

EE 343: Analog Electronics-I (EE/IE)

L T P
(3 - 1 - 3)
Theory Marks = 100
Sessional Marks = 50
Laboratory Marks = 50

1. **The p-n junction, Basic construction:**

Fundamental of p-n junction principle. Study of volt-amp characteristics of diodes. Low level injection approximation. Analysis of current flow through a diode. Dynamic behavior of diode and the capacitances associated with a diode device, Effect of temperature on the current.

Current models of a diode piecewise linear static model and dynamic incremental model. Practical circuits employing diodes: diode gates and switches and power rectifying circuits. Power filters.

2. **The Bipolar junction Transistor:**

Basic construction and the physical behavior of the device. Low level injection condition. Forward Active Region (FAR) and the study of the flow of carriers through the BJT control valve action. Volt-amp curves, base with modulation and early voltage. Static circuit models. Ebers-moll equations for the currents of a B.J.T. for all bias conditions. A simple amplifier circuit and biasing methods. The common base, common emitter and the common collector connections.

Introduction to FET and MOSFET and biasing of FET and MOSTFET.

Small signal operation of the transistor amplifier, incremental models for the B.J.T. the hybrid II model. Analysis of amplifiers with the help of incremental models, simplified low frequency operation. Gain, input and output impedances of amplifiers. Some ideas about high speed analysis such as Miller effect and dominant pole approximation determination of the hybrid II parameters, introductory ideas about two port y and h-parameter analysis.

3. **Multiple stage transistor amplifiers:**

PNP and NPN combinations. Voltage and current biasing methods. Gain calculation. Frequency response of amplifiers. High power circuits and their efficiencies. Some ideas about distortion.

4. **Feed-back in amplifiers:**

The usefulness of this concept. Different feed back configurations, Negative and Positive feedback. Their effects on the performance of amplifiers. Positive feedback to produce oscillations and simple oscillator circuit, RC and LC oscillators with simple analysis. Introduction to device fabrication methods and some ideas about I.C.S. and the way they are made. Simple descriptions of processes such as diffusion, photolithography, ion implantation, metallization and crystal growing techniques.

5. **Power amplifiers:**

Direct coupled, R-C coupled, transformer coupled class A power amplifier, and Push-pull power amplifier.

6. **Fabrication of IC:**

Introduction to different methods and process involved in IC fabrication with sample examples.

Books:

1. Electronic Principles Physics, Models and Circuits – Paul E. Gray and Campbell L Searle
2. Integrated Electronics – Millman- Halkias (PHI)

EE 342: Electrical Engineering Material & Devices

L T P
(3 – 1 – 0)
Theory Marks

=100

Sessional
Mark=50

1. Structure of solids:

Crystalline state of solids, systems & classes, unit cell and space lattice, BCC, DC structure, Bragg's law, Miller indices, Crystal imperfections, grain boundaries.

2. Dielectrics :

(I): Properties of static field. Static dielectric constant, polarization, dielectric constant of mono atomic gases & poly atomic molecules, internal fields in solids & liquids, ferroelectric materials, spontaneous polarization, piezo electricity.

(II) Properties in alternating fields: Frequency dependence of electronic, ionic polarizability, complex dielectric constant, dielectric loss, dipolar relaxation, breakdown in dielectrics. General properties of common dielectrics (Electrical, mechanical chemical and thermal). Gaseous dielectrics, liquid insulating materials, solid insulating materials, films.

3. Magnetic properties of materials:

Magnetization, origin of permanent magnetic dipole moment, classification of Magnetic of materials, dia, para, ferro, antiferro & ferromagnetism, magnetic anisotropy, magnetostriction, soft & hard magnetic materials for electrical applications.

4. Conductors:

Electron gas model of a metal, Relaxation time, collision time, mean free path, electron scattering & resistivity, heating effect of current, thermal conductivity, superconductivity, electrical conducting materials (Cu, Al) & their application. Mechanical properties like corrosion, solid curability, contact resistance.

5. Semiconductors and Devices:

Intrinsic carrier concentration, Effect of doping on carrier concentration. Holes and electrons, Majority and Minority carriers, Mobility and diffusion constants. Passage of current through semi-conducting material – drift and diffusion process. Recombination and carrier life time. Effect of temperature. Density of carriers in intrinsic semiconductor & in n-type & p-type semiconductor, conductivity, Hall effect, drift & diffusion current, Einstein relation.

Books:

1. Electrical Engineering Material---Dekker A.J. (PHI)
2. A course in Electrical Engineering Material—Seth & Gupta
3. Electrical Engineering Material---Rajput A.K.
4. Electrical Engineering Material---C.S. Indulkar & S. Thiruvengadam.

1. Elements of electric circuits:

The resistor: Practical engineering devices. Solid & wire frame of common resistive materials, carbon film and metal film resistors. Heat dissipating area (wattage), tolerance and temperature stability of resistors. Mathematical models, the capacitor: Comparison of properties of different traditional & modern dielectric materials (e.g. paper, ceramic, polystyrene polycarbonates etc.) Short description of electrolytic capacitor- wet & solid dielectrics, solid tantalum & aluminum capacitors, Mathematical models, the inductors: Mutual inductance, Properties of core materials.

Brief studies of iron & ferrite cores, Mathematical models (only assignments).

2. Network theorems:

Millman's theorem, Reciprocity theorem, Compensation & Tellegen's, Millers theorem etc. Analysis of coupled circuits. The dot rule & equivalent conductivity coupled forms of magnetically coupled circuits.

3. Methods for the solution of circuit equations:

Analysis of electrical network with – independent/independent ideal, practical current voltage and current sources – both of DC and AC. Solution of network equations by matrix methods.

4. Network topology:

Elementary graph theory as applied to electrical networks. Matrices of graph: Incidence matrix, circuit matrix, cut set matrix. Advanced techniques of equation formulation for numerical solutions.

5. Transient phenomenon:

Forcing functions-impulse, step and ramp functions Study and solution of simple circuits undergoing transient disturbances, A.C. transients, Time domain equations and solutions by Laplace transforms.

6. Two port Network:

General principles, ABCD, Z, Y and hybrid parameters, Analysis of networks in tandem. Transmission lines. Lumped and distributed models. Combination of two ports network.

7. Introduction to Network Synthesis:

Foster and Cour forms of realization of network for given driving point impedance function

BOOKS:

1. A user's guide to selecting Electronic components---Gerald L. Sinsoutg (John Wiley)
2. Engineering Circuit analysis---- W. H. Hayt Jr. & J.E. Kemmerly (Mcgraw hill)
3. Electric Circuit---J.A. Edminiter. (Mcgraw hill)
4. Computer aided Network Design—Donald A. Calahan (Tata Mcgraw hill)
5. A course in Electric Circuit Analysis—Soni & Gupta