



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**  
**KAKINADA – 533 003, Andhra Pradesh, India**  
**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**

II Year I Semester		L	T	P	C
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ELECTRONIC DEVICES AND CIRCUITS					

**Preamble:**

This course introduces the concepts of semi-conductor physics and operation of various semi-conductor devices. Realization of rectifiers, amplifiers and oscillators using semi-conductor devices, transistors and their analysis is introduced in this course.

**Course Objectives:**

The main objectives of this course are:

- The basic concepts of semiconductor physics are to be reviewed.
- Study the physical phenomena such as conduction, transport mechanism and electrical characteristics of different diodes.
- The application of diodes as rectifiers with their operation and characteristics with and without filters are discussed.
- The principal of working and operation of Bipolar Junction Transistor and Field Effect Transistor and their characteristics are explained.
- The need of transistor biasing and its significance is explained. The quiescent point or operating point is explained.
- Small signal equivalent circuit analysis of BJT and FET transistor amplifiers in different configuration is explained.

**UNIT - I**

**Semi-Conductor Physics:** Insulators, Semiconductors, and Metals, classification using energy band diagrams, mobility and conductivity, electrons and holes in intrinsic semiconductors, extrinsic semiconductors, drift and diffusion, charge densities in semiconductors, Hall effect, continuity equation, law of junction, Fermi Dirac function, Fermi level in intrinsic and extrinsic Semiconductors

**Junction Diode Characteristics:** 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, energy band diagram of PN junction Diode.

**UNIT - II**

**Special Semiconductor Devices:** Zener Diode, Breakdown mechanisms, Zener diode applications, LED, Photodiode, Tunnel Diode, SCR, UJT. Construction, operation and characteristics of all the diodes are required to be considered.

**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, Capacitor 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, parameters, MOSFET-types, construction, operation, characteristics, comparison between JFET and MOSFET.



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**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  $\beta$ , 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.

**Course Outcomes:**

At the end of this course the student can able to:

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

**Text Books:**

1. Electronic Devices and Circuits- J. Millman, C.Halkias, Tata Mc-Graw Hill, 2<sup>nd</sup> Edition, 2010.
2. Electronics devices & circuit theory- Robert L.Boylestad and LouiNashelsky, Pearson/Prentice hall, 10<sup>th</sup> edition, 1999.

**References:**

1. Electronic Devices and Circuits-K. Satya Prasad, VGS Book Links, 2<sup>nd</sup> Edition, 2006.
2. Electronic Devices and Circuits-Salivahanan, Kumar, Vallavaraj, Tata Mc-Graw Hill, 2<sup>nd</sup> Edition, 2018.
3. Electronic Devices and Circuits – David Bell, Oxford, 5<sup>th</sup> Edition, 2008.