PPH447: NANOELECTRONICS

L	T	P	Cr
3	1	0	3.5

Course Objectives: The course aims at imparting knowledge of nanoscience applications in the field of electronics.

Fundamental of Nanoelectronics: Basics of nanoelectronics– physical fundamentals of nanoelectronics – basics of information theory – the tools for micro and nanofabrication – basics of lithographic techniques for nanoelectronics –microlithography- nanolithography- tools for nanolithography

MOSFETS: Silicon MOSFETS- fundamentals of MOSFET devices-NanoFETS-single electron MOS transistor –split gate transistor – Electron wave transistor – Electron spin transistor – advanced MOSFET concepts – Principles of Single Electron Transistor (SET) – SET circuit design – comparison between FET and SET circuit design-

Quantum Electron Devices: Classical to quantum physics – electrons in mesoscopic structure – Nanoelectronics with tunneling devices and superconducting devices – tunneling element technology – Resonant tunneling Devices single electron devices- single electron devices for logic and gate applications- Carbon Nanotube based logic gates, optical devices. Quantum dots, quantum wires, and quantum wire.

Memory Devices and Sensors: Nanoferroelectrics – Ferroelectric random access memory – Fe-RAM circuit design – ferroelectric thin film properties and integration – calorimetric sensors – electrochemical cells– resistive semiconductor gas sensors –electronic noses – identification of hazardous solvents and gases – semiconductor sensor array.

Course Learning Outcomes (CLO):

The students will be able to:

1. know basics of nanoelectronics and its fabrication.
2. understand fundamentals of ´MOSFETS and design of circuits
3. understand the concept quantum mechanics in electronics
4. learn molecular devices and its synthesis techniques
5. understand nanoferroelectronics using Fe-RAM, sensors

Recommended Books:

1. *W.R. Fahrner, Nanotechnology and Nanoelectronics: Materials, Devices, Measurement Techniques, Springer, (2010).*
2. *K. Goser, P. Glosekotter, J. Dienstuhl, Nanoelectronic and Nanosystems – From Transistors to Molecular Quantum Devices, Springer, (2004).*
3. *Rainer Waser, Nanoelectronics and Information Technology: Advanced Electronic Materials Novel and Devices, Wiley VCH, (2005).*
4. *Mick Wilson, KamaliKannangara, Geoff smith, Nanotechnology: Basic Science and Emerging Technologies, Overseas press, (2005).*