-2
7	A Course in Electrical Power	Gupta J.B. S. K Kataria and Sons, New Delhi. 2014,	9350143747
8	A Course in Electrical Power	Soni, Gupta, Bhatnagar, Dhanpatrai and Sons New Delhi, 2005	9788121924962
9	Textbook of Renewable Energy	S.C. Bhatia, R. K. Gupta Woodhead Publishing India, 2018	9788193644607
10	Biomass to Renewable Energy Processes	Jay Cheng, CRC Press, 2 nd edition, 2017	9781498778794

VI. Learning Websites & Portals

1. <https://ndl.iitkgp.ac.in/>
2. <https://www.electrical4u.com/>
3. <http://www.nhpcindia.com/>
4. <https://www.ntpc.co.in/>
5. <https://www.seci.co.in/>
6. <https://www.mahaurja.com/meda>

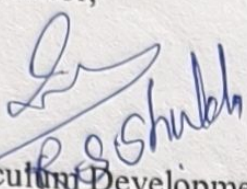
VII. Academic Consultation Committee/Industry Consultation Committee:

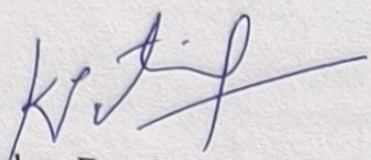
Sr. No	Name	Designation	Institute/Organization
1	Mr R. Alone	Superintending Engineer	MSEDCL Bandra, Mumbai
2	Dr S.S. Bharatkar	HOD Electrical Engineering	G.P.Pune
3	Mr R.S. Shukla	Lecturer in Electrical Engineering	G.P.Mumbai
4	Mrs. D. R. Kirtane	Lecturer in Electrical Engineering	G.P.Mumbai

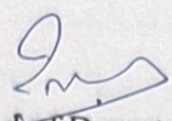
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[Signature]
CDC Co-ordinator
G. P. Mumbai

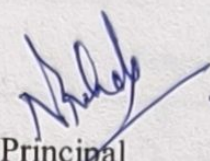
Coordinator,


Curriculum Development,
Department of Electrical Engineering


I/C, Curriculum Development Cell

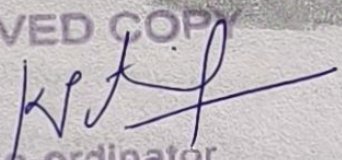

Head of Department


Department of Electrical Engineering


Principal



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CDC Co-ordinator
G. P. Mumbai

Programme : Diploma Electrical Engineering(Sandwich Pattern)													
Course Code: EE 23601						Course Title : Electrical Material and Wiring							
Compulsory / Optional: Compulsory													
Learning Scheme and Credits						Assessment Scheme							
CL	TL	LL	SLH	NLH	Credits	FA-TH		SA-TH (2:30 Hrs.)	FA- PR	SA		SLA	Total
						T1	T2			PR	OR		
2	-	4	2	8	4	-	-	-	50	-	#50	25	125

Total IKS Hrs. for course: 1

Abbreviations: CL- ClassRoom Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, SLA- Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @\$ Internal Online Examination

Note:

1. FA-TH represents an average of two class tests of 30 marks each conducted during the term.
2. SA-TH represents the end term examination.

I. Rationale

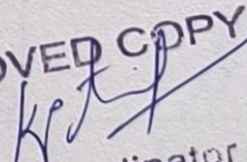
A sound knowledge of the properties, characteristics, applications and limitations of engineering materials is a must for every engineer and technologist. It helps a technician to study useful data and select materials from manufacturers catalogues.

A technician should also have the practical skills regarding wiring and fault finding. These skills will be developed when he/she actually performs the workshop.

II. Industry / Employer Expected Outcome

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

- i. Identify Various types of wiring materials like conducting, magnetising and insulating materials
- ii. Know electrical wiring systems and its accessories
- iii. Test and prepare wiring circuit

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III. Course Outcomes: Students will be able to achieve & demonstrate the following COs on completion of course based learning

CO1	Understand electrical Safety norms and importance of Electrical Materials
CO2	Know the various properties of conducting material
CO3	Know the various properties of insulating material
CO4	Know the various properties of Magnetic material.
CO5	Read and interpret the electrical wiring diagram
CO6	Select the type of wiring for particular application

Course Content Details:

Unit No.	Theory Learning Outcomes (TLO)	Topics / Sub-topics
1	TLO1.1 Describe safety precaution in indoor and outdoor installations TLO1.2 State the importance of Engineering materials in practise	1: Classification of electrical materials. 1.1 Observe safety precautions in electrical indoor and outdoor installations. 1.2 Importance of Materials in Electrical Engineering IKS HR. Collect information of any 2 Inventors/ scientist in Electrical Material Engineering Course Outcome: CO1 Teaching Hours :2 hrs
2	TLO2.1 Enlist properties of conducting material TLO2.2 State the properties of various conducting material	2: Conducting Materials (Physical, Mechanical and Electrical properties) 2.1 Current Carrying Conducting Materials (Copper, Aluminum, Bronze and Iron) 2.2 Non Current Carrying Conducting Materials (Cast iron, Cast Steel, etc) Course Outcome: CO2 Teaching Hours: 4 hrs
3	TLO3.1 Enlist properties of conducting material TLO3.2 Classify solid, liquid, gaseous insulating material TLO3.3 Classify insulating material on the basis of temperature	3: Insulating Materials (Thermal , Mechanical and Electrical properties): 3.1 Classification on basis of state of materials as solid, liquid gaseous insulating materials (Introduction and applications) 3.2 Classification on the basis of temperature withstanding ability such as Y (O), A, E, B, F, H and C type with list of insulating materials in each type. 3.3 Effect of Nano Technology on properties of materials Course Outcome: CO3 Teaching Hours: 4hrs

