FUNDAMENTALS OF ELECTRICAL AND ELECTRONISC ENGINEERING

Course Code: EX 101 & EE 101

Lecturer: 3 **Year: I**
Tutorial: 1 **Part: II**
Practical: 2 **Course Credit: 3**

Course Objectives:
The course aims to provide a comprehensive understanding of the fundamentals of electrical engineering, encompassing circuits, components, and related laws, and principle of operation of common electrical machines. The course also aims to impart knowledge on the basics of semiconductor devices and their application in electronic circuits.

	Teaching Schedule Hours/Week			Evaluation Scheme				
				Internal Evaluation		Final Evaluation		Total
	Lecture	Tutorial	Practical	Theory	Practical	Theory	Practical	125
Cr	3	1	2	40	10	60	15	

Course Contents:

Unit 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 & current computation in Balance Circuits
    1.8.4 Power Measurement in Three Phase Circuits

Unit 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

Unit 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 regulation

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

Unit 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 the understanding and application of the theory to solving practical problems.

Laboratory
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 torque-speed characteristics of induction machine.
5. Connection of electrical installations of residential buildings.
6. To study Characteristics of PN and Zener Diodes and perform basic operations using logic gates

Reference

1. **Mehta, V. K., and Mehta Rohit. Principle of Electrical Engineering and Electronics. S. Chand Publishing, 2014.**
2. **K.B. Raina S.K. Bhattacharya. Electrical Design Estimating and Costing, New Age Internation, 2007**.
3. Bhattacharya, S. K. Basic Electrical and Electronics Engineering I, Pearson Education India, 2010.
4. R. L. Boylestad, *Introductory Circuit Analysis*, Prentice Hall Inc
5. Floyd, Thomas L. Digital fundamentals, 10/e. Pearson Education India, 2011.

Evaluation Scheme:
The final evaluation will have questions from all the units. The marks distribution for all the units will be as follows:

		Scheduled Hours	**Marks**
Unit 1	Fundamentals of Electrical and Electronics Circuits	12	16
Unit 2	Electrical Machines	14	18
Unit 3	Introduction to Electronics Engineering	11	14
Unit 4	Electrical Installations	8	12
Total		**45**	**60**

Note: The marks distribution shown in the table above might be subjected to minor changes.