

GOVERNMENT POLYTECHNIC MUMBAI

Academically Autonomous Institute, Government of Maharashtra

Teaching and Examination Scheme (P23)

With effect from AY 2023-24

Programme: Diploma in Electrical Engineering (Sandwich Pattern) Term / Semester – III

S. N.	Course Title	Course Type	Course Code	Total IKS Hrs for Sem	Learning scheme					Credits	Assessment Scheme														
					Actual Contact Hrs/Week			Self Learning Hrs/Week	Notional Learning Hrs/Week		Paper Duration (Hrs)	Theory						Based on LL & TL				Based on Self Learning		Total Marks	
																		Practical							
					CL	TL	LL					FA TH	SA TH	Total		FA-PR		SA-PR		SLA					
																						T1	T2		Max
								Max	Max		Max			Min	Max	Min	Max	Min	PR	OR	Min	Max	Min		
1	DC Machine & Transformer	DSC	EE23 104	1	4	-	2	-	6	3	2.30	20	20	60	10	100	40	25	10	25#	-	10	-	-	150
2	Electrical Circuit & Network	DSC	EE23 105	1	4	2	2	-	8	4	2.30	20	20	60	10	100	40	25	10	25#	-	10	-	-	150
3	Electrical Transmission & Distribution	DSC	EE23 106	1	4	-	2	-	6	3	2.30	20	20	60	10	100	40	25	10	-	25#	10	-	-	150
4	Electrical Measurement and Transducer	DSC	EE23 107	1	4		2	2	8	4	2.30	20	20	60	10	100	40	25	10	-	25#	10	25	10	175
5	C Programming	AEC	EE23 501	-	1	-	2	1	4	2	-	-	-	-	-	-	-	25	10	25@	-	10	25	10	75
6	Electrical Workshop Practices	SEC	EE23 603	-	-	-	4	2	6	3	-	-	-	-	-	-	-	50	20	50#		20	25	10	125
7	Universal Human Values II	VEC	UV23 302	4	1	-	-	1	2	1	-	-	-	-	-	-	-	-	-	-	-	-	50	20	50
	Total			6	18	2	14	6	40	20		80	80	240		400		175		125	50		125		875

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.

Course Category : Discipline Specific Course Core (DSC) : 4, Discipline Specific Elective (DSE) : 0, Value Education Course (VEC) : 1, Intern./Apprenti./Project./Community (INP) : 0, Ability Enhancement Course (AEC) : 1, Skill Enhancement Course (SEC) : 1, Generic Elective (GE) : 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 Electrical Engineering (Sandwich Pattern)													
Course Code: EE23 104						Course Title : D.C. Machine & Transformer							
Compulsory / Optional: Compulsory													
Teaching Scheme and Credits						Examination 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	25#	-	-	150

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 20 marks each conducted during the term.
2. SA-TH represents the end term examination.

I. Rationale : This subject is intended to explain facts, concepts, working, operations & constructional details of machines like DC Machines and transformers at later stage. Students will be able to analyze the characteristics of d.c. Machines, transformer and qualitative parameters of these machines.

Also knowledge of this course is essential to study the further courses such as Testing and Maintenance of Electrical Equipments, Switchgear and Protection, Generation and Distribution of Electrical Energy. The knowledge & the skills obtained will be helpful in discharging duties such as supervisor, controller & R & D technician.

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 operations & constructional details of DC Machines & Transformers with functions of each parts. 2) Apply speed controlling & testing methods for DC machines & Transformers.

III. Course Outcomes: The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

D.C. Machines & Transformers (EE23 104)

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CDC Co-ordinator
G. P. M. G.
(Approved Copy)

P-23scheme

CO1	Identify constructional details of DC machine.
CO2	Evaluate performance of DC generator.
CO3	Evaluate performance of DC motor and appreciate various types of special DC Motor.
CO4	Analyze the performance of single phase transformer.
CO5	Select three phase transformer for given application
CO6	Select auto transformer, isolation transformer & instruments transformer for given application.

Course Content Details:

Unit No.	Learning Outcome	Topics / Sub-topics
1	TLO1.1 State the principle of Electromechanical Energy Conversion TLO1.2 Identify different parts of DC machine TLO1.3 Explain working principle of DC Generator TLO1.4 Draw performance characteristics of different types of DC Generators. TLO1.5 List the losses in DC generator.	1. D.C. Generator. 1.1 Principle of Electromechanical Energy Conversion 1.2 DC generator: construction, parts, materials and their functions. 1.3 Types of Armature winding- Lap and Wave windings. 1.4 Working principle of DC generator, E.M.F. Equation. 1.5 Characteristics of DC generators 1.6 Armature reaction. 1.7 Commutation, methods to improve commutation. 1.8 Total losses in DC generator. (Simple Numerical on above topics) Course Outcome : CO1, CO2 Teaching Hours :12 hrs Marks: 12
2	TLO2.1 Explain working of DC Motor TLO2.2 Describe meaning and significance of Back E.M F. TLO2.3 Calculate performance of DC Motor TLO2.4 Draw performance characteristics of different types of DC Motors and accordingly state their applications TLO2.5 Enlist and explain speed control of DC Motor TLO2.6 Justify the need of DC Motor Starter. TLO2.7 Calculate Losses and efficiency of DC motor. TLO2.8 Describe circuit diagram of BLDC motor.	2.D.C.Motor 2.1 Principle of operation of DC motor, Fleming's left hand rule, Types of DC motors. 2.2 Concept and significance of back emf. 2.3 Torque expression, voltage equation, and speed regulation of DC motor. 2.4 Characteristics & applications of DC motor, (shunt, series, compound) 2.5 Speed control of DC shunt and series motor: Flux and Armature control. 2.6 Starters of DC motor- Necessity, Three point starter. 2.7 Brushless DC Motor (BLDC) - Basic circuit diagram, Basic construction, Advantage and comparison of BLDC motor over DC motor, Application of BLDC. (Simple Numerals on above) Course Outcome: CO3 Teaching Hours : 12 Marks : 12
3	TLO3.1 Explain working of single phase transformer with sketches TLO3.2 Describe constructional details of	3. Single Phase Transformer 3.1 Transformer: Principle of operation 3.2 Types of transformers: Shell type and core type.

	Transformer TLO3.3 Classify the transformer based on various methods TLO3.4 Derive the EMF equation of transformer and transformation ratio TLO3.5 Explain Performance of Transformer on no load, resistive, inductive, capacitive load with phasor diagrams TLO3.6 Develop approximate equivalent circuit of transformer TLO3.7 Conduct different tests on single phase transformer to determine its performance TLO3.8 Solve numerical with respect to Performance of single phase transformer.	3.3 Construction: Parts and functions, materials used for different parts: CRGO, CRNGO, HRGO, amorphous cores 3.4 Construction: Parts and functions, materials used for different parts: CRGO, CRNGO HRGO, amorphous cores 3.5 EMF equation of transformer: Derivation, Voltage transformation ratio. 3.6 Concept of ideal transformer. 3.7 Transformer on No-load and on-load phasor diagram. 3.8 Magnetic leakage. 3.9 Equivalent circuit of transformer: Equivalent resistance and reactance. 3.10 Voltage regulation and Efficiency: Direct loading, OC/SC method. 3.11 kVA rating of transformer. 3.12 All day efficiency. 3.13 Polarity of transformer (Simple Numerical on above topics) Course Outcome: CO4 Teaching Hours : 20 Marks: 18
4	TLO4.1 Compare Single Three phase transformer with bank of three single phase transformers TLO4.2 Sketch the different types of connections of 3 Phase transformer including vector groups TLO4.3 State the various cooling methods of transformer TLO4.4 State the need of parallel operation of transformers & conditions for it	4. Three Phase Transformer 4.1 Concept of three phase transformer and its comparison with bank of three single phase transformers 4.2 Distribution & Power transformers. 4.3 Cooling methods & three phase transformers Connections. 4.4 Three phase transformers connections as per IS:2026 (part IV)-1977. 4.5 Vector groups 4.6 Three phase to two phase conversion (Scott Connection), 4.7 Need of parallel operation of three phase transformer. 4.8 Conditions for parallel operation. 4.9 Concept of energy efficient transformer. Course Outcome: CO5 Teaching Hours : 12 Marks: 12
5	TLO5.1 Compare ordinary two winding transformer and Autotransformer. TLO5.2. State the applications of autotransformer TLO5.3 State the applications of Isolation Transformer. TLO5.4 State the purpose and precautions to be taken while using Instrument Transformers	5. Special purpose Transformer 5.1 Single phase and three phase auto transformers: Construction, working and applications. 5.2 Isolation transformer: Constructional Features and applications. 5.3 Instrument Transformers: Construction, working and applications of Current transformer and Potential transformer. Course Outcome: CO6 Teaching Hours : 04 Marks: 06

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

Sr No	Laboratory outcomes	Laboratory Experiment	Number of hrs.	Relevant COs
1	LLO1.1 Demonstrate constructional parts of DC Machines.	To identify the constructional parts of DC Machines.	02	CO1
2	LLO2.1 Plot O.C.C. of D.C. Generator.	To plot O.C.C. of D.C. Generator.	02	CO2
3	LLO3.1 Plot Load characteristic of DC shunt generator.	To plot Load characteristic of DC shunt.	02	CO2
4	LLO4.1 Control speed of DC shunt motor.	Speed control of DC shunt motor by i) above normal speed control method ii) Below normal speed control method.	04	CO3
5	LLO5.1 Reverse rotating directions of DC shunt motor.	To reverse rotating directions of DC shunt motor.	02	CO3
6	LLO6.1 Find performances of DC shunt motor.	Load test on DC shunt motor & calculation of efficiency, output, torque etc.	04	CO3
7	LLO7.1 Perform O.C. & S.C. test on single phase transformer.	To perform O.C. & S.C. test on single phase transformer for finding efficiency & regulation of transformer.	04	CO4
8	LLO8.1 Perform the direct loading test on single phase transformer.	Determine the efficiency and voltage regulation of single phase transformer by direct loading.	02	CO4
9	LLO9.1 Demonstrate the constructional details of distribution and power transformer.	To demonstrate the constructional details of distribution and power transformer. (based on a visit to transformer manufacturing or repairing industry)	04	CO5
10	LLO10.1 Perform parallel operation of Single phase transformer.	Parallel operation of single phase transformer.	04	CO5
11	LLO11.1 To connect three phase transformers winding in Y/D	Three-Phase Transformer Connections.	02	CO5