4	TLO4.1 Enlist types of magnetic material TLO4.2 Classify magnetic materials TLO4.3 State applications of various magnetic material	4: Magnetic Material (Introduction and Applications) 4.1 Classification of magnetic material as Paramagnetic, Diamagnetic and Ferromagnetic material 4.2 C.R.G.O. Silicon Steel 4.3 H.R.G.O. Silicon Steel 4.4 Amorphous Metal Course Outcome: CO4 Teaching Hours: 4hrs
5	TLO5.1 State the requirements of electrical installations TLO5.2 Read and interpret electrical drawing TLO5.3 Enlist and explain types of wires system and their applications TLO5.4 Enlist and explain wiring accessories their applications	5: Wires and wiring accessories 5.1 Classification of electrical installations 5.2 General requirements of electrical installation 5.3 Reading & interpretation of electrical engineering drawings & symbols related to installations 5.4 Types of Wires and its Properties – PVC, CTS, TRS , Lead Sheathed, flexible, multicore, single strand, multi-strand 5.5 Main Switch and Distribution Boards (No diagram) 5.6 Switches, Socket outlets, Plug, Lamp Holders 5.7 Fuse and their types 5.8 Earthing conductor 5.9 Protective devices for wiring installation: Need, MCB, MCCB, ELCB 5.10 Concept of circuit and Subcircuit 5.11 Types of lighting circuits: Series, Parallel Course Outcome: CO5 Teaching Hours: 6 hrs
6	TLO6.1 Define the types of wiring system TLO6.2 Explain i. Looping in and Looping Out System ii. Casing capping wiring iii. Lead sheathed wiring iv. Conduit wiring TLO6.3 write advantages, disadvantages and applications of all types of wiring	6: Methods of Wiring and Different types of Wiring systems 6.1 Methods of Electrical Wiring systems w.r.t taking connection 6.2 Joint Box or Tee or Jointing system 6.3 Loop-in or Looping system 6.3.1 Advantages of loop-in method of wiring 6.3.2 Disadvantages of loop-in method of wiring 6.4 Concept and need of Cable termination and glands 6.5 Different types of Electrical wiring systems 6.6 Casing and Capping wiring 6.6.1 Advantages of Casing and Capping wiring 6.6.2 Disadvantages of Casing and Capping wiring 6.7 Lead sheathed wiring 6.8 Conduit wiring 6.8.1 Surface conduit wiring 6.8.2 Concealed conduit wiring 6.9 Types of Conduit 6.9.1 Metallic conduit 6.9.2 Nonmetallic conduit 6.10 Advantages of Conduit wiring system

		6.11 Disadvantages of Conduit wiring system 6.12 Comparison between different Wiring systems	
		Course Outcome: CO6	Teaching Hours: 10hrs

IV. Laboratory Learning Outcome and Aligned Practical / Tutorial Experiences.

Sr No	Laboratory Learning Outcomes (LLO)	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant CO
1	LLO 1.1 Enlist various safety devices LLO 1.2 To use various safety devices while working on electrical Installation	To Demonstrate (Video Demonstration) the use of safety devices and precaution while working on electrical installation (Safety devices such as Hand gloves, gumboot, mats tester, arms panel, life safety materials are to be studied with etc with their specifications, test as per IS, also permissible or withstand company of such material to specified voltage & current. First aid method information with video demonstration.)	4	1
2	LLO 2.1 To use various electrical tools for wiring installations	To Demonstrate types and use of various tools required for installation/maintenance of electrical work.	4	1
3	LLO 3.1 Able to trace wiring circuit using electrical symbols	Draw different symbols used in electrical engineering	4	1
4	LLO 4.1 Categorize engineering materials as conducting insulating and magnetic materials LLO 4.2 Explain the properties of electrical materials	Collect at least three samples of each category of materials (such as conducting, insulating, magnetic). To be submitted along with term work. Prepare report of source of collection, properties and applications.	6	2,3,4
5	LLO 5.1 Explain the use, types, sizes and rating of various wiring accessories	Draw diagrams of types of wires and cables, different wiring accessories and write information on each. (Use, types, sizes, ratings) 1. Wire and Cable 2. Main Switch and Distribution Boards (No diagram) 3. Switches, Socket outlets, Plug, Lamp Holders Build Casing Capping Conduit wiring	4 4 4	5

