

Course Type	Course Code	Name of Course	L	T	P	Credit
DE	NECD518	Advanced Solid State Devices	3	0	0	3

Course Objective

The course provides an opportunity for students to undertake advanced study and research in variety of different semiconductor devices and applications. Topics include the background solid state and semiconductor physics which serves to understand various optoelectronic and microwave devices

Learning Outcomes

At the end of the course, the students must be able to

- Understand the physics of advanced semiconductor electronic devices along with their charge transport mechanisms.
- Understand and analyse the behaviour of high-performance devices, device operation, and device characteristics.
- Understand how device design affects performance.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	Bonds, crystal lattices, crystallographic planes and directions, direct and indirect semiconductors and their comparison for optical applications, optical processes of absorption and emission, radiative and non-radiative deep level transitions, phase and energy band diagrams of binary, ternary and quaternary alloys, determination of cross-over compositions and band structures.	10	Student will learn about the crystal and band structures
2	Heterostructures: Introduction, abrupt isotype/anisotype junctions, band diagrams and band off-sets, electrical and optoelectronic properties, symmetrical and asymmetrical p-n diodes and their characteristics, 2-Dimensional Electron Gas (2-DEG).	11	Student will learn about the properties of 2D heterostructures
3	Heterostructure devices: HBT, MOSFET, MESFET, HEMT/MODFETs, quantum well and tunneling structures, lasers, LED and photodetectors, optoelectronic IC's and strained layer structures.	11	Students will learn about different heterostructure devices
4	High frequency devices: Design of high frequency amplifiers and oscillators, Resonant tunneling structures, RTD Oscillators; Intervalley scattering, Gunn diodes, IMPATT diodes, Step recovery diodes.	10	Students will learn about the high frequency devices.
Total		42	

Test Book:

1. Sze, S.M., "VLSI Technology", 4thEd., Tata Mc Graw-Hill.

Reference Books:

1. Plummer, J.D., Deal, M.D. and Griffin, P.B., "Silicon VLSI Technology: Fundamentals, Practice and Modeling", 3rd Ed., Prentice-Hall
2. Chang, C.Y. and Sze, S.M., "ULSI Technology", Mc Graw-Hill.
3. Gandhi, S.K., "VLSI Fabrication Principles: Silicon and Gallium Arsenide", John Wiley and Sons.
4. Campbell, S.A., "The Science and Engineering of Microelectronic Fabrication", 4thEd., Oxford University Press.