V. List of Tutorial

NIL

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

NIL

VII. Specification Table:

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	D.C. Generator	04	04	04	12
2	D.C. Motor	02	04	06	12
3	Single Phase Transformer	04	08	06	18
4	Three Phase Transformer	04	04	04	12
5	Special Purpose Transformer	02	06	--	06
Total		14	26	20	60

V. Assessment Methodologies/Tools

VI. 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, Practical Examination, Viva-voce (50 marks)

VII. 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	2	2	1	3	1	1	-	3	2	2
CO2	3	2	3	3	1	1	3	3	2	2
CO3	3	2	3	3	1	1	3	3	2	2
CO4	3	2	3	3	1	1	3	3	2	2
CO5	3	2	3	3	1	1	3	3	2	2
CO6	3	2	3	3	1	1				

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

3

VIII. Suggested Learning Materials / Books

Sr. No.	Author	Title	Publisher
1	G.C. Garg & P.S. Bimbhra.	Electrical Machines, Vol-I, II	Khanna Book Publishing House, New Delhi. ISBN: 978-9386173-447, 978-93-86173-607
2	Theraja B.L.,	Electrical Technology Vol-II	S. Chand and Co. Ltd., New Delhi. ISBN: 9788121924375
3	Bhattacharya S. K.	Electrical Machines.	McGraw Hill Education, New Delhi. ISBN: 9789332902855
4	Kothari D. P. and Nagrath I. J.	Electrical Machines.	McGraw Hill Education. New Delhi. ISBN: 9780070699670
5	Mehta V. K. and Mehta Rohit,	Principles of Electrical Machines.	S. Chand and Co. Ltd., New Delhi. ISBN: 9788121930888
6	Bandyopadhyay M. N.	Electrical Machines Theory and Practice.	PHI Learning Pvt. Ltd., New Delhi. ISBN: 9788120329973 Vi
7	Mittle V.N. and Mittle Arvind.	Basic Electrical Engineering.	McGraw Hill Education, New Delhi. ISBN: 9780070593572

IX. Learning Websites & Portals.

1. www.nptel.com
2. www.electrical4u.com
3. www.electrical-energing-portal.com
4. www.learnerstv.com

X. Academic Consultation Committee/Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organisation
1	Mr. Prathamesh Gaonkar.	Senior R & D Engineer.	Siemens Kalwa Works, 48, Thane - Belapur Rd, MIDC INDL Area, Airoli, Navi Mumbai.
2	Dr. S.V.Bhangale	HOD Electrical Engg.	Govt. Polytechnic, Awasari.
3	Prof. L.S. Patil	Selection Grade lecturer	Govt. Polytechnic Nasik.
4	Name of Faculty: 1. A.K. Dhulshette 2. Dr. P.N.Padghan (Curriculum Content Designer)	Selection Grade lecturer Selection Grade lecturer	Govt. Polytechnic Mumbai.

Coordinator,
Curriculum Development,
Department of Electrical Engineering

I/C, Curriculum Development Cell

Head of Department
Department of Electrical Engineering

Principal

Programme : Diploma in Electrical Engineering (Sandwich Pattern)													
Course Code: EE23 105						Course Title :Electrical Circuit & Network							
Compulsory / Optional: Compulsory													
Teaching Scheme and Credits						Examination Scheme							
CL	TL	LL	SLH	NLH	Credits	FA-TH		SA-TH (2.30Hrs.)	FA-PR	SA		SLA	Total
						T1	T2			PR	OR		
4	2	2	--	8	4	20	20	60	25	25#	--	--	150

Total IKS Hrs. for course: 1

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 30 marks each conducted during the term.
2. SA-TH represents the end term examination.

I. Rationale : Rationale: Knowledge of Electrical Circuits is essential in maintaining the electrical equipment. Understanding the layout of electrical circuits, their functioning and behaviour lays a foundation stone for an electrical engineer. This course will help the students to use the principles of circuit analysis in designing, maintaining the electrical circuits of equipment & wiring installations and discharge their duties as a supervisor where ever needed.

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) Apply basic principles of electrical engineering to solve the simple electrical engineering problems
2) Apply principles and basic laws of electrical engineering for solving electric circuit.

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

CO1	Describe the different parameters of single-phase series AC circuits, their interrelationships and behavior.
CO2	Describe the different parameters of single-phase parallel AC circuits, their interrelationships and behavior.
CO3	Describe the different parameters of polyphase AC circuits, their interrelationships and behavior.
CO4	Apply different circuit analysis techniques and theorems to solve basic circuit problems.

Course Content Details:

Unit No.	Learning Outcome	Topics / Sub-topics
1	Course Outcome: CO 1 TLO1.1 State Instantaneous equation for voltage and current of ac quantity. TLO1.2 Explain vector representation of alternating quantity: i) Rectangular form ii) Polar form Solve the Numerical on form conversion TLO1.3 State and explain A.C through pure resistance alone:- Expression of voltage, current and power, waveforms of v, i & p, phasor diagram TLO1.4 State and explain A.C through pure inductance alone:- Expression of voltage, current and power, waveforms of v, i & p, phasor diagram TLO1.5 State and explain A.C through pure capacitance alone:- Expression of voltage, current and power, waveforms of v, i & p, phasor diagram TLO1.6 State and explain Waveforms, phasor diagram and expression of voltage, current and power, impedance triangle, nature of power factor in R-L, R-C, R-L-C series circuits. TLO1.7 Solve the Numerical on Waveforms, phasor diagram and expression of voltage, current and power, impedance triangle, nature of power factor in R-L, R-C, R-L-C series circuits TLO1.8 State concept Power triangle:- active power, reactive power and apparent power Define and state causes of Electrical accident. TLO1.9 State Resonance in R-L-C series circuit TLO1.10 Solve the Numerical on Resonance in R-L-C series circuit TLO1.11 State & Explain Graphical Representation of Resonance, resonance curve, Quality (Q) Factor of series resonant circuit.	1. Single Phase AC Series Circuits 1.1 Instantaneous equations for voltage and current of ac quantity 1.2 Vector representation of alternating quantity: ➤ Rectangular form ➤ Polar form (Numerical on form conversion) 1.3 A.C through pure resistance alone:- Expression of voltage, current and power, waveforms of v, i & p, phasor diagram. 1.4 A.C through pure inductance alone:- Expression of voltage, current and power, waveforms of v, i & p, phasor diagram. 1.5 A.C through pure capacitance alone:- Expression of voltage, current and power, wave forms of v, i & p, phasor diagram. 1.6 Waveforms, phasor diagram and expression of voltage, current and power, impedance triangle, nature of power factor in R-L, R-C, R-L-C series circuits (Numerical) 1.7 Power triangle:- active power, reactive power and apparent power. 1.8 Resonance in R-L-C series circuit (Numerical) 1.9 Graphical Representation of Resonance, resonance curve, Quality (Q) Factor of series resonant circuit. Course Outcome: CO1 Teaching Hours: 16 Marks: 18 (R-04, U-04, A-10)

2	Course Outcome: CO 2 TLO2.1 Define Concept of susceptance, admittance and conductance TLO2.2 Solve AC parallel circuit by vector or phasor method, Admittance method and vector algebra. (Numerical on above) TLO2.3 Explain Series equivalent of parallel circuit. TLO2.4 Explain Parallel equivalent of series circuit TLO2.5 State & explain Parallel Resonance, Q-factor. TLO2.6 Solve Numerical on Parallel Resonance, Q-factor. TLO2.7 Explain Graphical representation of parallel resonance. TLO2.8 Comparison of series and parallel resonance	2. Single phase Parallel circuits 2.1 Concept of susceptance, admittance and conductance 2.2 Solving AC parallel circuit by vector or phasor method, Admittance method and vector algebra. (Numerical on above) 2.3 Series equivalent of parallel circuit. 2.4 Parallel equivalent of series circuit 2.5 Parallel Resonance, Q-factor (Numerical). 2.6 Graphical representation of parallel resonance. 2.7 Comparison of series and parallel resonance Course Outcome: CO.2 Teaching Hours 12 Marks: 12(R-04, U-04, A-04)
3	Course Outcome: CO 3 TLO3.1 Explain Principle of generation of 3-ϕ alternating emf. TLO3.2 State Advantages of Polyphase circuit over single phase circuit. TLO3.3 State & Explain Phase Sequence. TLO3.4 State Types of three phase connections-Star connection and delta connection. TLO3.5 State & Explain Concept of balanced and unbalanced load TLO3.6 State Relation between phase and line quantities of star connection. TLO3.7 State Relation between phase and line quantities of delta connection. TLO3.8 Solve Numerical on balanced load only	3. Polyphase circuits 3.1 Principle of generation of 3-ϕ alternating emf. 3.2 Advantages of Polyphase circuit over single phase circuit. 3.3 Phase Sequence. 3.4 Types of three phase connections-Star connection and delta connection. 3.5 Concept of balanced and unbalanced load 3.6 Relation between phase and line quantities of star connection. 3.7 Relation between phase and line quantities of delta connection. (Numerical on balanced load only) Course Outcome: CO.3 Teaching Hours :10 Marks: 10(R-04, U-02, A-04)

4	Course Outcome: CO 4 TLO4.1 State & explain Mesh analysis Solve Numerical on Mesh analysis (numerical on DC Circuits only) TLO4.2 State & explain Nodal analysis using voltage and current sources TLO4.3 Solve Nodal analysis using voltage and current sources TLO4.4 State & explain Superposition Theorem TLO4.5 Solve Numerical on Superposition Theorem sources (numerical on DC Circuits only) TLO4.6 State & explain Thevenin's Theorem TLO4.7 Solve Numerical on Thevenin's Theorem. (numerical on DC Circuits only) TLO4.8 State & explain Norton's Theorem TLO4.9 Solve Numerical on Norton's Theorem. (numerical on DC Circuits only) TLO4.10 State & explain Maximum Power Transfer Theorem TLO4.11 Solve Numerical on Maximum Power Transfer Theorem (numerical on DC Circuit only) TLO4.12 State & explain Thevenin's Theorem TLO4.13 Solve Numerical on Maximum Power Transfer Theorem. (numerical on DC Circuits only) TLO4.14 State & explain Reciprocity Theorem TLO4.15 Solve Numerical on Reciprocity Theorem. (numerical on DC Circuits only) TLO4.16 How to solve only AC Network	4. Network Analysis-Techniques (DC Circuits) and Theorems 4.1 Mesh analysis 4.2 Nodal analysis using voltage and current sources 4.3 Superposition Theorem. 4.4 Thevenin's Theorem. 4.5 Norton's Theorem. 4.6 Maximum power transfer Theorem. 4.7 Reciprocity theorem. 4.8 Introduction to AC Network (How to solve only)(4.1to4.7 numerical on DC Circuits only) Course Outcome: CO.4 Teaching Hours: 22 Marks: 20
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IV. List of Laboratory Experiment.

