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| **ourse Type** | **Course Code** | **Name of Course** | **L** | **T** | **P** | **Credit** |
| DC | ECC201 | Electronic Devices: | 3 | 1 | 0 | 11 |

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| **Course Objective** Group email for ED students: ECC201@iitism.ac.in: |
| 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 |

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| **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 | 7 | 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 | 7 | 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 | 8 | 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  Tot. 40 | 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. **Integrated Electronics, J. Millman and C. Halkias,and C. Parikh, Tata McGraw-Hill, 3RG ed., (2017)**
3. **Principle of Electronic Materials and Devices, S. O. Kasap, McGraw Hills, 3rd Ed (2006)**
4. Semiconductor Physics and Devices, D. Neamen and D. Biswas, McGraw Hill Education (2017)
5. Semiconductor Devices, Physics and Technology, S. M. Sze and M. Lee, John Wiley & Sons (2015)
6. Fundamentals of Modern VLSI Devices, Y. Taur and T. H. Ning, Cambridge University Press (2016)

**Weightage distribution of a course may now be done accordingly.**

The suggested distribution is:

Mid Sem: 0

End Sem: 48 Remaining 52% marks includes 4 mandatory quizzes (40% to 52%) and assignment(s) if any(12% to 0%)