



II Year-I Semester	L	T	P	C
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ELECTRONIC DEVICES AND CIRCUITS (RT21041)

Prerequisite Course:

-Nil-

Course Description and Objectives:

- To learn and understand the basic concepts of semiconductor physics.
- Study the physical phenomena such as conduction, transport mechanism and electrical characteristics of different diodes.
- To learn and understand the application of diodes as rectifiers with their operation and characteristics with and without filters are discussed.
- Acquire knowledge about the principle of working and operation of Bipolar Junction Transistor and Field Effect Transistor and their characteristics.
- To learn and understand the purpose of transistor biasing and its significance.
- Small signal equivalent circuit analysis of BJT and FET transistor amplifiers and compares different configurations.

Course Outcomes:

Upon completion of the course, the student will be able to achieve the following outcomes.

COs	Course Outcomes	POs
1	Understand the basic concepts of semiconductor physics.	3
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.	3
3	Know the construction, working principle of rectifiers with and without filters with relevant expressions and necessary comparisons.	3
4	Understand the construction, principle of operation of transistors, BJT and FET with their V-I characteristics in different configurations.	3
5	Know the need of transistor biasing, various biasing techniques for BJT and FET and stabilization concepts with necessary expressions.	3
6	Perform the analysis of small signal low frequency transistor amplifier circuits using BJT and FET in different configurations.	3

SYLLABUS

UNIT – I

Review of Semi Conductor Physics: Hall effect, continuity equation, law of junction, Fermi Dirac function, Fermi level in intrinsic and extrinsic Semiconductors

Junction Diode Characteristics: energy band diagram of PN junction Diode, Open circuited p- n junction, Biased p-n junction, p-n junction diode, current components in PN junction Diode, diode equation, V-I Characteristics, temperature dependence on V-I characteristics, Diode resistance, Diode capacitance.

UNIT – II

Special Semiconductor Devices: Zener Diode, Breakdown mechanisms, Zener diode applications, LED, Varactor Diode, Photodiode, Tunnel Diode, UJT, PN-PN Diode, SCR. Construction, operation and V-I characteristics.

Rectifiers and Filters: Basic Rectifier setup, half wave rectifier, full wave rectifier, bridge rectifier, derivations of characteristics of rectifiers, rectifier circuits-operation, input and output waveforms, Filters, Inductor filter (Series inductor), Capacitor filter (Stunt inductor), π - Filter, comparison of various filter circuits in terms of ripple factors.

UNIT – III

BJT: Junction transistor, transistor current components, transistor equation, transistor configurations, transistor as an amplifier, characteristics of transistor in Common Base, Common Emitter and Common Collector configurations, Ebers-Moll model of a transistor, punch through/ reach through, Photo transistor, typical transistor junction voltage values.

FET: FET types, construction, operation, characteristics μ , g_m , r_d parameters, MOSFET-types, construction, operation, characteristics, comparison between JFET and MOSFET.

UNIT – IV

Transistor Biasing and Thermal Stabilization: Need for biasing, operating point, load line analysis, BJT biasing- methods, basic stability, fixed bias, collector to base bias, self bias, Stabilization against variations in V_{BE} , I_c , and β , Stability factors, (S, S', S''), Bias compensation, Thermal runaway, Thermal stability.

FET Biasing- methods and stabilization.

UNIT – V

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, Analysis of CG, CS and CD amplifiers, comparison of FET amplifiers.

Text Books:

1. Electronic Devices and Circuits- J. Millman, C. Halkias, Tata Mc-Graw Hill, SecondEdition,2007
- 2.Electronic Devices and Circuits-K. Lal Kishore, BS Publications, FourthEdition,2016.
- 3.Electronics devices & circuit theory- Robert L.Boylestad andLouiNashelsky, Pearson/Prentice hall, tenth edition,2009

References:

- 1.Integrated Electronics-J. Millman, C. Halkias,Tata Mc-Graw Hill, SecondEdition,2009
- 2.Electronic Devices and Integrated Circuits – B.P. Singh,Rekha , Pearson publications,
- 3.Electronic Devices and Circuits-Salivahanan, Kumar, Vallavaraj, Tata Mc-Graw Hill, 4thEdition,2008.