Sr No	Laboratory outcomes	Laboratory Experiment	Number of hrs.	Relevant COs
1	LLO1.1 Draw phasor diagram & identify the circuit for i) $X_L > X_C$, ii) $X_L < X_C$, iii) $X_L = X_C$	To carryout analysis of given RLC series circuit	4	CO.1
2	LLO2.1 Perform & verify with theoretical calculation of total admittance , currents and power factor	To find out the current flowing through each component in RC parallel circuit	2	CO.2

3	LLO3.1 Practically verify the Reciprocity theorem for the network with the theoretical calculations.	Verification of Reciprocity Theorem	2	CO.3
4	LLO4.1 Practically verify the Superposition theorem for the network with the theoretical calculations.	Verification of Superposition Theorem	2	CO.4
5	LLO5.1 Practically verify the Thevenin's theorem for the network with the theoretical calculations.	Verification of Thevenin's Theorem	2	CO.4
6	LLO6.1 Practically verify the Maximum Power Transfer theorem for the network with the theoretical calculations.	Verification of Maximum Power Transfer Theorem	4	CO.4
7	LLO7.1 Practically verify the Norton's theorem for the network with the theoretical calculations.	Verification of Norton's Theorem	2	CO.4
8	LLO8.1 Perform & verify with theoretical calculation of total admittance, currents and power factor	To find out the current flowing through each component in LC parallel circuit	4	CO.4
9	LLO9.1 Perform & verify with theoretical calculation of total admittance, currents and power factor	To find out the current flowing through each component in parallel RLC circuit	4	CO.2

I. List of Tutorial

Sr No	Tutorial Titles	Number of hrs.	Relevant COs
1	Numerical on form conversion	02	CO 1
2	Solve RL, RC and RLC series circuit	04	CO 1
3	Solve problems on resonance in RLC series circuit	02	CO1
4	Solve AC parallel circuit by vector or phasor method, admittance Method and vector algebra	04	CO2
5	Solve problems on Parallel Resonance and Q-factor	04	CO2
6	Solve problems on balanced three phase star and delta connection	02	CO3
7	Solve the problems on superposition theorem	04	CO4
8	Solve the problems on Thevenin's and Norton's Theorem	04	CO4
9	Solve the problems on Maximum Power transfer theorem and Reciprocity theorem	02	CO4

10	Solve problems on resonance in RLC series circuit	02	CO4
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II. Suggested Micro Project / Assignment/ Activities for Specific Learning / Skills Development (Self Learning): Nil

III. Specification Table:

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Single Phase AC Series Circuits	4	4	10	18
2	Single phase Parallel circuits	4	4	4	12
3	Polyphase circuits	4	2	4	10
4	Network Analysis-Techniques (DC Circuits) and Theorems	4	2	14	20
Total		16	12	32	60

IV. 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)

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

VI. Suggested Learning Materials / Books

Sr.No	Author	Title	Publisher
1	M.N. Mittal	Fundamentals of Electrical Engineering	Everest Publishing House
2	B. L. Theraja and A. K. Theraja	Electrical Technology (Volume I)	S. Chand and Co. Ltd.
3	V. K. Mehta and Rohit Mehta	Basic Electrical Engineering	S. Chand and Co. Ltd.
4	Edward Hughes	Electrical Technology	ELBS Publications

VII. Learning Websites & Portals

Sr.No	Link / Portal	Description
1	https://archive.nptel.ac.in/courses/108/105/108105159/	Videos on basic concept, DC circuit, Capacitor and ac fundamental
2	https://www.khanacademy.org archive.nptel.ac.in > courses > 108/105/108105053	Videos on basic concept Representation of Sinusoidal Signal by a Phasor and Solution of Current in R-L-C Series Circuits
3	www.electricaltechnology.org	Superposition Theorem - Circuit Analysis with Solved Example
4	www.allaboutcircuits.com > textbook > direct-current	Introduction to Network Theorems for Circuit Analysis

3

VIII. Academic Consultation Committee/Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organisation
1	Mrs. Asmita S Marathe	Additional Executive Engineer	MSEDL, Thane
2	Mr. Vijay F Badguajr	Dy. Manager(Maintenance)	Graphite Vicarb India Ltd, Nasik
3	Mrs. R U Patil	LEE	VPM Polytechnic, Thane
4	Mrs. Rajitha T B	LEE	Bharti Vidyapeeth, Navi Mumbai
5	Miss .A. V. Patil	LEE	Govt. Polytechnic Mumbai
6	Dr. Mahesh S. Narkhede	LEE	Govt. Polytechnic Mumbai
7	Miss. M. B. Shirsat	LEE	Govt. Polytechnic Mumbai

M.B. Shirsat
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Coordinator,
Curriculum Development,
Department of Electrical Engineering

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Head of Department
Department of Electrical Engineering

K. Patil

I/C, Curriculum Development Cell

N

Principal

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K. Patil

CDC Co-ordinator

Programme: Diploma inDiploma in Electrical Engineering (Sandwich Pattern)													
Course Code: EE23 106						Course Title: Electrical Transmission & Distribution							
Compulsory / Optional:Compulsory													
Teaching Scheme and Credits						Examination Scheme							
CL	TL	LL	SLH	NLH	Credits	FA-TH		SA-TH (3Hrs.)	FA-PR	SA		SLA	Total
						T1	T2			PR	OR		
4	-	2	-	6	3	20	20	60	25	-	25#	-	150

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: This is the subject where the principles of electrical transmission and distribution systems are studied. The electricity is generated in bulk at remote places and transmitted to long distances and then distributed in cities, villages and to industry. Knowledge of components of electrical transmission and distribution system and their functions is necessary for understanding power system performance. Study of load dispatch and HVDC transmission is also important for working in power sector.

II. Industry / Employer Expected Outcome: The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain the proper functioning of the electrical transmission and distribution systems.

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

CO1	Explain various transmission and distribution systems.
CO2	Calculate the performance of transmission & distribution systems.
CO3	Compare between HVDC and HVAC systems.
CO4	Describe the Substation and the Power factor improvement.

Course Content Details:

Unit	Unit Outcomes (in Cognitive Domain)	Topics and Sub-topics
1	TLO 1.1 Describe with sketches the features of the given type of electric supply system. TLO1.2 Interpret the implications of the voltage levels in the given transmission system TLO1.3.Enlist different types of conductors used in the transmission lines. TLO1.4 Describe with sketches the given type of overhead conductor based on the given criteria. TLO1.5 Describe with sketches the method of erection of the given type of line supports. TLO1.6 Describe with sketches the types and properties of specified line insulators. TLO1.7 Calculate the string efficiency for the specified string of the given type of insulator. TLO1.8 Explain specified effects occurring in the given type of transmission line. TLO1.9 Explain necessity of Transposition of conductors. TLO1.10 Calculate the sag for the specified height of the given type of supports.	Transmission line components and parameters: 1.1 Introduction to line component. 1.2 Types of conductors- Al, Cu, ACSR, AAC, AAAC, ACSR, HTLS conductor and solid stranded bundle conductors. 1.3 Line supports – requirement, type. Construction of supporting structures, Towers, monopoles 1.4 Spacing between conductors. 1.5 Concept of length of span. 1.6 Sag in overhead line. 1.7 Calculations of sag: effect of wind and ice loading (Simple Numerical) 1.8 Types of insulators – Pin, Suspension, Strain, Stay, Shackle. 1.9 Safety factor, puncture and ultimate strength. 1.10 Potential distribution over a string of suspension insulator. 1.11 Simple numerical on string efficiency. 1.12 Constants of transmission lines 1.13 Skin effect 1.14 Transposition of conductor and necessity. 1.15 Proximity effect Course Outcome: CO1 Teaching Hours : 14 Marks: 12 (R- 4, U- 4, A-4)
2	TLO2.1 Describe with sketches the given line parameters and types of specified lines. TLO2.2 Interpret the performance of the specified short line. TLO2.3 Interpret the performance of the specified medium line.	Performance of transmission line: 2.1 Classification of transmission line, Important terms, regulation & efficiency of T/L 2.2 Short transmission line, eq. circuit representation & phasor diagram & analysis. (Simple Numerical) 2.3 Medium transmission line, End condenser

Course Content Details:

Unit	Unit Outcomes (in Cognitive Domain)	Topics and Sub-topics
1	TLO 1.1 Describe with sketches the features of the given type of electric supply system. TLO1.2 Interpret the implications of the voltage levels in the given transmission system TLO1.3.Enlist different types of conductors used in the transmission lines. TLO1.4 Describe with sketches the given type of overhead conductor based on the given criteria. TLO1.5 Describe with sketches the method of erection of the given type of line supports. TLO1.6 Describe with sketches the types and properties of specified line insulators. TLO1.7 Calculate the string efficiency for the specified string of the given type of insulator. TLO1.8 Explain specified effects occurring in the given type of transmission line. TLO1.9 Explain necessity of Transposition of conductors. TLO1.10 Calculate the sag for the specified height of the given type of supports.	Transmission line components and parameters: 1.1 Introduction to line component. 1.2 Types of conductors- Al, Cu, ACSR, AAC, AAAC, ACSR, HTLS conductor and solid stranded bundle conductors. 1.3 Line supports – requirement, type. Construction of supporting structures, Towers, monopoles 1.4 Spacing between conductors. 1.5 Concept of length of span. 1.6 Sag in overhead line. 1.7 Calculations of sag: effect of wind and ice loading (Simple Numerical) 1.8 Types of insulators – Pin, Suspension, Strain, Stay, Shackle. 1.9 Safety factor, puncture and ultimate strength. 1.10 Potential distribution over a string of suspension insulator. 1.11 Simple numerical on string efficiency. 1.12 Constants of transmission lines 1.13 Skin effect 1.14 Transposition of conductor and necessity. 1.15 Proximity effect Course Outcome: CO1 Teaching Hours : 14 Marks: 12 (R- 4, U- 4, A-4)
2	TLO2.1 Describe with sketches the given line parameters and types of specified lines. TLO2.2 Interpret the performance of the specified short line. TLO2.3 Interpret the performance of the specified medium line.	Performance of transmission line: 2.1 Classification of transmission line, Important terms, regulation & efficiency of T/L 2.2 Short transmission line, eq. circuit representation & phasor diagram & analysis. (Simple Numerical) 2.3 Medium transmission line, End condenser

