Savitribai Phule Pune University
First Year of Engineering (2024 Pattern)
Course Code: ESE-102-ELE Course Name: Basic Electrical Engineering

Teaching Scheme	Credit	Examination Scheme:
Theory : 02 Hours/Week **Practical : 02 Hours/Week**	**02** **01**	**CCE : 30 Marks** **End - Semester : 70 Marks** **Term Work : 25 Marks**

Prerequisite Courses, if any: Electric charges and fields, Coulomb's laws, Voltage, Potential, Current, Ohms law, Magnetism, EMF, Faraday's Laws, Alternating current, AC Generator, Power.

Companion Course, if any: **Laboratory Practical**

Course Objectives:

To impart the fundamental knowledge of electrical engineering to all the students of various disciplines and give comprehensive idea about AC and D C circuit analysis, working principles and applications of basic electric machines. The aim is also to familiarize students with different wiring components, wiring schemes and electricity bill.

Course Outcomes:

On completion of this course, learners will be able to:

CO1: Apply Kirchhoff's Laws, Superposition theorem and network simplification techniques for DC circuit analysis.

CO2: Analyze the magnetic circuit parameters, self-Inductance, mutual Inductance and Electromotive Forces (EMF's).

CO3: Calculate AC quantities using mathematical equations, waveforms and phasor diagrams.

CO4: Compute the voltage, current and power of the given 1-phase and 3-phase AC circuits

CO5: Understand the working principle of 1-Phase Transformer, Motors (DC, Induction) and their practical applications.

Course Contents

Unit I	Elementary Concepts and DC Circuits	(06 Hours)

Elementary concepts: Resistance, EMF, current, potential difference, Ohm's law. Overview of elementary power system showing stages such as Generation, Transmission, and Distribution of electrical energy.

DC Circuits: Classification of electrical networks, simplifications of networks using series-parallel combinations and star delta transformation technique, Kirchhoff's Laws and their applications for network solutions using loop analysis, Superposition theorem

#Exemplar	Electric power system, Electrical Load Distribution box, Robotics

Unit II	Electromagnetism	(06 Hours)

Magnetic Circuit: Concept of flux density, field strength, permeability, MMF, reluctance, their units, and relationships. Simple series magnetic circuit, comparison of electric and magnetic circuit.

Electromagnetic Induction: Faradays Laws of electromagnetic induction, Fleming's right-hand rule, statically and dynamically induced emf, self and mutual inductance, coefficient of coupling. Energy stored in magnetic field.

#Exemplar	Loudspeaker, Motor, Generator, Transformer

Unit III	AC Fundamentals	(06 Hours)
Generation of single-phase sinusoidal voltages and currents, their mathematical and graphical representation, Concept of cycle, period, frequency, instantaneous, peak, average and RMS. values, peak factor and form factor. Phase, Phase difference, lagging, leading in phase quantities and their phasor representation. Rectangular and polar representation of phasor. Study of AC circuits consisting of pure resistance, pure inductance, pure capacitance.		
#Exemplar	Generator, Electrical appliances response, Electrical heater, radio circuits, capacitor	
Unit IV	**AC Circuits**	**(06 Hours)**
Single Phase AC Circuits: Series R-L, R-C and R-L-C circuits, concept of impedance, power factor, phasor diagrams, Voltage, current and power waveforms. Concept of active, reactive and apparent power. Resonance in RLC series circuits. **Three Phase AC Circuits**: Concept of three-phase AC symmetrical system, phase sequence, balanced and unbalanced load. Voltage, current and power relations in three phase balanced star and delta connected loads along with phasor diagrams.		
#Exemplar	Machine windings, Electric power network	
Unit V	**Introduction to Electric Machines**	**(06 Hours)**
Single Phase Transformer: Construction, working principle, EMF equation, transformation ratio, rating, types, losses, regulation and efficiency at different loading conditions. **Electrical Motors :** a) **D.C. Motors**: Construction, working principle, types, voltage equation, characteristics and Applications. b) **Three Phase Induction Motor**: Working principle using rotating magnetic field theory, types and applications. c) **Single Phase Induction Motor**: Construction, working principle of single phase Induction motor. Applications of split phase, capacitor start and capacitor run motors.		
#Exemplar	Mobile charger, electric substations, UPS, Lathe machine, compressor, lifts, hoists, ceiling fan etc	

List of Laboratory Experiments (Any 8 experiments from the given list).

1. To study safety precautions while working on electrical systems, handling of various equipment's such as rheostat, multi-meter, ammeters, voltmeters, wattmeter's etc.
2. Study of wiring materials, switch board and different wiring schemes. (Simple wiring & staircase wiring).
3. To verify Kirchhoff's laws experimentally
4. To verify Superposition theorem experimentally
5. To determine efficiency and regulation of transformer by using direct loading test experimentally
6. To measure steady state response of series RL and RC circuits experimentally

7. To study RLC series resonance experimentally
8. To verify the relation between phase and line quantities in three phase balanced star delta connections of load experimentally
9. Study of cut view section of single phase/ three phase Induction motor.
10. To measure insulation resistance by using megger and study of Single-Phase LT electricity bill.

Guidelines for Instructor's Manual

The instructor's manual is to be developed as a hands-on resource and reference. The instructor's manual needs to include prologue (about university / program/ institute / department / foreword / preface), University syllabus, conduction & Assessment guidelines, topics under consideration-concepts, objectives, and outcomes.

Guidelines for Student's Lab Journal

The students Lab Journal should contain following related to every experiment –

1. Title of the experiment
2. Objective
3. Apparatus with their detailed specifications
4. Brief theory related to the experiment
5. Connection diagram /circuit diagram
6. Observation table
7. Sample calculations for one/two reading
8. Result table
9. Graph and Conclusions.

Guidelines for Laboratory/ TW Assessment

1. Continuous assessment of laboratory work is to be done based on overall performance and Laboratory performance of student.
2. Each Laboratory assignment assessment should assign grade/marks based on parameters with appropriate weightage.
3. Suggested parameters for overall assessment as well as each Laboratory assignment include- timely completion, performance, efficiency, punctuality, and neatness.

Learning Resources

Textbooks:

1. B.L. Theraja,A K Theraja "ABC of Electrical Engineering", S Chand Publications,2012
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill Education, 2nd edition 2019.

Reference Books:

1. C. L. Wadhwa, "Basic Electrical Engineering", New Age International (P) Limited 5th edition 2024
2. S K Bhattacharya, "Electrical Machines", McGraw Hill Education, 2nd edition, 2008
3. T. K. Nagsarkar, M. S. Sukhija, "Basic Electrical Engineering", Oxford University Press, 2nd edition 2018.

e-Books: https://www.schandpublishing.com/books/tech-professional/electrical-engineering-electronics/abc-electrical-engineering/9788121939096/

MOOC / NPTEL/YouTube Links: https://nptel.ac.in/courses/108105112