GANPAT UNIVERSITY

FACULTY OF DIPLOMA ENGINEERING

Programme	Diploma in Mechanical / Civil / Automobile / Chemical / PCT / Agriculture Engineering		
Semester	I / II	Version	1.0.0.0
Effective from Academic Year	2025-26	Effective for the batch Admitted in	JULY 2025
Course code	1ES1104	Course Name	Elements of Electrical Engineering

I. TEACHING-LEARNING AND ASSESSMENT SCHEME

Course Type	Course Code	Learning Scheme						Assessment Scheme										
		Actual Contact Hrs./Week			SLH	NLH	Credits	Theory				Practical				Based on SL		Total Marks
		CL	TL	LL				FA-TH	SA-TH	TOTAL		FA-PR	SA-PR	TOTAL		SLA		
								MAX	MAX	MAX	MIN	MAX	MAX	MAX	MIN	MAX	MIN	
AEC	1ES1104	2	-	2	-	4	2	40	60	100	40	30	20	50	20	-	-	150

Abbreviation:	**CL-** Classroom Learning	**TL -** Tutorial Learning	**LL -** Laboratory Learning
	SLH - Self Learning Hours	**NLH** - Notional Learning Hours	**SLA -** Self Learning Assessment
	FA - Formative Assessment (Term work +Mid Sem Exam +Attendance)		**SA -** Summative Assessment

II. PRE-REQUISITES

Basic knowledge of Physics.

III. INDUSTRY / EMPLOYER EXPECTED OUTCOMES

Operate and Maintain Electrical Engineering Equipment for various Industrial/field applications using relevant knowledge and skills related to electrical engineering.

IV. COURSE LEARNING OUTCOMES

At the end of the course, students will be able to achieve the following course learning outcomes:

CO1. Apply fundamentals of electric and magnetic circuits for electromagnetic induction.
CO2. Apply AC fundamentals of Electrical Engineering.
CO3. Apply single phase transformer and D.C. motor for different industrial purpose.
CO4. Identify various electrical instruments and safety devices.
CO5. Know about basic electronic components and colour coding of resistor.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT:

Name of Unit	Theory Learning outcomes (TLO's) aligned to CO's	Learning Content mapped with Theory Learning outcomes (TLO's) & CO's	Marks	Hours
Unit-1 Fundamental of Electric & Magnetic properties of materials	**TLO 1.1** Definitions of EMF, Current, Potential Difference, Power, and Energy. **TLO 1.2** Ohm's Law, Kirchoff's Current Law, Kirchoff's voltage Law **TLO 1.3** Magnetic field and terms related to magnetic field - M.M.F, magnetic force, magnetic field strength, permeability, reluctance etc. **TLO 1.4** Comparison of magnetic and electric circuit.	**1.1** Define the Electrical terms. **1.2** State and apply the basic Law of the network terminology. **1.3** Define the magnetic terms. **1.4** Comparative analysis of electric and magnetic. **1.5** State and apply the Faraday's Law of electromagnetic induction.	**12**	**06**

	TLO 1.5 State Faraday's laws of electromagnetic induction.			
Unit-2 A.C. Fundamentals	**TLO 2.1** Generation of Alternating waveform and related terms. **TLO 2.2** Define cycle, frequency, periodic time, amplitude, angular velocity, or Frequency with reference to alternating emf & current. **TLO 2.3** Definitions of RMS value, average value, form factor & peak factor. **TLO 2.4** A.C. through pure Resistors, Inductors and Capacitors.	**2.1** Define the terms related to AC cycle. **2.2** Fundamentals of A.C. quantities like frequency, periodic time, amplitude, angular frequency **2.3** Analysis of A.C. waveforms like RMS value, Average value, Form factor, Peak factor **2.4** A.C. response of components Voltage-current relationships in pure R, L, and C circuits	**08**	**04**
Unit-3 Single Phase Transformer and D.C. Motor	**TLO 3.1** General construction and principle of transformers. **TLO 3.2** Emf equation and transformation ratio of transformers. **TLO 3.3** List various losses in transformers and equation of efficiency. **TLO 3.4** Applications of Transformers. **TLO 3.5** Construction and uses of auto transformers. **TLO 3.6** Construction, working principle, types, and applications of D.C. motor. **TLO 3.7** Back EMF and torque equation of D.C. Motor (without derivation) **TLO 3.8** Speed Control of D.C. shunt motor.	**3.1** Construction & Principle of Transformers Transformer parts, core types, mutual induction **3.2** EMF Equation & Transformation Ratio EMF derivation, step-up/step-down transformers. **3.3** Transformer Losses & Efficiency Core & copper losses, efficiency formula. **3.4** Applications of Transformers Power systems, voltage stabilizers, welding, testing. **3.5** Auto-Transformer Construction & UsesSingle winding, advantages, motor starting **3.6** D.C. Motor Construction & Types, Motor parts, types, applications. **3.7** Back EMF equation & Torque proportionality. **3.8** D.C. Shunt Motor Speed Control-Field control, armature resistance, voltage variation	**20**	**10**
Unit-4 Electrical Instruments and Safety	**TLO 4.1** Measuring Electrical instruments and meters. **TLO 4.2** Electric shock and safety. **TLO 4.3** Protective devices such as Fuse, MCB, ELCB.	**4.1** Types and electric circuit of electrical instruments and meters. **4.2** Electric shock and Precautions of safety. **4.3** Study and electric circuit of Protective devices such as Fuse, MCB, ELCB.	**09**	**04**
Unit-5 Electronic Components and Circuits	**TLO 5.1** Types of resistors and its colour coding.	**5.1** Identify the value of the resistor using colour coding.	**11**	**06**

	TLO 5.2 Energy band diagram, P-type, and N-type semiconductor. **TLO 5.3** PN junction diode, transistor; construction, working and applications. **TLO 5.4** Rectifier circuits	**5.2** Difference between insulator, conductor, and semiconductor. **5.3** Explain PN junction diode, transistor; construction, working and applications. **5.4** Understand the construction and working of different types of rectifier circuits.		

