

# MSE 963 Semiconductor and Optical Materials

**CHs:** 3

**Pre-requisites:** Nil

## **Course Objectives:**

- To understand structure of materials
- To learn about the metal, semiconductor and insulators
- To study band gap of materials
- To learn the semiconducting devices
- To understand basic concept of optical properties of different materials
- To understand the concept of carrier transport in semiconductor
- To learn the growth of crystals using different techniques
- To learn the different deposition techniques

## **Course Contents:**

- Review of Atomic Structure and Statistical mechanism,
- Semiconductor materials and their properties, Energy bands in single crystal,
- Fermi energy and Fermi Surface, Compound Semiconductors,
- Metal-Semiconductor contacts, Rectifying contacts, OhmicContacts, Zener Diodes,
- Photo-Diodes, Carrier transport in Semiconductor, Optical Contacts, Damping Constant,
- Quantum Mechanical treatment of Optical Properties, Optical Spectra of pure metal,
- Ceramics and glasses.
- Crystal Growth and Wafer Preparation, Epitaxial Growth,
- Lithography, Dielectric and PolysiliconFilm Deposition, Metallization, Ion Implantation.

## **Course outcomes:**

- The student will be able to differentiate between conductor, semiconductor and insulator on the basis of Band theory.
- Understanding the phenomena for the fabrication of semiconducting materials and their optical properties
- Able to explain the concept of Fermi energy and Fermi surface in semiconducting materials

- Able to analyze the optical spectra of pure metals, ceramics and glasses
- To differentiate between Zener Diodes and Photo-Diodes

### **Recommended Text/ Reference Books**

- Introduction of Semiconductor Materials and Devices, M. S. Tyagi
- Electronic Properties of Materials, Rolf E. Hummel (Springer)
- Semiconductor Optoelectronic Devices, Pallab Bhattacharya (Prentice Hall)
- Solid State Physics, Ben G. Streetman (Prentice Hall)
- Introduction of Solid State Physics, Charles Kittel
- Fundamentals of Semiconductor manufacturing and Process Control, Gray S. May, Costas J. Spanos
- Semiconductor Materials and Devices Characterization, Dieter K. Schroder
- VLSI Technology by S M Sze