# ELECTRONIC DEVICES

**Course Code:22EC1101**

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**Course Outcomes:** At the end of the course the student will be able to
**CO1:** Illustrate fundamentals of semiconductor physics for active devices (L3)
**CO2:** Demonstrate the characteristics of PN Junction diodes and Zener Diode (L3)
**CO3:** Illustrate the functional behaviour of rectifiers and filters (L3)
**CO4:** Examine the V-I characteristics in different types of transistors (L3)
**CO5:** Analyze the V-I Characteristics and applications of Special Devices (L4)

**UNIT-I** **12 Lectures**

**Introduction to Semiconductor Physics:**

Review of Quantum Mechanics, Electrons in periodic Lattices, E-k diagrams, Energy bands in intrinsic and extrinsic silicon, Carrier transport, diffusion current, drift current, mobility and resistivity, Generation and recombination of carriers, Continuity equation.

Learning outcomes: At the end of this unit, the student will be able to

1. understand the basics of Semiconductor Physics (L2)
2. determine the equations for carrier concentration in semiconductors (L3)
3. differentiate drift and diffusion current of a Semiconductor device (L2)

**UNIT-II** **08 Lectures**

**Diode Characteristics:**

P-N junction characteristics, Diode Equation, V-I Characteristics of Diode, Zener Diode Characteristics, Zener Diode as Voltage Regulator.

Learning outcomes: At the end of this unit, the student will be able to

1. understand V-I Characteristics of P-N Diode (L2)
2. describe the characteristics of Zener diode (L3)
3. determine the behaviour of zener diode as voltage regulator (L3)

**UNIT-III** **10 Lectures**

**Rectifiers & Filters:**

Half wave rectifier, Full wave rectifier, Advantages of full wave rectifier over Half Wave rectifier, Bridge Rectifier, C- Filter, L filter, LC- Filter, Pi- filter.

Learning outcomes: At the end of this unit, the student will be able to

1. understand basics of rectifiers (L2)
2. determine the ripple factor of rectifiers with and without filters (L3)
3. understand the behaviour of filter circuits (L2)

**UNIT-IV** **12 Lectures**

**Transistor Characteristics:**

Bipolar junction transistor (BJT) - input & output Characteristics of transistor in CB, CE, CC configurations, Relations between current gain parameters (α, β, ϒ), Characteristics of JFET, MOSFET (enhancement and depletion).

Learning outcomes: At the end of this unit, the student will be able to

1. understand V-I characteristics of BJT and JFET (L2)
2. understand the V-I characteristics of MOSFET (L2)
3. illustrate the characteristics of different transistor configurations (L3)

**UNIT-V** **08 Lectures**

**Special Devices:**

Degenerate semiconductors, tunnel diode, Varactor Diode, LED, Photodiode, UJT characteristics and applications, PNPN device, SCR, DIAC, TRIAC.

Learning outcomes: At the end of this unit, the student will be able to

1. understand the V-I Characteristics of negative resistance device components (L2)
2. understand the V-I Characteristics of High power device components (L2)
3. analyze the applications of negative resistance and high power device components (L4)

**Text Books:**

1. G. Streetman, and S. K. Banerjee, *Solid State Electronic Devices*, 7th Edition, Pearson, 2014.
2. Millman Jacob Halkias C Christos, *Electronic Devices and Circuits*, 2nd Edition, Tata McGraw-Hill Publications, 2007.

**Reference Books:**

1. D. Neamen, D. Biswas, *Semiconductor Physics and Devices*, 4th Edition, McGraw-Hill Education, 2017.
2. S. M. Sze, K. N. Kwok, *Physics of Semiconductor Devices*, 3rd Edition, John Wiley & Sons, 2006.
3. C.T. Sah, *Fundamentals of solid state electronics*, World Scientific Publishing Co. Inc, 1991.
4. Y. Tsividis and M. Colin, *Operation and Modeling of the MOS Transistor*, 3rd Edition, Oxford University Press, 2011.

**Web References:**

https://onlinecourses.nptel.ac.in/noc21_ee55/preview

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