

EC-3004 ELECTRONIC DEVICES & CIRCUITS

COURSE OBJECTIVE: Any electronic trade has its basis on a certain number of components and some basic standard circuits. These common circuits are applied in all sections of the Electronics technology. A good understanding of the basic functioning of all these components and circuits will be a solid platform to enter into the more complex portion and specialized field of Electronics Engineering. Emphasis has been given on the characteristics and application of semiconductor devices/ components. In the case of basic standard circuits, the focus has been made on the interaction of active and passive components and overall performance according to the stated requirements.

COURSE CONTENTS:

Introduction to semiconductor physics: insulator, conductor, semiconductor and semiconductor types. Drift and diffusion carries, Hall Effects.

Review of PN junction diode: PN junction diode in forward and reverse bias, temperature dependence of V-I characteristics, diode resistances, diode junction capacitance. Types of diodes: Zener Diode, Varactor Diode, Tunnel Diode, PIN Diode, Schottky Diode, LED and Photo Diodes, Switching characteristics of diode.

Bipolar junction transistor - Construction, basic operation, current components and equations, CB, CE and CC-configuration, input and output characteristics, Early effect, Region of operations: active, cut-off and saturation region. BJT as an amplifier. Ebers-Moll model, Power dissipation in transistor ($P_{d, \max}$ rating), Photo transistor.

Transistor biasing circuits and analysis: Introduction, various biasing methods: Fixed bias, Self bias, Voltage Divider bias, Collector to base bias, Load-line analysis: DC and AC analysis, Operating Point and Bias Stabilization and Thermal Runaway. Transistor as a switch.

Small Signal analysis: Small signal Amplifier, Amplifier Bandwidth, Hybrid model, analysis of transistor amplifier using h-parameter, Multistage Amplifier: Cascading amplifier, Bootstrapping Technique, Darlington amplifier and cas-code amplifier, Coupling methods in multistage amplifier, Low and high frequency response, Hybrid π model, Current Mirror circuits.

Large Signal analysis and Power Amplifiers: Class A, Class B, Class AB, Class C, Class D, Transformer coupled and Push-Pull amplifier.

FET construction- JFET: Construction, n-channel and p-channel, transfer and drain characteristics, parameters, Equivalent model and voltage gain, analysis of FET in CG, CS and CD configuration. Enhancement and Depletion MOSFET drain and transfer Characteristics.

Uni-junction Transistor (UJT) and Thyristors: UJT: Principle of operation, characteristics, UJT relaxation oscillator, PNP Diode and its characteristics, Silicon controlled rectifier: V-I characteristics, DIAC and TRIAC, Thyristors parameters and applications.

TEXTBOOKS

1. Millman and Halkias: Integrated electronics, TMH.
2. Boylestad and Nashelsky: Electronic Devices and Circuit Theory, Pearson Education.
3. [nptelvideos dot in/2012/12/basic-electronics-drchitralekha-mahanta.html](http://nptelvideos.in/2012/12/basic-electronics-drchitralekha-mahanta.html)

REFERENCES:

1. Sedra and Smith: Microelectronics, Oxford Press.
2. Anil K. Maini, Varsha Agarwal: Electronic Devices and Circuits, Wiley Publications.
3. Rashid: Electronic Devices and Circuits, Cengage learning.
4. Donald A Neamen: Electronic Circuits Analysis and Design, TMH
5. Salivahanan: Electronic Circuits Analysis and Design, TMH
6. Mottershead: Electronic Devices and Circuits an introduction, PHI
7. Kumar and Jain: Electronic Devices and Circuits, PHI.
8. David A. Bell Electronic Devices and Circuits Oxford University press.

COURSE OUTCOMES:

Students who are successful in this class will be able to:

1. Understand the basic physics of carrier transport in bulk semiconductors and real device structures.
2. Understand the fundamentals of operation of the main semiconductor electronic devices.
3. Understand the basic parameters of electronic devices, their performance, and limiting factors.
4. Understand the basic principles of electronic device operation with emphasis on bipolar transistors, and unipolar microwave devices.

LIST OF EXPERIMENTS:

1. To determine and analyze the V-I characteristics of PN Junction diode and Zener diode.
2. To determine input and output characteristics of transistor amplifiers in CE, CB & CC configurations.
3. To determine the frequency response of transistor CE amplifier, direct coupled and RC coupled amplifier.
4. To determine characteristics of UJT as relaxation Oscillator.
5. To determine Drain and Transfer Characteristics of JFET Amplifier.
6. To determine Drain and Transfer Characteristics of MOSFET Amplifier.
7. To determine characteristics of class A and B power amplifiers.
8. To determine characteristics of class C and AB power amplifiers.