	TLO2.4 Calculate the transmission efficiency for the specified given type of short transmission line. TLO2.5 Define the specified terms and effects of transmission lines. TLO2.6 Describe Corona and its related terms.	method, Nominal T and π circuit representation & analysis, phasor diagram. 2.4 Ferranti effect. 2.5 Introduction of Long transmission line. 2.6 Corona • Factors affecting corona. • Important terms • Advantages and disadvantages of corona. • Methods of reducing corona effect Course Outcome: CO1, CO2 Teaching Hours : 10 Marks: 12 (R- 4, U- 4, A- 4)
3	TLO3.1 Explain the specified features of the given type of extra high voltage transmission line. TLO3.2 Describe with sketches the layout of given HVDC transmission line as per the given criterion. TLO3.3 Explain functioning of load dispatch centers. TLO3.4 Explain the given feature of the Flexible AC Transmission line. TLO3.5 Compare between EHVAC & HVDC. TLO3.6 Interpret the implications of the voltage levels in the given transmission system.	EHVAC, HVDC and Load Dispatch Center: 3.1 EHVAC transmission system, advantages, disadvantages. 3.2 HVDC transmission system, applications, configuration & parts of HVDC system, types of HVDC system, standard rated voltage, present status and growth prospects of HVDC transmission system 3.3 Compare between EHVAC & HVDC 3.4 National, Regional and State Load Dispatch Centers. 3.5 Introduction to grid and different voltage levels for HVAC and HVDC. 3.6 Introduction to Line In Line Out system (LILO). Course Outcome: CO1, CO3 Teaching Hours : 10 Marks: 10 (R- 4, U- 4, A- 2)
4	TLO4.1 Describe with sketches the circuit components of the AC distribution system. TLO4.2 Describe the factors to be considered for design of specified feeder and distributor TLO4.3 Describe with sketches the types of different schemes for given type of distribution system. TLO4.4 Calculate the sending end and receiving end voltage of the given AC distribution system. TLO4.5 Describe with sketches the components and their functions for the given type of distribution sub-station.	Distribution system: 4.1 Components of Distribution system - distributor, feeder and service mains. 4.2 Classification of distribution system. 4.3 A.C. distribution. 4.4 Connection scheme of distribution system - radial and ring mains system. 4.5 Factors to be considered for design Considerations. 4.6 Voltage drop calculation for feeder fed at one end for single phase and three phase four wire A.C. balanced system. Course Outcome: CO1, CO2

	TLO4.6 Describe with neat sketches the single line diagram of a given type of distribution sub-station.	Teaching Hours : 12 Marks:12 (R- 4, U- 4, A- 4)
5	TLO5.1 Describe with sketches the specified underground cable based on the given criteria. TLO5.2 Describe with sketches the specified underground cable laying methods based on the given criteria. TLO5.3 Compare between Underground cables and overhead lines. TLO5.4 Classify different types of cables based on voltage levels.	Underground Cables: 5.1 Introduction and requirement. 5.2 Classification of Cable. 5.3 Cable conductor. 5.4 Cable construction. 5.5 Cable insulation, metallic sheathing and mechanical protection. 5.6 Comparison with overhead lines. 5.7 Methods of cable laying. Course Outcome: CO1 Teaching Hours: 06 Marks: 06 (R- 4, U- 2, A- 0)
6	TLO6.1 Classify the Substations based on the given data/situation. TLO6.2 Interpret the symbols used in the given single line diagram. TLO6.3 Draw the pole mounted distribution substation for the given data or situation. TLO6.4 Draw the layout diagram of 33KV/11KV substation for the given data or situation. TLO6.5 Draw the layout diagram of 132 KV or 220 KV substation for the given data or situation. TLO6.6 Describe the Causes and disadvantages of low power factor. TLO6.7 Describe with sketch the specified P.F. improvement using static capacitor based on the given criteria. TLO6.8 Describe the advantage of P.F. improvement	Substation, Tariffs & Power factor improvement: 6.1 Introduction, classification of substations according to service & location. 6.2 Typical single line connection diagrams of Substation layouts, 11 KV/0.415KV pole mounted distribution substation, 33KV/11KV substation, 132 KV or 220 KV substations. 6.3 Substation equipment and auxiliary systems, their functions, types (AIS, GIS, Hybrid) and substation earthing. 6.5 Causes and disadvantages of low power factor 6.6 P.F. improvement using static capacitor. 6.7 Advantage of P.F. improvement. Course Outcome: EE23 106.4 Teaching Hours : 08 Marks: 08 (R- 4, U- 4, A- 0)

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IV. List of Laboratory Experiment.

Sr No	Laboratory outcomes	Laboratory Experiment	Number of hrs.	Relevant COs
1	LLO1. Identify different types of transmission and distribution line supports based on specified criterion.	Identify different types of transmission and distribution line supports. Prepare report.	4	CO1
2	LLO2.1. Calculate String efficiency for the specified string of the given type of insulator. LLO2.2. Calculate the sag for the specified height of the given type of supports.	Assignment on string efficiency and sag.	2	CO2
3	LLO3.1 Compare between HVDC and HVAC systems based on specified parameters.	Compare between HVDC and HVAC systems.	2	CO3
4	LLO4.1 Write report with diagram on 11KV/0.415KV pole mounted distribution substation	Identify different components of 11KV/0.415KV pole mounted distribution substation. Prepare report and draw sheet.	2	CO1
5	LLO5.1 Write report on different types of transmission line conductors	Identify different types of transmission line conductors. Prepare report.	2	CO1
6	LLO6.1 Write report on different types of overhead line insulators.	Identify different types of overhead line insulators. Prepare report.	2	CO1
7	LLO7.1 Solve the numerical with given values	Assignment on transmission efficiency.	2	CO2
8	LLO8.1 Write report on different components of HVDC terminal substation.	Identify different components of HVDC terminal substation. Prepare report.	4	CO1
9	LLO9.1 Write report on particular visit.	Visit to HVDC terminal substation and Prepare report.	6	CO1
10	LLO10.1 Write report on various method of 3- Ph, 3- wire AC and 3- Ph, 4- wire AC Distribution system.	Prepare report on various method of 3- Ph, 3- wire AC and 3- Ph, 4- wire AC Distribution system.	2	CO1
11	LLO11.1 Solve the numerical with given values	Assignment on voltage drops in the distributor.	2	CO2
12	LLO12.1 Write report on various voltage control methods used in the power system.	Prepare report on various voltage control methods used in the power system.	2	CO4

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 G. P. Mumbai

13	LLO13.1 Write report on different types of underground cables.	Identify different types of underground cables. Prepare report.	2	CO1
14	LLO14.1 Write report on various methods of improvement of power factor in A.C. System.	Prepare report on various methods of improvement of power factor in A.C. System.	2	CO4
15	LLO15.1 Write report on particular visit.	Visit/ Identify different components of 132 or 220 or 400 KV outdoor substation. Prepare report and draw sheet.	6	CO4

I. Specification Table:

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Transmission line components and parameters	4	4	4	12
2	Performance of transmission line	4	4	4	12
3	EHVAC, HVDC and Load Dispatch Center	4	4	2	10
4	Distribution system	4	4	4	12
5	Underground Cables	4	2	0	06
6	Substation & Power factor improvement	4	4	0	08
Total		24	22	14	60

II. 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 (25marks)

III. Suggested COs - POs Matrix Form

Course	Programme Outcomes (POs)	Programme Specific Outcomes (PSOs)
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Outcomes (COs)	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	-	2	2	3	3	3	2	3
CO2	3	2	3	2	2	3	3	1	-	1
CO3	1	1	-	-	2	1	3	3	2	3
CO4	3	1	1	1	2	3	3	3	2	3

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

IV. Suggested Learning Materials / Books

S.N.	Title	Author	Publisher
1	Elements of Power System	V. K. Mehta and Rohit Mehta, S. Chand and Co. Ltd.	ISBN-10: 9788121924962 ISBN-13: 978-8121924962
2	Transmission & Distribution	J. B. Gupta , S. K. Khanna	ISBN-13: 978-9350143629 ISBN-10: 8185749574
3	Electrical Power System	Dr. S. L. Uppal ,Prof. S. Rao , Khanna Publisher, New Delhi.	ISBN-10: 8174092382 ISBN-13: 978-8174092380
4	A course in Electrical Power	Soni, Gupta, Bhatnagar , Dhanpat Rai & Sons	ISBN-10: 8177000209 ISBN-13: 978-8177000207
5	A course in Power plant Engineering	Dr. V. M. Domkundwar, Dhanpat Rai & Sons	ISBN-10: 8177001957 ISBN-13: 978-8177001952
6	Electrical Power system Design	M.V.Deshpande , Tata Mcgraw-Hill	ISBN-10: 9780074515754 ISBN-13: 978-0074515754

V. Learning Websites & Portals

S.N.	Link/Portal	Description
1	https://ndl.iikgp.ac.in	Videos on basic concept
2	https://www.electrical4u.com/electrical-engineering-articles/transmission,distribution,substation,cables/	Transmission & Distribution and their numerical
3	https://nptel.ac.in (Prof.D.P.Kothari)	Videos on Transmission & Distribution concept
4	https://swayam.gov.in	Videos on Transmission & Distribution concept

5	www.khanacademy.org	Transmission & Distribution
6	www.youtube.com	Videos on basic concept

VI. Academic Consultation Committee/Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organization
1	Mr. Kuldeepsingh Rajput	Dy. Executive Engg	MAHATRANSCO
2	Mrs. J.D. Waghmare	Lecturer in Electrical Engg	G.P. Mumbai
3	Ms. Nilima Suryawanshi	Lecturer in Electrical Engg	G.P. Nagpur
4	Mrs. D.R. Kirtane	Lecturer in Electrical Engg	G.P. Mumbai

Coordinator,

Curriculum Development,

Department of Electrical Engineering

Head of Department

Department of Electrical Engineering

I/C, Curriculum Development Cell

Principal

Programme : Diploma in Electrical Engineering (Sandwich Pattern)													
Course Code: EE23 107						Course Title :Electrical Measurement and Transducer							
Compulsory / Optional: Compulsory													
Teaching Scheme and Credits						Examination Scheme							
CL	TL	LL	SLH	NLH	Credits	FA-TH		SA-TH (2.30Hrs.)	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:

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

I. Rationale: The course Electrical & Industrial Measurement is an important subject in the field of Electrical Engineering. This subject deals with the technique of measuring Voltage, current and wattage by the indicating type of instruments. The technique of measurement of Electrical power in single phase and three phase circuits will be studied here. Measurement of energy and calibration and adjustment of energy meters will be studied under this subject. Prior to above the working principle construction of all type of measuring instruments like indicating, integrating and recording type will also be studied here. Users of potentiometers and other resistance measuring instruments are included under this subject. The course also covers Concept, Classification, Construction and working of some of major transducers.

