

Course Type	Course Code	Name of Course	L	T	P	Credit
DC	ECC201	Electronic Devices	3	0	0	09

Course Objective

The objective of the course is to develop an understanding of the device concepts and their operation that will be needed in a broad range of areas including modern semiconductor devices, circuit and VLSI design and engineering.

Learning Outcomes

Upon successful completion of this course, students will:

- acquire a basic knowledge of the physical characteristics, such as electronic structures and optical and transport properties of semiconductors
- develop the understanding of the physics and internal working of the basic solid state devices and derive their characteristics
- have appreciation of semiconductor technology and advanced devices

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	Physics and Properties of Semiconductors: Band structure, Fermi distribution, Density of states, intrinsic and extrinsic semiconductors, carrier concentration at thermal equilibrium.	6	Acquire an understanding of the semiconductor band structure and calculation of carrier concentrations.
2	Carrier transport phenomena: Carrier drift and diffusion, Generation and recombination, Minority carrier lifetime, Continuity equation, Solution of diffusion equations, Quasi Fermi levels, Hall effect.	8	Develop an understanding about the carrier transport in semiconductors.
3	p-n junctions: Built-in potential, Depletion region, Electrostatics of p-n junction, Derivation of diode equations, Current voltage characteristics, Capacitance, Transient behavior, Junction breakdown, Metal semiconductor junctions, Ohmic contact, Schottky diode, Solar Cells, Photodiodes, LEDs and Laser Diodes.	10	Understand the functioning of various pn junction and metal semiconductor junction devices and derive their characteristics.
4	Bipolar junction transistors: Transistor analysis, Frequency response and switching, Ebers-Moll model, small signal model (h equivalent), Deviations from the ideal behavior.	8	Ability to derive the BJT characteristics and obtain their mathematical models.
5	MOS system, Electrostatics of MOS structure, Capacitance Voltage characteristics, MOSFET fundamentals, I-V characteristics and MOS models.	7	Understand the fundamentals and characteristics of MOS devices.
6	State-of-the-Art MOS Technology: small-geometry effects, fin-FETs, ultrathin body FETs, ballistic transport, hot-electron effects.	3	Get an overview of MOS technology and recent developments of device features.

Textbook:

1. Solid State Electronic Devices, B. G. Streetman and S. K Banerjee, Pearson Education India (2015)

Reference Books:

1. Semiconductor Device Fundamentals, R, F, Pierret, Pearson (2006)
2. Semiconductor Physics and Devices, D. Neamen and D. Biswas, McGraw Hill Education (2017)
3. Semiconductor Devices, Physics and Technology, S. M. Sze and M. Lee, John Wiley & Sons (2015)
4. Fundamentals of Modern VLSI Devices, Y. Taur and T. H. Ning, Cambridge University Press (2016)
5. Integrated Electronics, J. Millman and C. Halkias, and C. Parikh, Tata McGraw-Hill (2017)