



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING								
I Semester: CSE / IT								
II Semester: CSE (AIML) / CSE(DS) / AERO / MECH / CE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P		CIA	SEE	Total
AEEE01	Foundation	3	-	-	3	40	60	100
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 48			
Prerequisite: There are no prerequisites to take this course.								

I. COURSE OVERVIEW:

The course introduces the basic concepts of circuit analysis which is the foundation for all subjects of the electrical and electronics engineering. It includes the basic fundamental laws of electricity and magnetism with an emphasis on resistors, inductors and capacitors (RLC) circuits applied to alternating current (AC) or direct current (DC) of electrical networks. This course provides the hands-on experience on designing circuits using Diodes, Bipolar Junction Transistors, and Field Effect Transistors. Provides the capability to extract the characteristics of semiconductor devices and circuits with simulation tools.

II. COURSE OBJECTIVES:

The students will try to learn

- I The fundamental principles of electrical circuits including DC and AC systems, and their analysis using laws like KVL and KCL.
- II The electrical installations, components of LT switchgear, battery characteristics, and methods for calculating power and energy consumption.
- III The construction, working principles, and performance analysis of electrical machines such as transformers, DC motors/generators, and induction motors.
- IV The basics of semiconductor devices including diodes, rectifiers, BJTs, and FETs, along with their applications in electronics.

III. COURSE OUTCOMES:

At the end of the course students should be able to:

- CO1 Analyze and solve simple electrical circuits using Ohm's Law, Kirchhoff's laws, and phasor techniques for both DC and single-phase/three-phase AC circuits.
- CO2 Identify various components of LT switchgear, types of batteries, and perform basic calculations related to energy consumption and battery backup
- CO3 Explain the construction, working principles, and characteristics of electrical machines including transformers, DC motors/generators, and three-phase induction motors
- CO4 Demonstrate an understanding of the operation and characteristics of P-N junction and Zener diodes, and their role in rectifier and filter circuits.
- CO5 Analyze BJT and FET configurations to understand their working, amplification modes, and performance comparisons.
- CO6 Apply the knowledge of electrical and electronic components to real-world applications such as power systems, electronics circuits, and energy management.

IV. COURSE CONTENT:

MODULE – I: INTRODUCTION TO ELECTRICAL CIRCUITS (10)

D.C. Circuits: Electrical circuit elements (R, L and C), voltage and current sources, KVL and KCL, analysis of simple circuits with dc excitation.

A.C. Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits, Three phase balanced circuits, voltage and current relations in star and delta connections.

MODULE – II: ELECTRICAL INSTALLATIONS (08)

Electrical Installations: Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

MODULE – III: ELECTRICAL MACHINES (10)

Electrical Machines: Working principle of Single-phase transformer, equivalent circuit, losses in transformers, efficiency, three phase transformer connections. Construction and working principle of DC generators, EMF equation, working principle of DC motors.

Torque equations and Speed control of DC motors, Construction and working principle of Three phase Induction motor, Torques equations and Speed control of Three phase induction motor. Construction and working principle of synchronous generators.

MODULE – IV: DIODES AND RECTIFIERS (10)

P-N Junction and Zener Diode: Principle of Operation Diode equation, Volt, Ampere characteristics, Temperature dependence, Ideal versus practical, Static and dynamic resistances, Equivalent circuit, Zener diode characteristics and applications.

Rectifiers and Filters: P-N junction as a rectifier, Half Wave Rectifier, Ripple Factor, Full Wave Rectifier, Bridge Rectifier, Harmonic components in Rectifier Circuits, Filters – Inductor Filters, Capacitor Filters, L- section Filters, π - section Filters.

MODULE – V: BIPOLAR JUNCTION TRANSISTORS AND FIELD EFFECT TRANSISTOR (10)

Bipolar Junction Transistor (BJT): Construction, Principle of Operation, Amplifying Action, Common Emitter, Common Base and Common Collector configurations, Comparison of CE, CB and CC configurations.

Field Effect Transistor (FET): Construction, Principle of Operation, Comparison of BJT and FET, Biasing FET.

V. TEXT BOOKS:

1. Basic Electrical and electronics Engineering, M S Sukija and TK Nagasarkar, Oxford University, 1st Edition, 2012.
2. Basic Electrical and electronics Engineering, D P Kothari and I J Nagarath, McGraw Hill Education, 2nd Edition, 2020.

VI. REFERENCE BOOKS:

1. Electronic Devices and Circuits, R. L. Boylestad and Louis Nashelsky, PEI and PHI, 9th Edition, 2006.
2. Millman's Electronic Devices and Circuits, J. Millman, C. C. Halkias and Satyabrata Jit, TMH, 2nd Edition, 1998.
3. Fundamentals of Electrical Engineering, L. S. Bobrow, Oxford University Press, 12th edition, 2003.
4. Electrical and Electronic Technology, E. Hughes, Pearson Education, 10th Edition, 2010.
5. Electrical Engineering Fundamentals, V. D. Toro, Prentice Hall India, 2nd Edition, 1989.

VII. WEB REFERENCES:

1. <https://www.igniteengineers.com>
2. <https://www.ocw.nthu.edu.tw>
3. <https://www.uotechnology.edu.iq>
4. <https://www.iare.ac.in>

II. MATERIALS ONLINE

1. Course template
2. Tutorial question bank
3. Tech talk topics
4. Assignments
5. Definitions and terminology
6. Open ended experiments
7. Model question paper-I
8. Model question paper-II
9. Lecture notes
10. Power point presentations
11. ELRV videos