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL

Sr. No.	Practical/Laboratory Learning Outcome (LLO)	Practical Titles	Relevant COs
1	**LLO 1.1** Basic component identification (resistors, capacitors, inductors, diodes, transistors, relays, switches)	Identify the various electrical components use in electrical engineering	CO1
2	**LLO 1.2** Understanding voltage-current-resistance relationship.	Verify ohm's law.	CO1
3	**LLO 1.3** Understanding current distribution at a node.	To verify KCL for given Circuit.	CO1
4	**LLO 1.4** Understanding voltage drop in a closed loop.	To verify KVL for given Circuit.	CO1
5	**LLO 1.5** Observing waveform nature, polarity, frequency using CRO/ DSO.	Demonstrate difference between AC and DC using CRO/DSO.	CO2
6	**LLO 1.6** Understanding core, winding, insulation, tank, terminals of transformer.	Identify the different parts of transformer.	CO3
7	**LLO 1.7** Recognize yoke, field winding, armature, commutator, brushes of Motor.	Identify the different parts of dc machines in laboratory.	CO3
8	**LLO 1.8** Apply field control, armature resistance method practically.	Perform Speed Control of dc Motor	CO3
9	**LLO 1.9** Handling voltmeter, ammeter, wattmeter, multimeter, energy meter.	Use the various electrical instruments for measurement of electrical parameters	CO4
10	**LLO 1.10** Safety awareness and fault protection techniques.	Know the working of various domestic electrical circuit protective devices (fuse, MCB, ELCB)	CO4
11	**LLO 1.11** Demonstrate mock artificial respiration and first aid procedures to respond effectively to electrical hazards and ensure safety awareness.	Conduct mock artificial respiration and first aid exercises to learn about safety procedures of first aid in case of electrical hazards.	CO4
12	**LLO 1.12** Read and decode resistor values from colour bands.	Identify and specify different types of resistors as per colour code.	CO5
13	**LLO 1.13** Understanding diode forward and reverse bias behaviour**.**	To demonstrate V-I characteristics of PN junction diode.	CO5
14	**LLO 1.14** Learn basic rectification, observe AC to DC conversion.	Perform practical on half wave rectifier circuit and shown input and output waveforms.	CO5
15	**LLO 1.15** Study & observe improved rectification and ripple characteristics.	Perform practical on Bridge rectifier circuit and shown input and output waveforms on CRO	CO5

VII. SUGGESTED MICRO PROJECT / ASSIGNMENTS / ACTIVITIES FOR SELF LEARNING / SKILL DEVELOPMENT (SELF LEARNING)

- Demonstrate awareness of electrical safety.
- Watch NPTEL videos on Ohm's Law, Kirchhoff's Laws, AC/DC systems, Concept reinforcement through visual learning.
- Apply theoretical concepts in real or virtual environments.
- Identify and handle basic electrical components and tools.
- Demonstrate awareness of electrical safety.
- Use instruments and software for measurements and simulations.

Mini projects

- Design a working LED circuit using battery, switch, and resistor, Soldering, basic circuit assembly.
- Draw schematic diagrams of household wiring (fan, light, socket), Technical drawing, real-life application.
- Analyse an electric shock incident and report how it could be prevented of Safety awareness.

VIII. LIST OF INSTRUMENTS / EQUIPMENT / TRAINER BOARD

1	Variable DC power supply, display for voltage and current
2	D.C. Motor
3	CRO, Function generator, Digital multimeter, Power supply
4	Single phase variac
5	Lamps, Single pole one-way Switches, Single pole two-way switches, connection wires, patch chords etc.
6	Bread board with connecting wires & various logic input/output facilities.

IX. LIST OF REFERENCE BOOKS

Sr.No.	Title	Author	Publication
1	Electrical Technology vol. I & II,	B. L. Theraja	S. Chand Publication
2	Basic electronics	V. K. Mehta	S. Chand Publication
3	Basic Electrical Engineering	J. B. Gupta	S. K. Kataria & Sons
4	Electronics devices and circuit theory	Robert L. Boylestad, Louis Noshelsky	Pearson Publication

X. LINK OF LEARNING WEB RESOURCE

1	www.nptel.iitm.ac.in
2	www.electricals4u.com
3	www.vlab.co.in
4	https://ndl.iitkgp.ac.in
5	www.Howstuffworks.com

XI. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE

Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	Fundamental of Electric & Magnetic properties of materials	CO1	06	4	6	2	12
2	A.C. Fundamentals	CO2	04	4	4	0	08

3	Single Phase Transformer and D.C. Motor	CO3	10	6	12	2	20
4	Electrical Instruments and Safety	CO4	04	4	5	0	09
5	Electronic Components and Circuits	CO5	06	3	7	1	11
		Grand Total	30	21	34	5	60

XII. COs AND POs AND PSOs MAPPING

Course outcome (Cos)	**Programme Outcomes (POs)**							**Programme Specific Outcomes (PSOs)**		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	2	3	3	2	3	2	2	1
CO2	2	1	0	2	1	3	0	0	1	2
CO3	3	3	3	3	2	3	3	3	3	2
CO4	3	3	3	2	2	3	1	2	2	3
CO5	3	2	3	2	3	3	3	3	3	2

Legends: - *3- High 2-Moderate/Medium 1-Slight/Low 0-None*