BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

ENEE 153

Lecture : 3 **Year : I**
Tutorial : 1 **Part : II**
Practical : 1.5

Course Objectives:
The course aims to provide a comprehensive understanding of electrical engineering basics, encompassing circuits, components, and related laws, emphasizing safety in installations. It also seeks to familiarize students with electrical machines, semiconductor devices, and initiate them into applications in digital electronics.

1 Fundamentals of Electrical and Electronics Circuits (12 hours)

- 1.1 Current and potential
- 1.2 Circuit components: Source, conductor, resistor, inductor, capacitor
- 1.3 Ohms law
- 1.4 Series and parallel circuits
- 1.5 Kirchhoff's law and its application
  - 1.5.1 Nodal analysis
  - 1.5.2 Mesh analysis
- 1.6 Introduction to AC circuits and parameters
  - 1.6.1 Generation of AC voltage
  - 1.6.2 Waveforms
  - 1.6.3 Average value
  - 1.6.4 RMS value
- 1.7 Single phase AC circuit analysis with R, RL, RC and RLC load
- 1.8 Three phase AC circuits
  - 1.8.1 Waveform and advantage
  - 1.8.2 Line and phase quantities in star and delta connection
  - 1.8.3 Voltage and current computation in balance circuits
  - 1.8.4 Power measurement in three-phase circuits

2 Electrical Machines (14 hours)

- 2.1 Faraday's law of electromagnetic induction
- 2.2 Dynamically and statically induced EMFs
- 2.3 Transformer
  - 2.3.1 Introduction of single-phase transformer
  - 2.3.2 Working principle of transformer
  - 2.3.3 Components of transformer
  - 2.3.4 Transformation ratio
  - 2.3.5 EMF equation of transformer

- 2.3.6 Types of transformers
- 2.3.7 Load and no-load operation
- 2.3.8 Ideal and practical transformer
- 2.3.9 Losses and efficiency
- 2.3.10 Applications

2.4 Three-phase induction motor
- 2.4.1 Construction
- 2.4.2 Rotating magnetic field
- 2.4.3 Working principle
- 2.4.4 Direction of rotor and slip
- 2.4.5 Types of rotors
- 2.4.6 Standstill and running condition
- 2.4.7 Modes of operation
- 2.4.8 Torque equations
- 2.4.9 Torque-slip characteristics
- 2.4.10 Applications

2.5 DC motors
- 2.5.1 Construction
- 2.5.2 Working principle
- 2.5.3 Back EMF and its significance
- 2.5.4 Power torque relationships
- 2.5.5 Types of motors
- 2.5.6 Losses and efficiency
- 2.5.7 Applications

2.6 Synchronous generator
- 2.6.1 Construction
- 2.6.2 Working principle
- 2.6.3 EMF equation
- 2.6.4 Applications

3 Introduction to Electronics Engineering (11 hours)

3.1 Semiconductor and doping
3.2 Introduction to diode
3.3 Characteristics of PN junction diode
3.4 Half-wave and full-wave rectifiers
3.5 Zener effect
3.6 Zener diode and its characteristics
3.7 Zener diode as a voltage regulator
3.8 Bipolar junction transistor
- 3.8.1 Biasing
- 3.8.2 BJT as a switch
- 3.8.3 BJT as an amplifier

3.9 Introduction to digital electronics
3.10 Logic gates and Boolean algebra

4 Electrical Installations (8 hours)

4.1 Consumer power supply system
4.2 Overview of electrical wiring components: Switches, sockets, and distribution boards
4.3 Protective devices, their constructions and sizing
  4.3.1 Fuse
  4.3.2 MCB
  4.3.3 MCCB
4.4 Wires and power cable
4.5 Types of wiring system
4.6 Determination of size of conductor
4.7 Earthing system and its importance
4.8 Electrical safety rules

Tutorial (15 hours)

The tutorial sessions will focus on chapter-specific exercises aimed at enhancing understanding and application in electrical and electronics engineering.

Practical (22.5 hours)

1. Verification of Ohms law and Kirchhoff's law
2. Measurement of AC quantities using oscilloscope and study phase relation of RL and RC load
3. Measurement of line, phase and power in three-phase balanced load
4. Load test on single phase transformer and T-S characteristics of induction Machine
5. Connection of electrical installations of residential buildings
6. To study characteristics of PN and Zener diodes and perform half-wave and full-wave rectifiers

Final Exam

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks Distribution *
1	11	18
2	14	18
3	12	14
4	8	10
Total	**45**	**60**

* There may be minor deviation in marks distribution.

References

1. Mehta, V.K., Mehta, R. (2022). Principles of Electrical Engineering and Electronics. S. Chand Publishing.
2. Bhattacharya, S.K. (2017). Basic Electrical and Electronics Engineering I. Pearson Education India.

3. Bakshi, U.A., Bakshi, M.V. (2020). Electrical Technology. Technical Publications.
4. Floyd, T.L. (2021). Digital Fundamentals. Pearson Education India.
5. Neidle, M. (2016). Electrical Installation Technology. Elsevier.