Core VIII **Semester IV**

Analog Systems

Course Outcomes

- Basic understanding of semiconductor diodes, devices and their applications.
- To understand the basic concepts in transistors and amplifiers.
- To understand the concept of coupled amplifier and its application in feedback circuit.
- To understand the concepts of operational amplifier and its application.
- To apply the acquired knowledge of electronic circuits in Experiments.

Unit 1

- **Semiconductor Diodes:** P and N type semiconductors, energy level diagram, conductivity and Mobility, Concept of Drift velocity, PN junction fabrication (simple idea), Barrier formation in PN Junction Diode, Static and Dynamic Resistance, Current flow mechanism in Forward and Reverse Biased Diode, Drift velocity, derivation for Barrier Potential, Barrier Width and current Step Junction.
- **Two terminal device and their applications:** (1) Rectifier Diode: Half-wave Rectifiers. center- tapped and bridge type Full-wave Rectifiers, Calculation of Ripple Factor and Rectification Efficiency, L and C Filters (2) Zener Diode and Voltage Regulation, Principle and structure of LEDS, (2) Photo diode(3) Solar Cell.

Unit II

- **Bipolar Junction Transistors:** n-p-n and p-n-p transistors, Characteristics of CB, CE and CC Configurations, Current gains a and b, Relation between a and b, Load line analysis of Transistors, DC Load line and Q-point, Physical mechanism of current flow, Active, Cut-off and Saturation Regions.
- **Transistors Biasing:** Transistor Biasing and Stabilization circuits, Fixed Bias and Voltage Divider Bias.
- **Amplifiers:** Transistors as 2-port network h-parameter Equivalent Circuit, Analysis of a single stage CE amplifier using Hybrid Model, Input and Output impedance, Current, Voltage and Power Gains.

Unit III

- Classification of class A, B and C amplifiers, Push-pull amplifier (class B).
- **Coupled Amplifier:** RC-coupled amplifier and its frequency response.
- **Feedback in Amplifiers:** Effect of Positive and Negative Feedback on In- put Impedance, Output Impedance, Gain Stability, Distortion and Noise. Sinusoidal Oscillations: Barkhausens criterian for self- sustained oscillations. RC Phase shift oscillator, determination of Frequency, Hartley and Colpitts oscillators.

Unit IV

- **Operational Amplifiers (Black Box approach):** Characteristics of an Ideal and Practical OP-AMP (IC741). Open-loop and Closed loop Gain. Frequency Response. CMRR, Slew Rate and concept of virtual ground.
- **Applications of Op-Amps:** (1) Inverting and non-inverting amplifiers (2) Adder(3) Subtractor (4) Differentiator, (5) Integrator (6) Log amplifier, (7) Zero crossing detector (8) Wein bridgeoscillator.

Text Books

- ✓ *Foundations of Electronics-Raskhit and Chattopadhyay (New age International Publication)*
- ✓ *Concept of Electronics- D.C.Tayal (HimalayPublication)*

Reference Books:

- ✓ *Electronic devices and circuits R.L.Boylstad(PearsonIndia)*
- ✓ *Electronic Principles- A.P.Malvino (Tata McGrawHill)*
- ✓ *Principles of Electronics- V. K. Mehta and Rohit Mehta (S. Chand Pub- lication)*
- ✓ *OP-Amps and Linear Integrated Circuit-R. A. Gayakwad (PrenticeHall)*
- ✓ *Physics of Semiconductor devices, DonaldANeamen(PrenticeHall)*
- ✓ Analog System and Application: Gupta Kumar, Pragati Prakashan

LAB: Credit-1

(Minimum 5 experiments are to be done)

1. To study the V-I characteristics of a Zener diode and its use as voltage regulator.
2. Study of V-I and power curves of solar cells, and find maximum power point and efficiency.
3. To study the characteristics of a Bipolar Junction Transistor in CE configuration.
4. To study the various biasing configurations of BJT for normal class A operation.
5. To study the frequency response of voltage gain of a RC-coupled transistor amplifier.
6. To design a Wien bridge oscillator for given frequency using a non-amp.
7. To design a phase shift oscillator of given specifications using BJT.
8. To study the Colpitt's oscillator.

Reference Books:

- ✓ *Modern Digital Electronics, R.P. Jain, 4th Edition, 2010, Tata McGraw Hill.*
- ✓ *Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1994, Mc Graw Hill.*
- ✓ *Microprocessor Architecture Programming and applications with 8085, R.S. Goankar, 2002, Prentice Hall.*
- ✓ *Microprocessor 8085: Architecture, Programming and interfacing, A. Wadhwa, 2010, PHI Learning.*