EC804 ELECTRONIC AND PHOTONIC TECHNOLOGY 4-0-0-4

Objectives

(1) Understanding the development of electronic and photonic technology as industrial standards;

(2) Understanding the bottlenecks of electronic technology and scope of photonic technology;

(3) Relationship between electrons and photons;

(4) Relevant Semiconductor physics and introduction to nanotechnology in Electronics and Photonics.

Keywords: Nano-technology, Electronics, Photonics, Semiconductors.

Course Contents

Moore's Law and technology nodes; interconnects between classical and quantum systems. General postulates of quantum mechanics; time independent Schroedinger equation; analogies between quantum mechanics and classical electromagnetic fields; probability current density. Free electron gas theory of metals; electrons confined to a bounded regions of space and quantum numbers; Fermi level and chemical potential; partially confined electrons finite potential wells; electron confined to atoms the hydrogen atoms and periodic table; quantum wells, wires and dots. Crystalline materials and periodic potential; time and length scales of electrons in solids; band theory of solids; statistics of electrons in solids and nanostructures; the density of states of electrons in nanostructures; electron transport in nanostructures; graphene and carbon nanotubes. Resonant tunneling diodes; field effect transistors; time dependent Schroedinger equation; Fermis golden rule, spontaneous and stimulated emissions; optical cavity and quantum well lasers; electrical, optical and plasmonic interconnects.

TEXT BOOKS/ REFERENCES:

1. Introduction to Nanoelectronics by V.V. Mitin, V.A. Kochelap and M. A. Stroscio (Cambridge University Press 2008)
2. Quantum Transport : Atom to Transistor by Suprio Datta (Cambridge University Press, 2005)
3. Applied Quantum Mechanics by A.F.J. Levi (Cambridge University Press, 2006)
4. Introduction to Nanophotonics by Sergey V. Gaponenko (Cambridge University Press, 2010)
5. Photonics, Volume 1, 2 by David L. Andrews (John Wiley & Sons, 24-Feb-2015)
6. Chiral Nanophotonics: Chiral Optical Properties of Plasmonic Systems by Martin Schäferling (Springer, 11-Nov-2016)
7. Nanophotonics and Plasmonics: An Integrated View by Dr. Ching Eng (Jason) Png, Dr. Yuriy Akimov (CRC Press, 21-Aug-2017)