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:
Troubleshoot electrical and industrial measuring instruments used for laboratory and industrial measurements

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

CO1	Define terminology used in electrical measuring instruments.
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CO2	Demonstrate various constructional parts of electrical measuring instruments with working principles.
CO3	Measure electrical quantities with various instruments.
CO4	Explain calibration procedure of electrical measuring instruments.
CO5	Select suitable transducer for particular application.

Course Content Details:

Unit No.	Learning Outcome	Topics / Sub-topics
1	TLO1.1 State purpose of measurement & significance of measurement TLO 1.2 State effects of electricity employed in electrical measuring instruments TLO1.3 explain Characteristics of Instruments TLO 1.4 State Types of static error TLO1.5 Explain classification of instruments TLO 1.6 State different types of torque in Analog Instruments	1.Basic Concepts: 1.1 Purpose of measurement & significance of measurement. 1.2 Various effects of electricity employed in electrical measuring instruments. 1.3 Characteristics of Instruments: <u>Static</u> - Accuracy, Precision, sensitivity, resolution, Static error, Repeatability, Drift, Dead zone. <u>Dynamic</u> - speed of response, Lag, Fidelity, Dynamic error. 1.4 Types of static error- Gross, Systematic, Random. 1.5 Classification of instruments based on – a) Electrical effects. b) Nature of operation. c) Limits of permissible errors. 1.6 Different types of torque in Analog Instruments. Course Outcome : CO1 Teaching Hours :8hrs Marks: 8
2	TLO2.1 Explain with sketches Construction and principle of specified instrument. TLO2.2 Explain methods of production of torque.. TLO2.3 Solve example on extension range of ammeter and voltmeter. TLO2.4 Explain methods of extension range of ammeter and voltmeter. TLO 2.5 Explain Errors and their compensation in Extension of Range of Ammeter and Voltmeter. TLO 2.6 State how Calibration of Ammeter and Voltmeter is achieved.	2. Measurement of Current, Voltage and Resistance: 2.1 Construction and principle of PMMC, MI & Electro-dynamometer type Instrument. Merits and demerits. 2.2 Methods of production of torque. 2.3 Extension of Range of Ammeter and Voltmeter. (Simple Numerical) 2.4 Different methods of Extension of Range of Ammeter and Voltmeter. 2.5 Errors and their compensation. 2.6 Calibration of Ammeter and Voltmeter. 2.7 Use and Advantages of Clamp on meter, Digital ammeters and voltmeters

	TLO 2.7 State advantages and application of Clamp on meter, Digital ammeters and voltmeters. TLO 2.8 State Classification of Resistance. TLO 2.9 Explain Methods of Measurements of Low, Medium and High Resistance TLO 2.10 Explain Measurement of Earth resistance. TLO 2.11 State advantages of Digital Multimeter TLO 2.12 Explain Measurement of Power factor meter, and Frequency meter	2.8 Classification of Resistance- Low, Medium and High. 2.9 Methods of Measurements of Low, Medium and High Resistance (Potentiometer, Wheatstone's bridge and Megger) 2.10 Measurement of Earth resistance- Earth tester (Analog & Digital) 2.11 Advantages of Digital Multimeter, 2.12 Measurement of Power factor meter, and Frequency meter(Analog & Digital) Course Outcome: CO2,CO3 Teaching Hours : 14 Marks : 14
3	TLO 3.1 Define power in A.C.circuit. TLO 3.2 State and explain working of dynamometer type wattmeter TLO 3.3 Explain errors and compensation of dynamometer type wattmeter TLO 3.4 Explain Poly phase wattmeter. TLO 3.5 Explain measurement of power in 3 phase circuit for balanced and unbalanced load. TLO 3.6 Explain Effect of power factor variation on wattmeter readings in two wattmeter method. TLO 3.7 Explain Measurement of reactive power in three phase balanced load by one wattmeter method and two wattmeter method. TLO 3.8 Compare digital wattmeter with analog wattmeter.	3.Measurement of Power: 3.1 Concept of power in A.C. Circuit. 3.2 Principle and Construction of dynamometer type wattmeter 3.3 Errors and their compensation. 3.4 Poly phase wattmeter. 3.5 Measurements of power in 3 phase circuit for balanced and unbalanced load 3.6 Effect of power factor variation on wattmeter readings in two wattmeter method. 3.7 Measurement of reactive power in three phase balanced load by one wattmeter method and two wattmeter method. 3.8 Advantages of Digital Wattmeter over analog wattmeter Course Outcome: CO2, CO3 Teaching Hours : 12 Marks: 12

4	TLO 4.1 Describe working of induction type energy meters. TLO 4.2 Explain working of single phase and three-phase bidirectional (Import-Export type) energy meter. TLO 4.3 List errors in energy measurement & compensation methods. TLO 4.4 Describe Calibration of single phase and three-phase energy meter. TLO 4.5 State Advantages of Electronic energy meter over mechanical energy meter. TLO 4.6 Describe working of Tri vector meter.	4.Measurement of Electrical Energy: 4.1 Concept of electrical energy. 4.2 Constructional feature & principle of working of single phase and three-phase electronic energy meter. Merits and demerits of each 4.3 Constructional feature & principle of working of single phase and three-phase bidirectional (Import-Export type) energy meter. 4.4 Different types of errors and their compensation. 4.5 Calibration of single phase and three-phase energy meter. 4.6 Tri vector meter- Construction, working and Applications. Course Outcome: CO2, CO3, CO4 Teaching Hours : 12 Marks: 10
5	TLO5.1 State facts and concept of instrumentation. TLO5.2 Explain classification of Transducers. TLO5.3 Explain Construction and working principles of specified Transducers. TLO5.4 Differentiate between given types of transducers with sketches TLO 5.5 Select relevant transducer for given application TLO5.6 Prepare specifications for given transducers	5.Transducers: 5.1 Facts and concept of Instrumentation 5.2 Concept of Transducers 5.3 Classification of Transducers • Primary and Secondary Transducers • Electrical and Mechanical Transducers • Analog and Digital Transducers • Active and Passive Transducers 5.4 Construction and working principles of Transducers • Resistive, Inductive and capacitive transducers • Strain gauge (No derivation only formula) • Types of strain gauges:- unbounded, bounded, Semiconductor • Bourden tube, Bellows, Diaphragm. • LVDT • Piezoelectric transducer, photoconductive cell, photovoltaic cells, • load cell. • RTD, Thermistor, Thermocouple.

		- Pyrometers (Radiation, optical, Photoelectric) ultrasonic temperature Transducers. - Electromagnetic and turbine flow meter, ultrasonic flow meter. Course Outcome: CO5 Teaching Hours :14 Marks: 16
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IV. List of Laboratory Experiment.

The Term work consist of minimum 10 experiments with approx. number of hours required with corresponding CO's

Sr No	Laboratory outcomes	Laboratory Experiment	Number of hrs.	Relevant COs
1	LLO1.1 Demonstrate any one type of static error in given instrument	To demonstrate any one type of static error in given instrument	02	CO1
2	LLO2.1 Give the constructional details of PMMC and MI instruments.	To Demonstrate the constructional details of PMMC and MI instruments.	04	CO2
3	LLO3.1 Measure high value of DC current by low range ammeter with shunt	To measure high value of DC current by low range ammeter with shunt.	04	CO3
4	LLO4.1 Calibrate and use single phase energy meter.	To calibrate and use single phase energy meter.	02	CO4
5	LLO5.1 Measure temperature using thermocouple	To measure temperature using thermocouple.	04	CO5
6	LLO6.1 Measure active and reactive power in three phase balanced load by one wattmeter method.	To measure active and reactive power in three phase balanced load by one wattmeter method.	04	CO3
7	LLO7.1 Measure active power in three phase balanced and unbalanced load by two wattmeter method LLO7.2 Observe the effect of power factor variation on wattmeter reading.	To measure active power in three phase balanced and unbalanced load by two wattmeter method and observe the effect of power factor variation on wattmeter reading.	04	CO3
8	LLO8.1 Measure high value of DC voltage by low range voltmeter with multiplier	To measure high value of DC voltage by low range voltmeter with multiplier.	04	CO2
9	LLO9.1 Measure medium resistance by Wheatstone's bridge.	To measure medium resistance by Wheatstone's bridge.	04	CO3

10	LLO10.1 Measure insulation resistance by Megger	To measure insulation resistance by Megger.	04	CO3
11	LLO11.1 Measure Earth resistance by earth tester. (Substation / Earth pit.)	To measure Earth resistance by earth tester. (Substation / Earth pit.)	04	CO3
12	LLO12.1 Calibrate and use three phase energy meter.	To calibrate and use three phase energy meter.	04	CO4
13	LLO13.1 Plot characteristics of Thermistor	To plot characteristics of Thermistor	04	CO5
14	LLO14.1 Plot characteristics of RTD.	To plot characteristics of RTD.	04	CO5
15	LLO15.1 Measure liner displacement by LVDT	To measure liner displacement by LVDT	04	CO5

V. List of Tutorial

NIL

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

1. Collect makes and types of measuring instruments and interpret the meaning of technical specification.
2. Collect the information related to degree of accuracy & types of instruments based on class of accuracy.
3. Collect information on biomedical instruments and know procedure to use them.
4. Identify type of instrument from symbols marked on the instrument
5. Measure the value of earth resistance of generator back up & lab installation.
6. Visit industrial exhibitions/fairs organised e.g. NIMA, IEEMA and prepare report .
7. Collect photograph of PMMC, MC and MI instrument showing internal parts.
8. Collect photographs of electronic energy meter /smart energy meter and prepare report on it.