		(Group activity)		
6	LLO 6.1 Determine size and type of fuse wire	Determination of size and type of fuse wire	4	5
7	LLO7.1 Identify the type of wiring circuit LLO7.2 Build various types of wiring circuits	Build wiring circuit (Group Activity) 1. For one lamp controlled by one switch 2. Socket outlet controlled by one pole switch 3. Two lamp controlled by individual switches 4. Three lamps and one socket outlet controlled by individual switches 5. One lamp, one fan , one socket outlet controlled by individual switches 6. Two Way Switching Prepare Sample of Staircase Wiring, Godown Wiring, (Group Activity)	12 Each 2 hrs.	6
8	LLO8.1 Carry out testing of wiring installations	Testing of wiring installation(Group Activity) 1. Testing of insulation resistance between wiring and earth 2. Testing of insulation resistance between conductors 3. Testing of polarity of single pole switch 4. Testing of earth continuity path	8 Each 2 hrs.	6
5	LLO9.1 Draw wiring diagram of classroom	Trace and draw electrical installation of a classroom	2	6
6	LLO10.1 To prepare switch board/extension board	Prepare the switch board /extension board of minimum four point.(Group activity)	6	6

I. Suggested Micro Project / Assignment/ Activities for Specific Learning / Skills Development (Self Learning):

1. Information on need of Electrical Safety.
2. Market survey for manufactures of Electrical Wires and accessories
3. Collection of catalogue for standard ratings of wire and accessories
4. Collect the electrical engineering material suppliers and manufacturers list.
5. Information on latest wiring systems for example: Tunnel Wiring, Marine wiring, GI Pipe wiring
6. List of IS code used for wiring and installation.

Note: if any

Formative assessment (Assessment for Learning) for PR and SLA

Electrical Material and Wiring (EE23601)

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P-23 scheme

- Rubrics for continuous assessment based on process and product related performance indicators (___ marks)

Summative Assessment (Assessment of Learning)

End term examination, Viva-voce, Workshop performance (___ marks)

Suggested Cos – Pos Matrix Form

Course Outcomes (Cos)	Programme Outcomes (Pos)							Programme Specific Outcomes (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	2	1	3	3	1	2	1	3	2
CO2	3	2	1	3	3	1	2	1	3	2
CO3	3	2	1	3	3	1	2	1	3	2
CO4	3	2	1	3	3	1	2	1	3	2
CO5	3	2	1	3	3	1	2	1	3	2
CO6	3	2	1	3	3	1	2	1	3	2
Legends: - High:03, Medium:02, Low:01, No Mapping: --										

a) Suggested Learning Materials / Books

Sr.No	Autor	Title	Publisher
01	A.J. Dekker	Electrical Engineering Materials	Prentice Hall of India Pvt. Ltd., Delhi.
02	Indulkar	Electrical Engineering Materials	S. Chand Publication, Delhi
03	Uppal, S.L. & Garg, G.C.	Electrical Wiring, Estimating and Costing	Khanna Publication, New Delhi
04	Surjit Singh	Electrical Estimating & Costing	Dhanpat Rai & Co. New Delhi
05	R.P. Singh	Electrical Workshop	I.K. International Publishing House
06	K.B. Raina S.K. Bhattacharya	Electrical Design Estimating, Costing	New Age International Publishers

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b) Learning Websites & Portals

Sr.No	Link / Portal	Description
1	http://www.nsci.org.in/	Material and wiring system
2	http://www.esfi.org/	Material and wiring system
3	http://www.osha.gov/Publications/electrical_safety	Electrical safety
4	http://www.nfpa.org/safety	Electrical safety
5	http://www.electricaltechnology.org/2015/09/types-of-wiring-systems-electrical-wiring-methods.html	Wiring system
6	www. nptel.com	Basics
7	www.electrical4u.com	Wiring circuits
8	www.khanacademy.org	Basics
9	https:// ndl.iitkgp.ac.in/	Electrical Materials

c) Academic Consultation Committee/Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organization
1	Mr. Kuldeep Singh Rajput	Deputy Executive Engineer	400KV RSOM, Kharghar Navi Mumbai
2	Mrs. S. S. Umare	Lecturer in Electrical Engineering	Government Polytechnic, Awasari
3	Mrs. D.R. Kirtane	Lecturer in Electrical Engineering	Government Polytechnic, Mumbai
4	Mrs. J. D. Waghmare	Lecturer in Electrical Engineering	Government Polytechnic, Mumbai

Coordinator,
Curriculum Development,
Department of Electrical Engineering

I/C, Curriculum Development Cell

Head of Department
Department of Electrical Engineering

Principal

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G. P. Mumbai

Programme : Diploma in Electrical Engineering													
Course Code:EE 23301						Course Title: Environmental Studies							
Compulsory / Optional: Compulsory													
Teaching Scheme and Credits						Assessment Scheme							
CL	TL	LL	SLH	NLH	Credits	FA-TH		SA-TH (2:30 Hrs.)	FA- PR	SA		SLA	Total
						T1	T2			PR	OR		
-	-	2			1	-	-	-	25	-	@25		50

Total IKS Hrs. for course: 1

Abbreviations: CL- ClassRoom Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, SLA- Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @\$ Internal Online Examination

Note:

1. FA-TH represents an average of two class tests of 30 marks each conducted during the term.
2. SA-TH represents the end term examination.

I. Rationale

Technicians working in industries or elsewhere essentially require the knowledge of environmental Studies so as to enable them to work and produce most efficient, economical and eco-friendly finished products. Solve various engineering problems applying ecosystem to produce eco – friendly products. Use relevant air and noise control method to solve domestic and industrial problems. Use relevant water and soil control method to solve domestic and industrial problems. To recognize relevant energy sources required for domestic and industrial problems. Solve local solid and e-waste problems.

