II Year II Semester	**L**	**T**	**P**	**C**
Code: 23ES112	**3**	**0**	**0**	**3**

ANALOG CIRCUITS

Course Objectives:

To learn basic concepts of semiconductor physics and working of Diode with its applications

1. To know the basics of BJT, FET, MOSFET and other transistors
2. To acquire the knowledge of the biasing and stabilization concepts of BJT and FET
3. To understand the working, analysis and design of transistor amplifier circuits at low frequencies
4. To design and analyze different Multivibrator circuits.

Course Outcomes:

A student who successfully fulfils this course requirement will be able to:

1. Apply the basic concepts of semiconductor and to understand the formation and
2. characteristics of PN Junction Diode with relevant applications
3. Understand the construction, working and characteristics of BJT, FET, MOSFET and other transistors
4. Know the need of various biasing techniques for BJT and FET, and analyze stabilization concepts with necessary expressions.
5. Analyze small signal, low frequency transistor amplifier circuits using BJT and FET in different configurations.
6. Design and analyze different multivibrator circuits.

UNIT–I: PN Junction Diode

Semiconductors and Metals – Classification using Energy gap, Mobility and Conductivity, Intrinsic and Extrinsic Semiconductors, Charge Densities in Semiconductors, Fermi level in semiconductors, Drift and Diffusion Currents. Formation of P-N Junction, Energy Band structure of PN Junction Diode, Diode Current Equation, V-I Characteristics of Diode, Temperature Dependence on V-I Characteristics, Diode Resistances, Diffusion and Transition Capacitances. Diode Applications – Half-Wave and Full-Wave Rectifiers, Clippers and clampers

UNIT–II: Transistors

Bipolar Junction Transistor – Types, Symbols and Operation, Transistor Current Components, Transistor Equation, Relation among α, β, and γ, Transistor as an Amplifier, Transistor Configurations and Characteristics – CB, CE and CC, Early effect, Transistor as a switch, Transistor switching times, Punch/Reach through, Ebers-Moll Model, FET – Construction and operation of N- and P-channel FETs, characteristic parameters and I_{DSS}, MOSFET – Enhancement and Depletiontype, Photo Transistor, UJT

UNIT–III: Biasing and Stabilization

BJT Biasing: Need for Biasing, Operating Point, Load Line Analysis – DC and AC Load Lines, Stability factors S, S' and S'', Biasing methods – Fixed bias, Collector-to-base bias and Self bias, Bias Compensation – Thermistor, Sensistor, Diode Compensation, Thermal Runaway, Thermal Stability, heat sinks. **FET Biasing:** Fixed method, self-bias method and

voltage divider method, Comparison of BJT and FET, Comparison between JFET and MOSFET

UNIT–IV: Small Signal Low Frequency Transistor Amplifier models

BJT: Two port network, Transistor hybrid model, determination of h-parameters, conversion of h- parameters, generalized analysis of transistor amplifier model using h-parameters, Analysis of CB, CE and CC amplifiers using exact and approximate analysis, comparison of transistor amplifiers. **FET:** Generalized analysis of small signal model of FET, Analysis of CG, CS and CD amplifiers, comparison of FET amplifiers.

UNIT–V: Multivibrators

Bistable Multivibrator – Analysis and Design of Fixed Bias, Self-Bias Bistable Multivibrator, Collector Catching Diodes, Commutating Capacitors, Triggering of Binary Circuits, Emitter Coupled Bistable Multivibrator (Schmitt Trigger). Monostable Multivibrator – Analysis and Design of Collector Coupled Monostable Multivibrator, Triggering of Monostable Multivibrator, Applications of Monostable Multivibrator. Astable Multivibrator – Analysis and Design of Collector Coupled Astable Multivibrator, Application of Astable Multivibrator as a Voltage to Frequency Converter.

Correlation of COs with POs & PSOs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO 2	2	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO 3	3	2	2	-	-	-	-	-	-	-	-	-	3	-	-
CO 4	3	3	2	-	-	-	-	-	-	-	-	-	3	-	1
CO 5	2	3	2	-	-	-	-	-	-	-	-	-	3	-	1

Text Books:

1. Electronic Devices and Circuits – Millman & Halkias, Tata McGraw Hill, Second Edition, 2007.
2. Electronic Devices and Circuits – S. Salivahanan, N. Suresh Kumar, McGraw Hill, Third Edition, 2010.
3. Pulse, Digital and Switching Waveforms – J. Millman and H. Taub, McGraw-Hill.

Reference Books:

1. Electronic Devices and Circuits Theory – Robert L. Boylestad and Louis Nashelsky, Pearson/Prentice Hall, Tenth Edition, 2009.
2. Electronic Devices and Circuits – K. Lal Kishore, BS Publications, Fourth Edition, 2016.
3. Pulse and Digital Circuits – A. Anand Kumar, PHI, 2005.