EC16102 Elements of Electronics Engineering

L-T-P-Cr: 3-0-2-4

PREREQUISITE

- Basics of Circuit Analysis

COURSE OBJECTIVE

- This course is intended to familiarize the students with the operational principle, analysis, design, and applications of semiconductor devices like diodes, bipolar junction transistors and field effect transistors.
- Further, it is also intended to introduce the analysis of wide variety of electronic circuits to the students.

COURSE OUTCOMES

Upon successful completion of this course, the students should be able to:

COl: Understand the operational principle of diode and develop skills to design rectifier, filter, clipping and clamper circuits using diodes.

CO2: Understand the operation of BJT amplifiers and switching circuits and Implement common emitter RC-coupled amplifier.

CO3: Understand the operation of FET amplifiers and switching circuits and Implement common source amplifier.

CO4: Develop and analyze the practical circuits using operational amplifiers

CO5: Design the logic gates using diodes and transistor and analyze their operation.

COURSE CONTENT

Unit 1: Semiconductor Diodes (10 Lectures)

Semiconductor materials: Intrinsic and Extrinsic types; Introduction to the concept of Fermi level; Ideal diode; Terminal characteristics of diode: p-n junction diode under open circuit, Drift and diffusion current along with derivation. Built-in potential (potential barrier) along with derivation, Forward bias and reverse bias conditions. Static and dynamic resistance, Temperature dependence, Breakdown mechanism in diode. Junction capacitance: Diode applications: Half-wave Rectifiers, Full-wave Rectifiers & Filters, Clipping & Clamping Circuits, Voltage doubler; Zener Diode & its application as voltage regulator.

Unit 2: Bipolar Junction Transistor (12 Lectures)

BJT Introduction: PNP and NPN transistor, BJT current components and base width modulation, CB, CE, CC configuration and characteristics, Load line analysis, Operating point; Biasing: Need for biasing, different biasing circuits, Bias stability; BJT as an amplifier: Low frequency small signal model of BJT, CE amplifier with and without feedback, Multi-stage amplifier; BJT as a switch: Cut-off and saturation modes.

Unit 3: Field Effect Transistor (8 Lectures)

General characteristics of FET; Comparison between FET & BJT; JFET: Construction, Principle of Operation, Shockley equation. Output and transfer characteristics; Depletion & Enhancement Type MOSFET:

Construction, Principle of operation. Output and transfer characteristics; FET Amplifier- FET biasing configurations, Low frequency small signal model of FET, Analysis of FET amplifier without feedback.

Unit 4: Operational Amplifier (6 Lectures)

Ideal op-amp; characteristics of ideal and practical op-amp; Practical op-amp circuits: Inverting and non-inverting amplifiers, voltage follower, summer, subtractor, integrator, differentiator, active filters.

Unit 5: Digital Logic Circuits (4 Lectures)

Logic gates, Logic circuit implementation using diodes and transistors.

List of Experiments of Elements of Electronics Lab

Experiment No.01:	Study of Cathode Ray Oscilloscope (CRO) (a) Measurement of amplitude, time period and frequency of unknown continuous signals, (b) Use of Lissajous pattern for unknown frequency measurement of signal.
Experiment No.02:	Identification of active and passive component.
Experiment No.03:	Study of RC and CR filters
Experiment No.04:	Study the characteristics of P-N junction diode under (a) Forward bias, and (b) Reverse bias
Experiment No.05:	Study of Zener diode characteristics and load and line regulations of Zener voltage regulator
Experiment No.06:	Study of clipping circuits and clamping circuits.
Experiment No.07:	Study of the performance of full wave bridge rectifier with filter circuits.
Experiment No.08:	Study of the input and output characterization of common base (CB) bipolar junction transistor
Experiment No.09:	Study the input and output characterization of common emitter (CE) bipolar junction transistor.
Experiment No. 10:	Study the frequency response of common Emitter bipolar junction transistor.
Experiment No. 11:	Study the output and transfer characteristics of JFET (Junction field effect transistor)
Experiment No. 12:	Study of operational amplifier as (i) Inverting (ii) Non-inverting amplifier.
Experiment No. 13:	Construction and verification of all other gate (AND, OR, NOT, XOR) using only a) NOR gate b) only NAND gate

TEXTBOOKS

1. Electronic Devices & Circuit Theory by Boylestad and Nashelsky, Pearson.
2. Microelectronics, Millman and Grabel, TMH.
3. Electronic Principles by Albert Malvino & Davis J. Bates, TMH.

REFERENCE BOOKS

1. Electronic Devices-Conventional Current Version by Thomas L. Floyd, Pearson.
2. Microelectronic Circuits: Theory and Applications by Sedra, and Smith, Oxford University.
3. Digital Logic and Computer Design, Morris Mano, Pearson.