II. Industry / Employer Expected Outcome

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

- i. Identify Various environment pollutants, their causes, effect and remedies
- ii. Know renewable energy sources and its parameters as energy source
- iii. Identify and resolve e waste problem

III. Course Outcomes: Students will be able to achieve & demonstrate the following COs on completion of course based learning

CO1	Understand the ecosystem and terminology and solve various engineering problems
CO2	Applying ecosystem knowledge to produce eco-friendly products.
CO3	Understand the suitable air, extent of noise pollution, and control measures and acts.
CO4	Understand the water and soil pollution, and control measures and acts.
CO5	Understand different renewable energy resources and efficient process of harvesting.
	Understand Solid Waste Management & E Waste Management,

Course Content Details:

Unit No.	Theory Learning Outcomes (TLO)	Topics / Sub-topics
1	TLO1.1 Define Ecosystem TLO1.2 List functions of ecosystem TLO 1.3 Describe major ecosystem TLO 1.4 State overview of Global Warming, carbon footprints	Ecosystem 1.1 Structure of ecosystem, biotic & Abiotic components 1.2 Food chain and foodweb 1.3 Aquatic (Lentic and Lotic) and terrestrial ecosystem 1.4 Carbon, Nitrogen, Sulphur, Phosphorus cycle 1.5 Global warming-Causes, effects, process, Green House Effect, Ozone depletion Course Outcome:CO1 Teaching Hours:6hr
2	TLO2.1 Enlist sources of air and noise pollution TLO2.2 State effect of air and noise pollution TLO2.3 Identify measures for prevention of air and noise pollution	Air and Noise Pollution 2.1 Definition of pollution and pollutant, Natural and manmade sources of air pollution (Refrigerants, I.C.,Boiler) 2.2 Air Pollutants: Types, Particulate Pollutants: Effects and control (Bag filter, Cyclone separator, Electrostatic Precipitator) 2.3 Gaseous Pollution Control: Absorber, Catalytic Converter, Effects of air pollution due to Refrigerants, I.C.,Boiler 2.4 Noise pollution: sources of pollution, measurement of pollution level, Effects of Noise pollution Course Outcome:CO2 Teaching Hours:6hrs
3	TLO3.1 Enlist sources of water and soil pollution TLO3.2 State effect of water and soil pollution TLO3. Identify measures for prevention of water and soil pollution	Water and Soil Pollution 3.1 Sources of water pollution, Types of water pollutants, Characteristics of water pollutants Turbidity, pH, total suspended solids, total solids BOD and COD: Definition 3.2 Waste Water Treatment: Primary methods: sedimentation, froth floatation, Secondary methods: Activated sludge treatment, Trickling filter, Bioreactor, Tertiary Method: Membrane separation technology, RO(reverse osmosis) 3.3 Causes, Effects and Preventive measures of Soil

		Pollution: Causes–Excessive use of Fertilizers, Pesticides and Insecticides, Irrigation, E-waste 3.4 Mangroves: Importance, benefits. Course Outcome: CO3 Teaching Hours: 6hrs
4	TLO4.1 Enlist overview of various renewable energy sources TLO4.2 State various renewable energy sources applications	Renewable Sources of Energy 4.1 Solar Energy: Basics of Solar energy. Flat plate collector (Liquid & Air). Theory of flat plate collector. Importance of coating. Advanced collector. Solar pond. Solar water heater, solar dryer. Solar stills. 4.2 Biomass: Overview of biomass as energy source. Thermal characteristics of biomass as fuel. Anaerobic digestion. Biogas production mechanism. Utilization and storage of biogas 4.3 Wind energy: Current status and future prospects of wind energy. Wind energy in India. Environmental benefits and problem of wind energy 4.4 New Energy Sources: Need of new sources. Different types new energy sources. Applications of (Hydrogen energy, Ocean energy resources, Tidal energy conversion) Concept, origin and power plants of geothermal energy Course Outcome: CO4 Teaching Hours: 6hrs
5	TLO5.1 Identify the sources of solid waste. TLO5.2 Select the relevant method of collection and transportation and treatment of solid waste.	Solid Waste Management OR E-Waste Management 5.1 Various e-waste sources, their constituents, and health impacts 5.2 e-Waste Problem in India 5.3 Initiatives on building awareness in e-waste management. 5.4 Current Status of e-Waste Management & Environmental (Protection) Act 1986 5.5 Development of waste recycling technologies. 5.6 Opportunities of e-Waste Management in India 5.7 e-Waste Management techniques Course Outcome: CO5 Teaching Hours: 6hrs

IV. Laboratory Learning Outcome and Aligned Practical / Tutorial Experiences.

- One write-up on each unit (altogether five in number) that summarizes the whole chapter and presents all the important points/material on it.
- 10 MCQs (twenty questions each) at the start of each tutorial based on the topic of previous tutorial unit

