

# SIDDARTHA INSTITUTE OF SCIENCE AND TECHNOLOGY: PUTTUR

**I B. TECH, II – Semester**

**L T P C**  
**3 1 0 4**

**Branch: ECE and CSE.**

## **SEMICONDUCTOR PHYSICS (18HS0851)**

### **Objectives:**

- Basic concepts of free electron theory and energy bands in solids.
- Key points, formation and importance of semiconductors.
- Will Understand working principles and applications of optoelectronic devices.
- Will recognize the basic concepts related properties of Lasers and Optical Fibers..
- To understand the fundamentals Nano materials.

### **Unit – I: ELECTRONIC MATERIALS.**

Free electron theory, density of states and energy band diagrams – Energy bands in solids – E – K band diagram, direct and indirect band gaps, types of electronic materials : metals , semiconductors and insulators – occupation probability – Fermi level – effective mass .

### **Unit – II: SEMICONDUCTORS.**

Intrinsic and Extrinsic semiconductors – Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics) - Carrier generation and recombination - Carrier transport: diffusion and drift -Hall Effect- p -n junction – Metal semiconductors junction-Ohmic and Schottky Junctions.

### **Unit –III: LIGHT EMITING DIODE (LED) & PHOTODETECTORS.**

Rate equations for carrier density – radiative and non - radiative recombination mechanisms in semiconductors – LED: structure, materials, characteristics and figure of merits.

Photo detectors – PIN and Avalanche diode and their structure, materials working principle and characteristics – Solar cell.- Principle and characteristics

### **Unit – IV: LASERS AND FIBER OPTICS.**

Characteristics of laser beams, Einstein’s theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: Semiconductor laser, applications of lasers in science, engineering and medicine.

Principle of fiber optics – acceptance angle and numerical aperture – types of fibre cables- losses in fiber optics – optical fiber communication system - applications of fiber optics.

## **UNIT-V: PHYSICS OF NANOMATERIALS.**

Introduction, significance of nano scale – surface area and quantum confinement- Quantum dot, Quantum well , Quantum wire -Synthesis of nanomaterials- Top Down Process- Ball Milling ; Bottom Up Process: Sol-Gel method– CNT-Properties of Graphene- Applications.

### **Reference books:**

1. J. Singh, Semiconductor optoelectronics, Physics and Technology, McGraw-Hill Inc. (1995).
2. S.M. Sze, Semiconductor devices: Physics and Technology, Wiley (2008).
3. P. Bhattacharya, Semiconductor optoelectronic devices, Prentice Hall of India (1997).
4. B.E.A. Saleh and M.C, Tech, Fundamentals of photonics, John Wiley & Sons.
5. Engineering Physics – K.Thyagarajan, MCGrawHill Education Private Ltd, New Delhi.

### **Course outcomes:**

- Would understand the basic concepts of free electron theory and energy bands in solids.
- Able to deliver importance of semiconductors.
- Would understand working principles and applications of optoelectronic devices.
- Able to explain concepts related to Lasers and Optical fibers. .
- Understand the importance of Nanotechnology.