VII. Specification Table:

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Basic Concepts	4	4	--	8
2	Measurement of Current, Voltage and Resistance	2	6	6	14

3	Measurement of Power	2	6	4	12
4	Measurement of Electrical Energy	2	4	4	10
5	Transducers	4	6	6	16
Total		14	26	20	60

VIII. 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)

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	2	2	2	2	2	2	2	1	1
CO2	3	3	2	3	2	2	2	3	3	3
CO3	3	3	2	3	2	2	2	3	3	3
CO4	3	3	2	3	2	2	2	3	2	2
CO5	3	3	2	3	2	2	2	3	2	2
Legends: - High:03, Medium:02, Low:01, No Mapping: --										

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X. Suggested Learning Materials / Books

Sr.No	Author	Title	Publisher
1	A. K. Sawhney	Electrical & Electronics Measurements & Instrumentation	Dhanpat Rai & sons, New Delhi ISBN:9780000279744
2	N. V. Suryanarayana	Electrical Measurements & Measuring Instruments	S. Chand & co. New Delhi ISBN: 8121928116
3	C. T. Baldwin	Fundamentals of Electrical Measurements	Lyall book Dept. Delhi
4	R. K. Rajput	Electrical Measurements & Measuring Instruments	S. Chand & co. New Delhi ISBN: 9789385676017
5	E.W.Golding,F.C. Widdis	Electrical Measurement & Measuring Instrument	Reem publication New Delhi, 2011 ISBN-10: 8190630725 ISBN-13: 978-8190630726
6	Rangan Mani& Sharma	Instrument Devices & System	Tata McGraw Hill
7	Alan Morris	Principles of Measurement & Instrumentation	Prentice Hall & India

XI. Learning Websites & Portals

Sr.No	Link / Portal	Description
1	https://ndl.iitkgp.ac.in/	Measurement of Current, Voltage and Resistance
2	https://www.electrical4u.com/electrical-engineering-articles/measurement/	Types of Instrument and meter
3	https://nptel.ac.in	A Course on Electrical and Electronic Instruments, Prof.Avishek Chatterjee, IIT Kharagpur
4	https://swayam.gov.in	Electrical Measurement and Electronic Instruments, Prof.AvishekChatterjee, IIT Kharagpur

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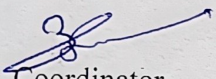
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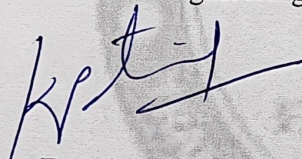
CDC Co-ordinator
G. P. Mumbai

XII. Academic Consultation Committee/Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organization
1	Mrs. Asmita M Marathe	Additional Executive Engineer	MSEDCL Thane
2	Dr. Mahesh S. Narkhede	Lecturer in Electrical Engineering	G.P. Nashik
3	Miss. Ashwini V Patil	Lecturer in Electrical Engineering	G.P. Mumbai
4	Mr. A.K. Dhulshette	Lecturer in Electrical Engineering	G.P. Mumbai

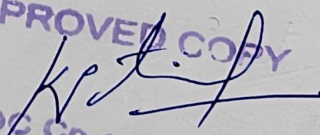

Coordinator,
Curriculum Development,
Department of Electrical Engineering


Head of Department
Department of Electrical Engineering


I/C, Curriculum Development Cell


Principal

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CDC Co-ordinator
G. P. Mumbai

Programme : Diploma in Electrical Engineering (Sandwich Pattern)													
Course Code:EE23 501						Course Title : C Programming							
Compulsory / Optional: Compulsory													
Teaching Scheme and Credits							Examination Scheme						
CL	TL	LL	SLH	NLH	Credits	FA-TH		SA-TH (3Hrs.)	FA-PR	SA PR OR		SLA	Total
1	-	2	1	4	2	-	-	-	25	25@	-	25	75

Total IKS Hrs. for course: 0

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

In today's information technology era, computer Technology plays an important role. Computer applications are all pervasive in day to day life of human being. It became compulsory to all employable to have sound knowledge of how computer works and process data and information. This subject covers from the basic concept of C to pointers in C. This course will act as "programming concept developer" for students. It will also act as "Backbone" for subjects like OOPS, VB, Windows Programming, JAVA, OOMD, etc.

II. Industry / Employer Expected Outcome

Students should be able to develop application in C programming.

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

CO1	Understand I/O statements in C
CO2	Use Conditional and iterative statements in C programs
CO3	Demonstrate arrays, strings and functions
CO4	Understand Structures and unions and Files.

Course Content Details:

Unit No.	Theory Learning Outcomes (TLO's) aligned to CO's	Topics / Sub-topics
1	TLO 1.1: Explain the different programming approaches - Procedural approach, Object Oriented approach, Event Driven approach with examples. TLO 1.2 : Explain what is structure of C with diagram and each section of the diagram. Explain the use of comments and compilation of the program. TLO 1.3: Explain Data Concepts: Variables, Constants, data types like: int, float char, double and void with different example programs. Qualifiers: short and long size qualifiers, signed and unsigned qualifiers. Declaring variables, Scope of the variables according to block, Hierarchy of data types with different example programs. TLO 1.4: Explain different operators in C - Logical , Arithmetic, Bitwise, Relational, Assignment with example programs. TLO 1.5: Explain different Input output statements - Input and output using printf() and scanf() character I/O.(Programs based on I/O) with different example programs.	Basics of C programming 1.1 Different approaches in programming: Procedural approach, Object Oriented approach, Event Driven approach. 1.2 Structure of C: Header and body, Use of comments, Compilation of a program. 1.3 Data Concepts: Variables, Constants, data types like: int, float char, double and void. Qualifiers: short and long size qualifiers, signed and unsigned qualifiers. Declaring variables, Scope of the variables according to block, Hierarchy of data types. 1.4 Operators in C: Logical , Arithmetic, Bitwise, Relational, Assignment 1.5 Basic Input output: C program structure, Input and output using printf() and scanf(), character I/O.(Programs based on I/O) Course Outcome- CO1 Teaching Hours – 03 Marks: NA
	TLO 2.1: Explain different Decision making like - If Statement, If else statement, Nesting of if-else using syntax and examples and student should be able to write programs.	Control Structures 2.1 Decision making: If Statement, If else statement, Nesting of if-else

2	TLO 2.2: Describe branching statement The switch statement with syntax and examples. TLO 2.3: Explain the looping statement While loop, Do-while loop, For loop with syntax and example programs. TLO 2.4: Describe the Ternary operator with syntax and example programs. TLO 2.5: Explain the Go to statement with syntax and example programs. TLO 2.6: Explain the use of break and continue statements with syntax and example programs.	2.2 branching: The switch statement 2.3 Looping: While loop, Do-while loop, For loop 2.4 Ternary operator 2.5 Go to statement 2.6 Use of break and continue statements Course Outcome- CO2 Teaching Hours – 04 Marks: NA
3	TLO 3.1: Explain One dimension, two dimension and multidimensional arrays with syntax and example programs. TLO 3.2: Describe and explain Array declaration with examples. TLO 3.3: Explain Array initialization with examples. TLO 3.4: Describe and explain calculating the length of an array with examples. TLO 3.5: List and explain different operations on array. TLO 3.6: List different String input/output. TLO 3.7 : List different String operations. TLO 3.8: Uses and concept of Library functions. TLO 3.9 : List different String functions (comparison, concatenation, length) with example programs TLO 3.10: User-defined functions and example programs.	Arrays, Strings and Functions 3.1 One dimension, two dimension and multidimensional arrays 3.2 Array declaration, Array initialization 3.3 Operation on array 3.4 String input/output, String operations 3.5 Concept of library functions, String functions (comparison, concatenation, length) 3.6 User-defined functions 3.7 Local & global variables, Parameter passing Course Outcome- CO3 Teaching Hours – 04 Marks: NA

	TLO 3.11: Define Local & global variables and give examples.	
4	TLO 4.1: Explain Basic Concept of Structure and Union and Files. TLO 4.2: Describe Structure declaration, initialization with examples. TLO 4.3: Explain Structure within structure with example program. TLO 4.4: Describe Structure within structure with example programs. TLO 4.5: Describe Array of Structure. TLO 4.6: Describe and Explain Union.	Structure and Union and Files 4.1 Basic Concept 4.2 Structure declaration, initialization 4.3 Structure within structure 4.4 Nested Structures 4.5 : Array of Structure 4.6 Union Course Outcome- CO4 Teaching Hours:04 Marks: NA

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

Sr No	Practical / Tutorial / Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant Cos
1	LLO1.1: Able to write program to find out number is odd or even. LLO1.2: Able to write program to find out factorial value of a number. LLO1.3: Able to write program to check a number is prime number or not.	Program based on Input/output statement. a) To find out number is odd or even. b) To find out factorial value of a number. c) To check a number is prime number or not.	2	CO1
2	LLO 2.1: Understand and write program to find whether the input number is even or odd. LLO 2.2: Understand and write program to find whether the	Program using control structures: Branching a) To find whether the input number is even or odd.	4	CO1

	number entered is positive or negative. LLO2.3: Understand and write program to find the greatest number among three numbers using nested if LLO2.4: Program that asks user an arithmetic operator (,,+,,-,,,*,** or ,/,/) and take two operands and perform the corresponding calculation on the operands using switch case	b) To find whether the number entered is positive or negative. c) To find the greatest number among three numbers using nested if d) Program that asks user an arithmetic operator (,,+,,-,,,*,** or ,/,/) and take two operands and perform the corresponding calculation on the operands using switch case		
3	LLO3.1: Understand and write program to find the sum of first n natural numbers where n is entered by user. LLO3.2: Understand and write program to Find Number of Digits in a Number. LLO3.3: Understand and write program to check whether a number is palindrome or not. LLO3.4: Understand and write program to Generate Multiplication Table.	Program using control structures: Looping(using loops) To find the sum of first n natural numbers where n is entered by user. b) To Find Number of Digits in a Number. c) To check whether a number is palindrome or not. d) To Generate Multiplication Table.	4	CO3
4	LLO4.1: Understand and write program to accept values in 2-Dimensional 3 by 3 arrays and display the sum of all the elements. LLO4.2: Understand and write program to compute the sum of all elements stored in an array using pointers	Program for arrays – a) to accept values in 2-Dimensional 3 by 3 arrays and display the sum of all the elements. b) Program to compute the sum of all elements stored in an array using pointers	4	CO3
5	LLO5.1: Able to write Program using array of strings.	Program using array of strings.	2	CO3
6	LLO6.1: Able to write Program to perform different operations on	Program to perform different operations on string.	2	CO3