Sr No	Laboratory Learning Outcomes (LLO)	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant CO
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1	LLO 1.1 Determine the Concept of Ecosystem, Classification, Structure and functions of Ecosystem LLO 3.2 Identify the Energy flow in ecosystem	a) Concept of Ecosystem, Classification, Structure and functions of ecosystem: Basics, b) Energy flow in ecosystem: Gross primary product and Net primary product, Autotrophic levels and Bioaccumulation	6	1
2	LLO 2.1 Describe the concept of Global warming, Acid rain, Ozone Layer Depletion, Nuclear Accidents and Holocaust LLO 2.2 Describe the concept of Carbon Credits and its advantages	a) Global warming, Acid rain, Ozone Layer Depletion, Nuclear Accidents and Holocaust b) Concept of Carbon Credits and its advantages	6	1
3	LLO 3.1 Explain the Definition of environmental pollution LLO 3.2 Explain the types of environmental pollution	a) Definition of environmental pollution, Air pollution: Definition, sources, effects, prevention b) Water Pollution: Definition, sources, effects, prevention	4	2
4	LLO 4.1 Explain the Soil Pollution LLO 4.2 Explain the Noise Pollution	a) Soil Pollution: Definition, sources, effects, prevention b) Noise Pollution: Definition, sources, effects, prevention or Visit/ video demonstration of a polluted site : Urban/Rural/Industrial/Agricultural and prepare a report	4	3
5	LLO 5.1 Enlist and explain the various renewable energy sources	a) Information on various Renewable and Nonrenewable Energy Sources b) Advantages, Limitations of all energy sources	4	4
6	LLO 6.1 Enlist Sources and effects of E waste LLO 6.2 Explain the process of E waste management	a) Prepare a report on solid waste/ E-waste Management or Visit to municipal solid waste management organization or an authorized waste recycling plant and prepare a report based on visit.	6	5

Note: if any

Formative assessment (Assessment for Learning) for PR and

SLA

- Rubrics for continuous assessment based on process and product related performance indicators (marks)

Summative Assessment (Assessment of Learning)

End term examination, Viva-voce, Workshop performance (___ marks)

Suggested COs - POs Matrix Form

Course Outcome s (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Developmen t of Solutions	PO-4 Engineerin g Tools	PO-5 Engineering Practices for Society, Sustainabilit y and Environmen t	PO-6 Project Managemen t	PO-7 Life Long Learnin g	PSO - 1	PSO - 2	PSO - 3
CO1	2	3	--	1	3	1	2	1	3	2
CO2	2	3	--	1	3	1	2	1	3	2
CO3	2	2	--	1	3	1	2	1	3	2
CO4	2	2	--	1	3	1	2	1	3	2
CO5	2	3	--	1	3	1	2	1	3	2

Legends: - High:03, Medium:02, Low:01, No Mapping: --

a) Suggested Learning Materials / Books

Sr.No	Author	Title	Publisher
1	S.C. Sharma & M.P. Poonia	Environmental Studies	Khanna Publishing House, New Delhi
2	C.N.Rao	Understanding Chemistry	Universities Press (India) Pvt. Ltd.
3	Arceivala, Soli Asolekar, Shyam	Waste water treatment for pollution control and reuse	Mc-Graw Hill Education India Pvt.Ltd.
4	O.P.Gupta	Elements of Environmental Pollution control	Khanna Publishing House, New Delhi

b) Learning Websites & Portals

Sr.No	Link / Portal	Description
1	https://moef.gov.in/	For environmental Info
2	www.youtube.com/	For Various subjects
3	http://civildigital.com	
4	http://www.quora.com	

c) Academic Consultation Committee/Industry Consultation Committee:

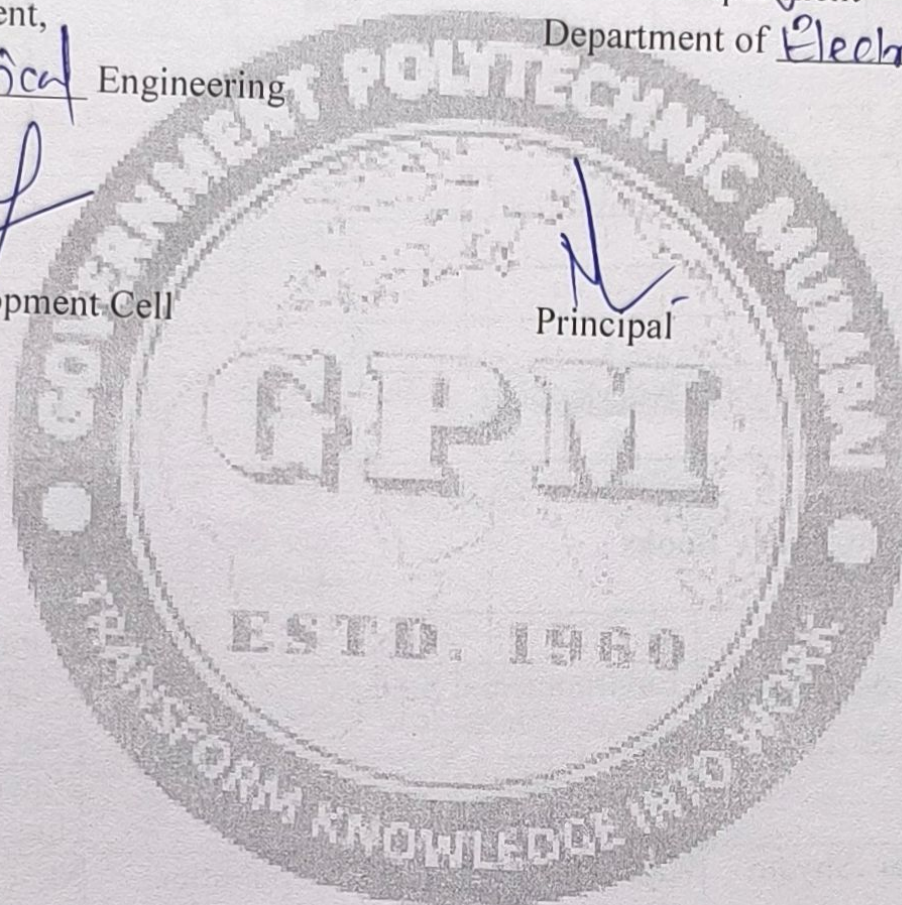
Sr. No	Name	Designation	Institute/Organization
1	Mrs. V. S. Jogalekar	Asst. Engineer, Training and Safety Dept,	MSEDCL
2	Dr.S.V. Bhangale	Head of Electrical Engg.	G. P. Awasari
3	Mrs. D. R. Kirtane	Lecturer in Electrical Engineering	G.P.Mumbai
4	Miss. A.V. Patil	Lecturer in Electrical Engineering	G.P.Mumbai

