2.4   FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS ENGINEERING

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COURSE OBJECTIVES

To learn basic concepts of various active and passive electronic components, signals, measuring instruments, digital electronics, electric and magnetic circuits, ac circuits, transformer, motors and their applications. To help the students deal with the electrical and electronics engineering principles and applications in industrial processes of different fields.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

- Understand and identify key electronic components and their applications.
- Use and understand basic electrical measuring instruments.
- Grasp the fundamentals of logic gates, Boolean algebra, and digital circuits.
- Understand basic concepts of electric and magnetic circuits.
- Analyze A.C. circuits and understand phase relationships and power calculations.
- Understand the principles and applications of transformers and electrical machines.

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COURSE CONTENTS

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UNIT- I Overview of electronic components: **(09 Periods)**

Active and Passive components, Resistor, Capacitor, Inductor and their types. Introduction to semi-conductor, Intrinsic and Extrinsic semi-conductors, P-N Junction diode - forward and reverse bias; introduction of Bipolar Junction Transistor; FET and MOSFET (brief idea only).

UNIT- II   Basic measuring instruments: **(05 Periods)**

Basic concept of Ideal and non-ideal voltage and current sources, ammeter, voltmeter, wattmeter and digital multimeter, CRO (Block diagram, working and its uses).

UNIT –III Overview of Digital Electronics: **(7 Periods)**

Analog and digital signal, advantages of digital system. number system and its conversion (Decimal, binary ,octal ,hexadecimal) , Boolean Algebra, Logic Gates-Truth Table and Symbol of AND, OR, NOT, NAND, NOR, ExOR, ExNOR Gates.

Unit -IV Electric and Magnetic Circuits: **(7   Periods)**

Definitions of basic terms, such as Current, Resistance, EMF, Potential Difference, Power and Energy, Ohm's Law and its limitation, Kirchhoff's laws; M.M.F, magnetic force, flux, permeability, reluctance, BH curve, hysteresis loop; Electromagnetic induction, Faraday's laws of electromagnetic induction, Lenz's law; Dynamically and Statically induced emf; concept of self and mutual inductance.

Unit -V   A.C. Circuits: **(7 Periods)**

Cycle, Frequency, Periodic time, Amplitude, Angular velocity, RMS value, Average value, Form Factor Peak Factor, impedance, phase angle, and power factor; Mathematical and phasor representation of alternating emf and current; A.C in pure resistors, pure inductors and pure capacitors; Power in A.C. Circuit, power triangle; Introduction of poly phase system and comparison with single phase system.

Unit -VI Transformers and Machines: **(7 Periods)**

Single phase transformer: General construction, working principle, types, EMF equation, transformation ratio; Brief idea of Auto transformer.

DC machines: Types, EMF equation of motor.

Single Phase Induction Motor: Principle of operation and introduction to methods of starting.

Three Phase Induction Motor: Principle of operation.

INSTRUCTIONAL STRATEGY

The instructional strategy combines lectures, demonstrations, and hands-on labs. Lectures will cover key concepts, while demonstrations will illustrate component functions and instrument operations. Hands-on labs will provide practical experience with electronic components and measuring instruments. Interactive quizzes and problem-solving sessions will reinforce and assess understanding, ensuring practical application of theoretical knowledge.

MEANS OF ASSESSMENT

–Assignment & Quiz
–Lab & Practical Work
–Viva-Voice

List of Practicals:- (8 practical to be performed)

1. Identify various passive and active electronic components in the given circuit.
2. Determine the value of given resistor using digital multi-meter to confirm with color code.
3. Exercise of soldering and de-soldering of components in circuits.
4. To measure frequency, time period and amplitude of a sinusoidal signal using CRO.
5. To measure voltage and current using digital multi-meter.
6. To verify the truth tables for all logic gates – NOT, OR, AND, NAND, NOR, XOR, XNOR
7. Verify the Kirchhoff's laws.
8. Measure voltage, current and power in 1-phase circuit with resistive load.
9. Verify the ohms law.
10. Use of voltmeter, ammeter, and watt-meter.
11. Connect resistors in series and parallel combination on bread board and measure its value using digital multi-meter.
12. Connect capacitors in series and parallel combination on bread board and measure its value using multi-meter.