EE 803 PHYSICAL ELECTRONICS

Total Credits: 03

Lecture/Recitation/Discussion Hours: (3-0)

Course Objectives:

At the end of this first graduate level course in solid state student will be able to understand basic concepts in quantum mechanics, identify common semiconductor crystal structures, select compatible semiconductor materials used in bandgap engineering, lattice vibrations and their influence on material properties, calculate energy bands in a free electron model for simple crystal structures, extract material properties such as effective mass, energy band gap from given energy band diagram, list common charge carrier scattering mechanism and movement of charge carriers under equilibrium and non-equilibrium.

Course Topics/outline:

1. Electron states in solids
    a. Bloch Theorem
    b. Energy band solutions
    c. Tight binding approximations
2. Electrons and holes in equilibrium
    a. Intrinsic semiconductors
    b. Extrinsic semiconductors
3. Electrons and holes in non-equilibrium
    a. Boltzman Transport Equation
    b. Carrier scattering
    c. Carrier mobility
4. Crystal Types and lattice properties
    a. Lattice definitions and symmetry types
    b. Real and reciprocal space
    c. Atomic bonds
5. Quantum Fundamentals
    a. Quantum mechanics postulates
    b. Solutions for allowed energies and wave functions

Prerequisites:

Undergraduate level courses on electronics and/or semiconductor/ physics.

Textbook:

Advanced semiconductor fundamentals, 2nd ed, by Robert F Pierret

Supplementary Textbooks:

1. Principles of electronic materials and devices by S O Kasap
2. Physics of semiconductor devices by S M Sze