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P-23scheme

	string.			
7	LLO7.1: Understand and write program using function (call by value) to swap to numbers LLO7.2: Understand and write program to find square of given number using functions.	Program using function (call by value) a) to swap to numbers b) to find square of given number	4	CO4
8	LLO8.1: Understand and write program using structure and union to store information of 3 students (Name, Roll No, Marks) LLO8.2: Understand and write program to store information of 2 employees (empid, name, salary) and display the details of the employee having salary greater than Rs. 5000.	Program using structure and union a) To store information of 3 students (Name, Roll No, Marks) b) To store information of 2 employees (emp_id, name, salary) and display the details of the employee having salary greater than Rs. 5000.	4	CO4
9	LLO9.1: Able to write Program to print following pattern * ** ****	Write a program to print following pattern * ** ****	4	CO4
Total			30	

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

1. Bank Management System
2. Calendar Application Project
3. Contact Management System
4. Departmental Store Management
5. Personal Diary Management
6. Quiz Game Project

VI. Specification Table:

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Basics of C programming	NA			
2	Control Structures				
3	Arrays, Strings and Functions				

4	Structure and Union	
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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. 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	-	2		1
CO2	1	3	2	2	-	-	1		2	-
CO3	-	2	-	-	3	1	2	2	-	-
CO4	2	-	2	--	-	2	-	3	-	-
Legends: - High:03, Medium:02, Low:01, No Mapping: --										

IX. Suggested Learning Materials / Books

Sr. No	Author/ Publisher	Title	ISBN
1	Brian W. Kernighan, Dennis Ritchie Prentice Hall	The C Programming language	978-0131103627
2	E. Balgurusamy The Mc-Graw Hill	Programming in ANSI C	978-9339219666

3	Yashawant Kanetkar BPB Publications	Let us C	978-9387284494
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X. Learning Websites & Portals

Sr.No	Link / Portal
1	https://www.w3schools.com
2	https://www.tutorialspoint.com
3	www.cppinstitute.org/
4	https://www.programiz.com › c-programming
5	https://www.javatpoint.com › c-programming-language-tutorial
6	https://beginnersbook.com › 2015/02 › simple-c-programs
7	https://www.udemy.com › c-programming-for-beginners

XI. Academic Consultation Committee/Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organization
1	Mr. Bharat Kadam	Assistant Engg.	MSETCL, Pen, Dist Raigad
2	Mr. Prashant Anwekar	Director	Innovative Energy Services, Mumbai
3	Ms. Namrata A. Wankhade	Lecturer in Information Technology	Government Polytechnic Mumbai
4	Ms. Minakshi B. Shirsat	Lecturer in Electrical Engg.	Government Polytechnic Mumbai

M.B. Shirsat
Coordinator,
Curriculum Development,
Department of Electrical Engineering

[Signature]
Head of Department
Department of Electrical Engineering

[Signature]
I/C, Curriculum Development Cell

[Signature]
Principal

Programme : Diploma Electrical Engineering(Sandwich Pattern)													
Course Code : EE 23 603						Course Title: Electrical Workshop Practices							
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		
0	-	4	2	6	3	-	-	-	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

Diploma engineers are supposed to have in depth knowledge of basics of their branch and must have sufficient exposure to the various skills associated with the technicians who are going to help them in executing various tasks in the work field.

This course of workshop practice is intended to provide them enough hands on practice so as to inculcate the ground level understanding of the tasks associated with erection and maintenance of electrical installation and fault detection and repair of domestic electrical appliances.

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 types of wires, cables, protective and control devices to be employed for a particular application.
- ii. Detect the nature of fault in a device and be able to either repair or replace it.
- iii. Checking the control panel of machines, ups earthing arrangement and other protective and control devices.

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

CO1	Understand Safety norms
CO2	Understand specification ,ratings ,capacity of various safety devices
CO3	Develop the skill of fault finding.
CO4	Develop the skill of fault repairing.
CO5	Develop the capacity to identify irreparable domestic electrical devices /parts and select their replacements.

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 Able to identify different tools used in work shop. LLO 1.2 Understand the working of tools and precautions to be taken while using tools LLO1.3 Able to decide specifications and mandatory certification of required tools and manufacturers of tools	To demonstrate (Video Demonstration) the use of safety devices and precaution while working on electrical installation. Collect data regarding standard specifications of tools.	2	1
2	LLO 2.1 Study of general safety precautions ,IE rules and other standard practices	Prepare charts,study rules ,list rules and standard practices	2	1
3	LLO 3.1 Study of electrical safety devices such as hand gloves, gumboot ,insulating mats, line tester, life safety materials with their specification and testing as per IS code of testing.	Video demonstration ,sample study, actual testing in the laboratory	2	1,2
4	LLO 4.1 Study of different types of wiring systems LLO 4.2 Study of different types of cables/wires/sockets/switches/switch boards.	Demonstrate types by visiting various sites/videos. Do market survey for collecting specifications, standard sizes, make and price and samples.	4	2,5
5	LLO 5.1 Study of different types of earthing systems suitable for residential and commercial installation LLO5.2 Study of construction and working of MCB/ELCB/RCCB	Draw diagrams of types and layout of earthing, Visit the site of earthing ,observe the layout measure the earth resistance. Draw the constructional features of MCB/ELCB/RCCB visit the site of installation ,observe the		1,2,5

		connections. In the laboratory connect the MCB/ELCB/RCCB in sample circuit create fault and observe the operation	10	
6	LLO6.1 To understand construction, working fault finding and repair of different types of geysers water heaters.	Draw the constructional features of various types, study their working, dismantle the device available in the laboratory and reassemble it, identify the points of electrical faults and suggest remedies for the same.	6	2,3,4,5
7	LLO7.1 To understand construction, working fault finding and repair of different types of electric ovens LLO7.2 To understand construction, working fault finding and repair of different types of induction heaters LL07.3 construction, working fault finding and repair of domestic mixer grinder/food processor. LL07.4 To understand construction working and fault finding in different types of lighting arrangements used in residential unit.	Draw the constructional features of various types, study their working, dismantle the device available in the laboratory and reassemble it, identify the points of electrical faults and suggest remedies for the same.	18	2,3,4,5
8	LLO8.1 To understand construction, working fault finding and repair of ceiling/table/exhaust fans LL08.2 To understand construction, working fault finding and repair of different types of water coolers and room air coolers	Draw the constructional features of various types, study their working, write standard specifications, dismantle the device available in the laboratory and reassemble it, identify the points of electrical faults and suggest remedies for the same.	8.	2,3,4,5
5	LLO9.1 To understand construction, working fault finding and repair of home refrigerator LL09.2 To understand construction, working fault finding and repair of electrical faults in washing machines	Draw the constructional features of various types, study their working, write standard specifications observe the electrical circuitry, disconnect and connect it in the device available in the laboratory , identify the points of electrical faults and suggest remedies for the same.	8	2,3,4,5
6	LL10.1 Battery charging and maintenance procedure LL010.2 Fault detection and repair of electrical faults in UPS/inverters	Prepare battery maintenance chart, measure important features Draw the block diagram and circuit diagram, visit the site of installation and observe the	4	2,3,4,5

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G. P. Mumbai

		connection, prepare the chart for probable faults their identification process and remedies, connect the UPS for a given installation		
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V. Suggested Micro Project / Assignment/ Activities for Specific Learning / Skills Development (Self Learning):

1. Prepare sample wiring diagram set for a housing unit having one hall, one bed room and a kitchen .
2. Visit the actual site of electrical installation work being done and observe the process and prepare report.
3. Collection of catalogue for standard ratings of wire cables ELCB/MCB/RCCB and accessories
4. Visit electrical appliance repair units, interact and observe the various tasks , collect relevant information and prepare report.
5. Prepare a chart of routine and preventive maintenance for various domestic electrical appliances.
6. Visit inverter/UPS repairing unit, observe the procedure and prepare report.

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 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: --

VI. 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

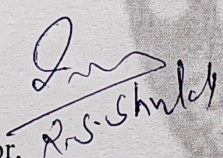
VII. Learning Websites & Portals

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-	Wiring system

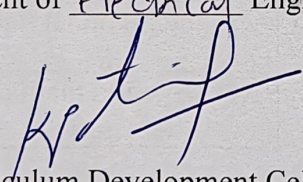
	systems-electrical-wiring-methods.html	
6	www.nptel.com	Basics
7	www.electrical4u.com	Wiring circuits
8	www.khanacademy.org	Basics
9	https://ndl.iitkgp.ac.in/	Electrical Materials

VIII. 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	Mr. Sunil Ashtaputre	Lecturer in Electrical Engineering	Government Polytechnic, Pune
3	Mr R S Shukla	Lecturer in Electrical Engineering	Government Polytechnic, Mumbai
4	Mrs D R Kirtane	Lecturer in Electrical Engineering	Government Polytechnic, Mumbai

Coordinator, 
Curriculum Development,
Department of Electrical Engineering

Head of Department
Department of _____ Engineering


I/C, Curriculum Development Cell


Principal

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G. P. Mumbai

Programme : Diploma in ME/CE/EE/CO/IF/IS/EC/RT/LT/LG (Sandwich Pattern), AIML												
Course Code: UV23302						Course Title : Universal Human Values-II						
Compulsory / Optional: Compulsory												
Learning Scheme and Credits						Assessment Scheme						
CL	TL	LL	SLH	NLH	Credits	FA-TH	SA-TH	FA- PR	SA		SLA	Total
									PR	OR		
01	-	-	01	02	01	-	-	-	-	-	50	50

Total IKS Hrs. for course: 04

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, *# Online 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.