Coordinator,
Curriculum Development,
Department of Electrical Engineering

Head of Department
Department of Electrical Engineering

I/C, Curriculum Development Cell

Principal



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G. P. Mumbai

Programme : Diploma in Electrical Engineering (Sandwich Pattern)													
Course Code: EE 23 602						Course Title: Computer Aided Electrical Drawing							
Compulsory / Optional: Compulsory													
Teaching Scheme and Credits						Examination Scheme							
CL	TL	LL	SLH	NLH	Credits	FA-TH		SA-TH (2:30 Hrs.)	FA- PR	SA		SLA	Total
						T1	T2			PR	OR		
-	-	2	2	4	2	-	-	-	-	50	-	50	100

Total IKS 2Hrs. for course:

Abbreviations: CL- Class Room Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA -Formative Assessment, SA -Summative assessment, SLA-Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @\$ Internal Online Examination

Note:

1. FA-TH represents an average of two class tests of 20 marks each conducted during the term.
2. SA-TH represents the end term examination.

I. Rationale

The computer software's become the essential part of today's world to keep pace with rowing technology and demand for the timely product design. Computer aided drawing software allow engineer to increase productivity, improves the quality, accuracy of the drawing, saves time and easier for documentation. Objective of this course is to provide practice in freehand sketching of electrical drawing, use of computer based software to draw working electrical drawing. This course also provides practice to read and interpret working electrical engineering drawings.

II. Industry / Employer Expected Outcome

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

- 1) To know the basic features, commands and general structure of the Electrical CAD software
- 2) Identify different types of tools of the Electrical CAD software and their application.
- 3) To plot, read, understand and interpret electrical drawings

III. **Course Outcomes:** Students will be able to achieve & demonstrate the following COs on completion of course based learning

CO 1	Make Use of Computer Aided Electrical Drawing Software & Use various symbols and notations in electrical engineering drawings
CO 2	Reproduce (Redraw) free hand proportionate sketches related to electrical engineering drawings
CO 3	Apply CAD commands for edit/modification of existing electrical engineering drawings using drafting software
CO 4	Read and interpret electrical drawings
CO 5	Print/Plot the drawing

IV. **Course Content Details:**

Unit No.	Theory Learning Outcomes (TLO)	Topics / Sub-topics
1	TLO1.1 Understand the User Interface of AutoCAD – Ribbon, Panels, Model space, Layout tabs, Status bar, & Properties TLO1.2 Understand AutoCAD setup tips – Options, Units, Workspace TLO1.3 Understand the types and structure of drawings in Auto CAD- Floor plan, RCP, Elevation, Section, & Details TLO1.4 Input commands and understand different selections. TLO1.5 Understand basic drawing tools- Origin, Rectangle. TLO1.6 List the steps of Computer aided electrical drawing. TLO1.7 Set the limits of the drawing to get the needed working area TLO1.8 Attach image/PDF/CAD and adjust the scale TLO1.9 Set the project folder, Save the file, and backups	Topic Title: Introduction to CAD Software: Explore the basic features, commands and general structure of the Electrical CAD software (open source/AutoCAD) environment. Start and exit the session GUI of electrical CAD software On-line help File types with extensions Initial settings- limit, units etc. Drawing command- line, circle, arc, square, spline, Array, Repeat Region, part marking Editing commands View command Dimensioning commands Lettering , Text , title Layer & layer properties Print /Plot the drawing Import export of File to other file formats
2	TLO2.1 Draw general graphical symbols and notations used in electrical engineering using CAD software	Topic Title: Electrical and Electronics Symbols : Concept of electrical symbols and its importance Different electrical and electronics symbols as per IS:20321976 or latest code Preparation and subsequent use of standard template for drawing in CAD

3	TLO3.1 Draw Circuit diagram, wiring diagram, control circuit diagram, single line diagram, block diagram, layout diagram, schematic diagram and logic diagram used in electrical engineering using CAD software.	Topic Title: Electrical Drawings: Concept of Electrical drawings Types of Electrical drawings- Circuit diagram, wiring diagram, control circuit diagram, single line diagram, block diagram, layout diagram, schematic diagram and logic diagram
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V. Laboratory Learning Outcome and Aligned Practical / Tutorial Experiences. (Any 10)

