

II B.Tech – I Semester
(17EC301) ELECTRONIC DEVICES AND CIRCUITS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	1	-	3

Pre-Requisites: Physics

Course Objectives:

- Know the properties of semiconductor materials.
- Understand the operation and principles of P-N diode and special diodes.
- Understand various types of rectifiers and filters.
- Know the working of BJT and need for transistor biasing and stabilization.
- Know the working of FET and other Transistors.

UNIT-I: OVERVIEW OF SEMICONDUCTORS:

Insulators, Semiconductors and Metals – Classification using Energy gap, Intrinsic and Extrinsic Semiconductors – Electrons and Holes, Conductivity, Mobility, Drift and Diffusion Currents, Transportation of Charge Carriers - Generation and Recombination of Carriers, Charge Densities in Semiconductors, Hall Effect - Quantitative Analysis and Applications, Continuity Equation, Mass Action Law, Einstein's Equation, Fermi level in intrinsic and extrinsic semiconductors.

UNIT- II: JUNCTION DIODE CHARACTERISTICS:

P-N Junction Diode - Formation of P-N Junction, Open Circuited P-N Junction, Biased PN Junction-Forward Bias, Reverse Bias, Current Components in P-N Junction Diode, Law of Junction, Diode Current Equation-Quantitative Analysis, V-I Characteristics of Diode Forward Bias, Reverse Bias, Breakdown in P-N Junction Diode, Temperature Dependence on V-I Characteristics, Diode Resistance-Static Resistance, Dynamic Resistance, Reverse Resistance, Diode Capacitance-Transition Capacitance, Diffusion Capacitance, Energy Band Diagram of P- N Junction Diode.

UNIT- III: SPECIAL DIODES AND RECTIFIERS:

Breakdown Mechanisms - Zener Breakdown and Avalanche Breakdown, Zener Diode-V-I Characteristics, Applications, Construction, Operation, Characteristics and applications of LED, Photodiode, LCD, Schottky diode, Varactor Diode and Tunnel diode. Basic Rectifier setup, Half Wave Rectifier, Full Wave Rectifier, Bridge Rectifier, Inductive and Capacitive Filters, L- Section and π -Section, Derive and compare rectifier parameters with and without filter.

UNIT- IV: BIPOLAR JUNCTION TRANSISTOR (BJT) & OTHER TRANSISTORS:

Bipolar Junction Transistor – Types, Symbols and Operation, Transistor Current Components, Transistor Equation - Relation among I_C , I_B , I_{CBO} , Transistor Configurations -CB, CE and CC, Transistor as a switch, Transistor switching times, Transistor as an Amplifier, Characteristics of Transistor in Common Base Configuration, Common Emitter and Common Collector Configurations - Input and output characteristics, Early effect, Transistor parameters, Current amplification factor, Relation among α , β , and γ , Comparison of CB, CE and CC Configurations, Punch Through/Reach through, Typical transistor junction voltage values, Photo Transistor, Silicon Controlled Rectifier, Two-Transistor version, Diac, Triac, UJT- Negative Resistance Property and Applications (Quantitative treatment).

UNIT- V: BJT BIASING AND THERMAL STABILITY:

Need For Biasing, Operating Point, Load Line Analysis - D.C. Load Line, A.C. Load Line, Biasing - Methods, Basic Stability, Fixed Bias, Collector-to-base Bias and Self Bias, Stabilization against variations in V_{BE} , I_c and β , Stability Factors S , S' and S'' , Bias Compensation - Thermistor, Sensistor, Diode Compensation for variation in I_{CO} , Thermal Runaway, Thermal Stability, heat sinks.

UNIT- VI: FET & BIASING:

FET Types and Symbols - JFET and MOSFET/IGFET, JFET: N-Channel and P-Channel Construction, Operation, Characteristics - Drain and Transfer, FET as Voltage Variable Resistor, Parameters - Drain Resistance, Amplification factor, Transconductance, Pinch-off voltage, MOSFET - Types-Depletion MOSFET - N Channel and P Channel, Enhancement MOSFET- N- Channel and P-Channel, Construction, Operation, Characteristics - Transfer and Drain Characteristics for Depletion and Enhancement Modes, Comparison between JFET and MOSFET, Comparison of BJT and FET. Biasing – Fixed method, self bias method and voltage divider method, FET Common Source Amplifier, Common Drain Amplifier, Generalized FET Amplifier

Course Outcomes:

After successful completion of the course, the students can be able to:

S. No	Course Outcome	BTL
1.	Understand the basic concepts of semiconductor physics	L1,2
2.	Understand the formation of p-n junction and how it can be used as a p-n junction as diode in different modes of operation	L1,2
3.	Know the construction, working principle of different diodes and rectifiers with and without filters	L1,2
4.	Understand the construction, principle of operation of BJT with their V-I characteristics in different configurations	L1,2
5.	Analyze and design the different biasing circuits of BJT	L2,3
6.	Understand the construction, principle of operation and biasing of FET and MOSFET with their V-I characteristics in different configurations	L1,2

Correlation of COs with POs & PSOs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	1	1	-	-	-	-	-	2	2	-	-	3	2
CO 2	3	2	2	-	-	-	-	-	2	2	-	-	3	2
CO 3	3	2	3	-	-	-	-	-	2	2	-	-	3	3
CO 4	3	2	2	-	-	-	-	-	2	2	-	-	3	2
CO 5	3	2	2	-	-	-	-	-	2	2	-	-	3	3
CO 6	3	2	2	-	-	-	-	-	2	2	-	-	3	3

Text Books:

1. Electronic Devices and Circuits– J. Millman, C. Halkias, Tata McGraw-Hill, Third Edition, 2010.
2. Electronic Devices and Circuit Theory– R.L. Boylestad and Louis Nashelsky, Pearson Publications, Eleventh Edition, 2013.
3. Electronic Devices and Circuits—G.S.N Raju, I.K International Publishing Housing Pvt.Ltd
4. Electronic Devices and Circuits David A Bell, Fifth Edition 2008, Oxford University Press.

Reference Books:

1. Integrated Electronics: Analog and Digital Circuits and Systems J. Millman and Halkias, TMH.
2. Electronic Devices and Circuits– Salivahanan, N. Suresh Kumar, A. Vallavaraj, Tata McGraw-Hill, Second Edition, 2008.
3. Micro Electronic Circuits Sedra and Smith, Oxford University Press.
4. Electronic Devices and Circuits G.K. Mithal, Khanna Publishers.