Course Type	Course Code	Name of Course	L	T	P	Credit
DE	NECD531	Nanoelectronics	3	0	0	3

Course Objective

The objective of the course is to develop an understanding of physical background and applications of nanoelectronics. The course will cover the basic concepts required for understanding the working of novel devices, transport phenomena in nanostructures. It will introduce to the fabrication of nanostructures, and the characterization tools. Some important devices including resonant-tunneling devices, single electron transistors etc. will be discussed

Learning Outcomes

Upon successful completion of this course, students will:

- acquire a knowledge of the fundamentals required for nanoelectronics.
- develop the understanding of the working of some important nanoelectronic devices along with the fabrication and characterization techniques.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1.	Trends in nanoelectronics, Characteristic lengths in mesoscopic systems, Essentials of Quantum Mechanics, Semiconductor heterostructures, Quantum wells, wires and dots	5	Acquire an understanding of the basic concept of nanostructures
2.	The Physics of Low-Dimensional Semiconductors: Basic properties of two-dimensional semiconductor nanostructures, Density of states in lower dimensions, classical and quantum statistics of particles	8	Get an understanding of the fundamentals of lower dimensional semiconductors
3.	Tunnelling transport: Transfer matrix approach, Tunnelling through a potential barrier, Kronig Penney model, WKB method, applications of tunneling, Schottky barrier, field emission, hot electron effects in MOSFETs	10	Learn about the basic tools for tunneling transport and their applications
4.	Classical and semiclassical transport, ballistic transport through a quantum wire, Landauer formula, quantum resistance and conductance	6	Acquire an understanding of the semiclassical and quantum transport in nanostructures
5.	Nanoelectronic devices, Resonant tunneling devices, single electron transfer devices, Field effect transistors, LEDs and lasers	8	Have a knowledge of some of the important nanoelectronic devices
6.	Fabrication techniques for nanostructures: Lithography, split-gate technology, self-assembly, Characterization of nanostructures	5	Acquire the information about the fabrication and characterization techniques for nanostructures
	Total	**42**	

Text Books:

1. Fundamentals of Nanoelectronics, George. W. Hanson, Pearson Prentice Hall (2008)

Reference Books:

1. Introduction to Nanoelectronics, V.V. Mitin, V. A. Kochelap and M. A. Stroscio, Cambridge University Press (2007)
2. The Physics of Low-dimensional Semiconductors: An Introduction, John Davies, Cambridge University Press (1997).
3. Quantum Transport: Atom to Transistor, SupriyoDatta, Cambridge University Press (2005).