- One write-up on each unit (altogether five in number) that summarizes the whole chapter and presents all the important points/material on it.
- 10 MCQs (twenty questions each) at the start of each tutorial based on the topic of previous tutorial unit

Sr No	Laboratory outcomes	Laboratory Experiments	Number of hrs.	Relevant COs
1	LLO1.1 Identify & use of basic drawing commands. LLO1.2 Draw minimum 2 simple drawings using above commands using drawing software Save and print the file on A3/A4 paper.	Practice open source Electrical CAD/Auto CAD software- Open sample examples, read and understand Create new file Practice basic drawing commands to draw Line, circle arc, ellipse, triangle, square and other geometric figures Perform basic operations such copy, erase, delete, undo, redo, mirror, zoom, offset Prepare minimum 2 simple drawings using above commands. Save drawing –with default extension and as pdf format. Print the drawing on A3/A4 paper.	2	CO1 CO5
2	LLO2.1 Prepare a standard template include the name of students, enrolment no. of student LLO2.2 Draw minimum 4 simple geometric figures/patterns using draw and Edit commands in a prepared template using drawing software. Save and print the file on A3/A4 paper.	Preparation of standard template for drawing in CAD. Standard template should include the name of students, enrolment no. of student, etc. Draw minimum 4 simple geometric figures/patterns using draw and Edit commands in a prepared template. Save and print drawing on A3/A4 paper	2	CO1 CO5
3	LLO3.1 Draw Rangoli/Street light Pole/Decorative Garden lamp post using CAD software Save and print drawing	Draw minimum 2 proportionate drawings on sketch book with creative imagination which includes combinations of geometric pattern for example Rangoli /Street light Pole/Decorative Garden lamp post Redraw the above drawing using CAD software. Save and print drawing on A3/A4 paper	2	CO1 CO3 CO5

4	LLO4.1 Draw Electrical and electronics symbols/legends As per IS:1032 or Latest code by using drafting software Save and print file	Electrical and electronics symbols /legends Draw Electrical and electronics symbols/legends As per IS:1032 or Latest code by freehand on sketchbook Draw same symbols by using drafting software Save and print file	2	CO1 CO2 CO3 CO5
5	LLO5.1 Redraw the electrical installation layout plan of ceiling fans and luminaries fitted in a residential/commercial office /classroom (any one) using drawing software Save and print the file on A3/A4 paper.	Layout of ceiling fans and luminaries Collect electrical installation layout plan of ceiling fans and luminaries fitted in a residential / commercial office / classroom (any one) Read, understand and redraw the same using drawing software. Save and print the file on A3/A4 paper.	4	CO1 CO3 CO4 CO5
6	LLO 6.1 Draw the single line drawings of any one installation of a residential, commercial office or educational classroom using drawing software. Save and print the file on A3/A4 paper.	Single line diagram of electrical installation of a residential, commercial office or educational classroom. Collect drawings of single line drawings of any one installation Read and interpret the drawing. Draw the same using drawing software Save and print the file on A3/A4 paper.	4	CO1 CO2 CO4 CO5
7	LLO 7.1 Draw the single line drawings of Panel layout diagram like Distribution panel in the laboratory/ electrical meter room/ workshop (any one)	Visit to electrical laboratory and workshop Draw Panel layout diagram like Distribution panel in the laboratory/ electrical meter room/ workshop (any one) on sketchbook Draw the same electrical panel layout diagram at above place using drawing software, Prepare and draw single line diagram of above panel layouts Save and print the file on A3/A4 paper.	4	CO1 CO3 CO5
8	LLO8.1 Draw the single line drawings of Panel layout diagram like Distribution panel in the laboratory/ electrical meter room/ workshop (any one) using drawing software Save and print the file on A3/A4 paper.	Visit to 11 KV substation of the institute or nearby small scale industry having outdoor/indoor switch yard - Observe, and sketch, outdoor/indoor switch yard , layout of equipment with specifications on sketch book Draw the same using drawing software Prepare and draw single line diagram of above panel layouts Save and print the file on A3/A4 paper	4	CO1 CO3 CO5

9	LLO9.1 Draw the wiring diagram of any one equipment Star Delta semiautomatic Starter, DOL Starter using layer concept using drawing software Save and print the file on A3/A4 paper.	Trace wiring of anyone of the following Star Delta semiautomatic Starter, DOL Starter Draw using freehand on sketchbook Draw the wiring diagram of any one equipment using layer concept using drawing software. Save and print the file on A3/A4 paper.	2	CO1 CO2 CO3 CO5
10	LLO 10.1 Draw single line diagram of any 132 KV or 400 KV substations using drawing software Save and print the file on A3/A4 paper.	Single line diagram for different substation layouts. Collect single line diagram of any 132 KV or 400 KV substations. Read and interpret drawing. Draw the same using drawing software Save and print the file on A3/A4 paper	2	CO1 CO3 CO4 CO5
11	LLO11.1 Draw block diagram of any one type of power plant layout using drawing software Save and print the file on A3/A4 paper.	Draw block diagram of any one type of power plant layout By freehand on sketch book. Draw the same using drawing software Save and print the file on A3/A4 paper.	2	CO1 CO3 CO5
12	LLO12.1 Draw diagram of sequential operation of control circuits Used for functional operation of electric motors/electric devices using drawing software Save and print the file on A3/A4 paper.	Draw diagram of sequential operation of control circuits Used for functional operation of electric motors/electric devices by free hand on sketch book. (At least two circuits) Example-Operation of five electric motors working in tandem Draw the same using drawing software Save and print the file on A3/A4 paper.	2	CO1 CO2 CO3 CO5
13	LLO13.1 Draw the electrical control diagram of any two among Fridge, washing machine, air conditioner, machines used in metal turning workshop, APFC panel using drawing software Save and print the file on A3/A4 paper.	Collect, read and interpret electrical control circuit for the operations of – (any three) Fridge, washing machine, air conditioner, machines used in metal turning workshop, APFC panel etc. Redraw the electrical control diagram of any two using drawing software Save and print file	4	CO1 CO3 CO4 CO5
14	LLO14.1 Draw ladder diagram used for operation of any industrial process using drafting software Save and print the file on A3/A4 paper.	Collect existing ladder diagram used for operation of any industrial process Draw ladder diagram of above using drafting software Save and print the file on A3/A4 paper	4	CO1 CO3 CO5