Rationale:

Universal Human Values-I course helped students to discover themselves and comfortably connect with their peers. Students experienced living in harmony with nature by visiting a nature park and participating in activities like tree plantation, beach cleaning and institute cleaning.

The Universal Human Values-II course is more focused on helping students to create health consciousness and experience living in harmony with their bodies. It will help to create a holistic perspective based on self-exploration about themselves, family, society and nature. Patriotic values will be imbibed by learning about the constitution of India.

Through experiential learning, an ideal personality will be developed to excel in the field of work. It is the journey of thought process from 'my family' to 'world family'. In essence, it promotes human values, inculcates ethics and develops the best citizens.

Industry / Employer Expected Outcome:

To demonstrate value based behavior at the workplace.

Course Outcomes:

On completion of this course, Students will be able to achieve & demonstrate the following COs on completion of course based learning

CO1	Understand and appreciate duties and civic responsibilities.
CO2	Develop health consciousness.
CO3	Develop respect and recognition for others' work.
CO4	Understand the importance of living in harmony with nature and society.
CO5	Internalize lessons from great souls who exemplified nobility, courage and righteousness.
CO6	Develop holistic well-being through balancing individual needs with common good.

Course Content Details:

Sr. No.	CO	Activity	Related Value/s	Methodology of Implementation	Student's Role	Mentor's role	Resources Required
1	CO1 CO3	Read preamble of constitution and list down duties and responsibilities of a citizen	Patriotism Integrity Loyalty Harmony Righteousness	Read preamble of constitution of India from internet website	Brainstorm to understand the importance of preamble.	Motivate students to present different stories related to Indian constitution	https://www.constitutionofindia.net/constitution_of_india/preamble
2	CO6	Prepare your own SWOT Analysis	Self-exploration, Honesty	Analysis and report writing	Thoughtfully analyze self	Explain process of SWOT analysis	Case studies
3	CO2	Student will prepare a diet chart, analyze food consumption habit-List food consumed during last 3 days and identify its nutritional effects on body	Health consciousness	Balanced diet chart preparation	Find out the ways to maintain balanced diet chart	Provide information resources	Internet websites, Professional dietician

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(P23 Scheme)

4	C03 C05	Identify 5 personalities from the areas like sports, defense, politics,, businesses and social workers who have demonstrated great spirit of integrity in their life and write a report. e.g. Rajendra singh - Water man of india, Dr. A P J Abdul kalam - scientist and former president of india. Mohammed Yunus - Bangladeshi social entrepreneur, Kapil Dev -Cricketer of the century. David Packard - Chairman of Hewlett-Packard (HP)	Integrity , respect	Information collection and analysis	Identify personalit ies and study their extraordi nary work	Guide students to identify various dimension s of the personalit y	Internet websites, Institute Library
5	C04 C06	Study the Sustainable Development Goals of the United Nations for peace and prosperity of people and the planet, now and into the future by visiting the following website: https://sdgs.un.org/goals	Social Gratitude , Empathy, Compassi on, Accountab ility	Visit the website, study history and List 17 SDGs	Study the sdg in detail (assigned to your group by mentor), prepare presentati on	Assign 17 SDGs to different groups of students	Local NGOs working for UN
6	C02 C06	Understanding Eight limbs (Ashtanga) of Yoga for gaining the best mental health. IKS hours - Cultural and spiritual history of India- eight fold path of yoga.	Health consciou sness Social gratitud e	Arrange the session of a meditation expert to understand the philosophy of Yoga.	Students will need to understan d and practice the principles of the eight limbs of yoga. Practice it daily for the best physical and mental health.	Mentors will need to provide guidance on understandi ng and practicing the principles of the eight limbs of yoga and provide feedback on students' progress.	Resource s such as yoga mats or printed material s on the eight limbs of yoga may be required.

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7	C05	1. Seven blunders told by Mahatma Gandhi and practice them as an ethic in your daily life to be a moral citizen. 2. Swami Vivekananda and his philosophy 3. Bharatratna Dr Babasaheb Ambedkar and his philosophy, teachings Any other social reformer IKS hours- Cultural history of India- Religious and Civic philosophies.	Character Humanity Sacrifice Honesty Accountability Patriotism	Select any one topic. Prepare Group presentations on selected topics.	Students will need to prepare and present a group presentation on a selected topic.	Mentors will need to provide guidance on preparing and presenting a group presentation and provide feedback on students' presentations.	
8	C03 C06	Visit websites of reputed industries and study their Corporate Social Responsibility (CSR) activities. Also arrange an interview of a successful entrepreneur.	Social Gratitude Accountability	Visit CSR section of the website of selected industry	Students will need to research and report on the CSR activities of a selected industry.	Mentors will need to provide guidance on researching and reporting on CSR activities and provide feedback on students' reports.	Access to the internet or relevant industry publications may be required.

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9	C03	Analyze behavior pattern of self and group member while performing any group activity	Harmony in behavior	List different group activities, select anyone from the list and perform it.	Students will need to analyze their own behavior and that of their group members during a group activity and record their observations.	Mentors will need to provide guidance on observing and recording behavior patterns and provide feedback on students' observations.	Guidelines for observing and recording behavior patterns may be necessary.
10	C05	Read and create abstract of biography like, 1. Ek Hota Carver 2. Biography of a yogi 3. JRD Tata 4. Mahatma Gandhi 5. Pant pratinidhi 6. Shriman Yogi	Righteousness	Visit library, find out books, read and prepare the report	Students will need to select a biography to read and create an abstract that summarizes the key ideas and messages in the biography.	Mentors will need to provide guidance and support to help students select an appropriate biography and create a well-written abstract.	Access to a library or online resources to select a biography to read and create an abstract.
11	C01 C03 C04	NDRF one day training OR Police Mitra training OR Red cross training OR Fire safety training OR Self defense training for Girls OR CPR training	Accountability Empathy	Plan training with the help of related agencies	Students will need to attend a one-day training session.	Mentors will need to provide guidance on attending the selected training session and ensuring safety.	Access to training facilities and materials may be necessary.

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Methodology:

1. The course teacher will be the mentor.
2. In consultation and under supervision of a mentor, the student/ Group of students has to complete the activity.
3. The mentor will work as a facilitator/ advisor.
4. The strategies to learn the course is "Self- Exploratory" and "Experiential Learning"
5. The onus of responsibility for completing the activities is with students.
6. **Out of eleven activities the student has to complete at least five no. of activities throughout the term. Activity number two is compulsory.**

Suggested Micro Project / Assignment/ Activities for Specific Learning / Skills

Development (Self Learning):

During self learning hours students have to register online (<https://www.mahayouthnet.in/>) for the following "Youth Leadership for Climate Action" self-paced online courses. After completion of these courses students will appear for the online exam of these courses and earn a certificate of completion. Students will submit these 4 certificates to the mentor.

Sr. No.	Unit	Marks
1	Living with Climate Change	10
2	Water Management and Climate Action	
3	Energy Management and Climate Action	05
4	Waste Management and Climate Action	05
5	Bio-cultural diversity Conservation and Climate Action	05
6	The student has to complete at least five no. of activities out of the 11 activities mentioned in the course content details throughout the term and submit the reports. Each activity carries 05 marks.	25
Total		50

**Note: 1. Unit 1 and Unit 2 are presented together and carry one certificate.
2. Unit 3,4, and 5 are individual units.**

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Assessment methodologies/Tools:**Formative Assessment(Assessment for Learning)**

The student has to complete at least **five** no. of activities throughout the term. Each activity carries 05 marks.

Criterion No.	Criterion	Max. Marks	Not Satisfactory	Good	Excellent
1	Attendance	01	0	1	1
2	Knowledge	02	0	1	2
3	Presentation / Performance	02	0	1	2
	Total	05			

Suggested CO-PO 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, Experimentation and Testing	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO1	PSO 2	PSO 3
C01	-	-	-	-	-	-	3			3
C02	-	1	1	-	-	-	1			3
C03	-	1	-	-	-	-	2			3
C04	-	1	1	-	1	-	2			3
C05	-	-	-	-	-	-	3			3
C06	-	1	1	-	-	-	2			3

Legends :- High:03, Medium:02, Low:01, No Mapping: -
 *CO PSOs mapping to be formulated at department level

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References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
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1	A Foundation Course in Human Values and Professional Ethics	R.R. Gaur, R. Sangal, G.P. Bagaria, Excel Books, New Delhi, 2010	978-8-174-46781-2
2	Human Values	A.N. Tripathy, New Age International Publishers, 2003	978-8-122-42589-5
3	Teacher's Manual - A Foundation Course in Human Values and Professional Ethics	R.R. Gaur, R. Sangal, G.P. Bagaria, Excel Books, New Delhi, 2010	-
4	Science and Humanism, Towards a Unified World View	PL Dhar, RR Gaur, Commonwealth Publications, 1992	978-8-171-69222-4
5	Education for values in schools- a framework	NCERT	
6	Value oriented education	E N Gawande	

E-References:

- 1) https://youtu.be/k0Ju1vj_BVk (The 10 Most Important Human Values)
- 2) Dr. Prakash Baba Amte- Movie
- 3) <https://youtu.be/QeogOlzG2ls> (Value of Education -short film)

E-References for mentors:

- 1) <https://www.edutopia.org/>
- 2) <https://sdgs.un.org/goals>
- 3) <https://www.mahayoulinet.in/>

Consultation Committee:

Sr. No	Name	Designation	Institute/Organisation
1	Dr. L.A. Patil	Principal (Retired)	Pratap College, Amalner
2	Dr. Nitin Deshpande	Lead Consultant	Dnyanpeeth Academy, Pune
3	Dr. Chandrakant Shahasane	Founder Trustee	Karnala Charitable Trust, Pune
4	Mr. K. V. Patil	Lecturer, Mechanical Engineering	Government Polytechnic, Mumbai
5	Mrs. P. A. Khande	Lecturer, Electronics Engineering	Government Polytechnic, Mumbai
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