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G. P. Co-ordinator
G. P. Mumbai

VI. Suggested Micro Project / Assignment/ Activities for Specific Learning / Skills Development (Self Learning): (Minimum 5)

Following is the list of proposed student activities like

1. Contact a design engineer, understand the use of computer aided drawings in profession.
2. Visit to an industrial workshop collect various electrical drawings.
3. Visit to 11 KV substation of the institute or nearby small scale industry having outdoor/indoor switch yard, Observe, and sketch, outdoor/indoor switch yard, layout of equipment with specifications.
4. Collect existing ladder diagram used for operation of any industrial process.
5. Collect the list of latest software used for Electrical Engg. Drawing.

VII. Specification Table: Not Applicable

VIII. Assessment Methodologies/Tools

Formative assessment (Assessment for Learning)

- Rubrics for continuous assessment based on process and product related performance indicators (50 marks)

Summative Assessment (Assessment of Learning)

End term examination, Viva-voce, Workshop performance (50 marks)

IX. Suggested COs - POs Matrix Form

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	-	1	3	2	2	2	-	3	-
CO2	3	-	1	2	2	2	2	1	3	-
CO3	3	-	1	2	1	2	2	-	3	-
CO4	3	-	1	2	1	2	2	2	3	-
CO5	3	-	1	2	1	2	2	1	3	-

Legends: - High:03, Medium:02, Low:01, No Mapping: --

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 CDC Co-ordinator
 G. P. Mumbai

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Libre CAD user manual	https://wiki.librecad.org/index.php/LibreCAD_users_Manual	-----
2	Electrical Engineering Drawing	S. K. Bhattacharya, New Age International Publisher, Second Edition, Reprint 2005	81-224-0855-9
3	Control of Electrical Machines	S. K. Bhattacharya, Brijinder Singh, New Age International Publisher, First Edition, 1996	8122409970
4	Graphical Symbols used in Electro technology	IS: 2032 1976, Bureau of Indian Standards	-----
5	Electrical Engineering Drawing Part 1	SurjitSingh, Katariya S.K.Publisher, revised edition, 2001	10: 9350143054 13: 978-9350143056
6	Electrical Engineering Drawing Part 2	SurjitSingh, Katariya S.K.Publisher	10: 9350143216 13: 978-9350143216
7	Electrical Engineering Drawing	C. R. Dargan, Computech Publications Limited, 2 nd edition 2010	8173180032, 9788173180033
8	Practical Troubleshooting of Electrical Equipment and Control Circuits	Mark Brown, Jawahar Rawtani, Dinesh Patil, Elsevier Publisher, 2004	0080480284, 9780080480282
9	Handbook of Electrical Motor Control Systems	Eswar, Tata McGraw-Hill Education, 1990	0074601113, 9780074601112

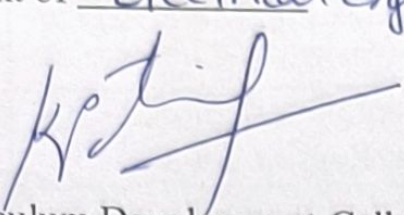
E-References:

1. https://wiki.librecad.org/index.php/LibreCAD_users_Manual
2. <https://www.autodesk.in/campaigns/autocad-tutorials>
3. <https://www.youtube.com/watch?v=6gYLGt9DEqs> An Introduction to AutoCAD Electrical
4. <https://www.youtube.com/watch?v=Ua2IK-PCfUU> for single line diagram
5. <https://www.youtube.com/watch?v=Z05xughGNZ8> AutoCAD Electrical Tutorial | Panel Drawings

Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organisation
1	Dr. Dilip Lulekar	HOD , Electrical Engineering	Govt. Polytechnic Nagpur
2	Mrs. Swati Kadam	Manger, Electrical Engineering	Siemens
3	Dr. Vijay Rathod	Lecturer , Mechanical Engineering	Govt. Polytechnic Mumbai
4	Mr. Ishwar N. Khuspe	Lecturer In Electrical Engineering	Govt. Polytechnic Mumbai
5	Ms. Minakshi B. Shirsat	Lecturer In Electrical Engineering	Govt. Polytechnic Mumbai

Coordinator, 
Curriculum Development,
Department of Electrical Engg.


I/C, Curriculum Development Cell


Head of Department
Department of Electrical Engg.


Principal

