1. ECE 471A (ECE 480A2): Semiconductor Physics

2. 1 credits: 2-75 minute lecture sessions/week – 5 weeks

3. Carmen Menoni

4. Semiconductor Physics and Devices: Basic Principles. Neamen, D. A. 2011.

5. Course Information
    a. Fundamentals of semiconductor electron, hole states and motion: bandgap, effectrive mass, carrier density, Fermi level, doping, drift and diffusion
    b. Prerequisites: MATH 340 or MATH345; PH142
    c. Selected Elective: Computer Engineering; Electrical Engineering; Lasers & Optical Engineering

6. Goals for the Course
    a. Course Learning Objectives
        i. Understand the fundamentals in the behavior of optical devices: lasers, and detectors, and of light propagation through experiments
        ii. Acquire basic skills for working with modern optics components through weekly experiments
        iii. Enhance skills for record keeping of laboratory experiments
        iv. Present technical results
    b. Student Outcomes
        1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

7. Topics Covered

    Electronic states of semiconductors
    E vs. k plots, direct and indirect bandgaps
    Density of states, effective mass, statistical distributions, Fermi-Dirac integral
    Maxwell-Boltzmann distribution
    Equilibrium carrier concentrations, equilibrium thermal generation, instrinsic carrier concentration, dopants, extrinsic carrier concentration,
    Relationship between carrier concentrations and Fermi level
    Drift currents
    Velocity-field relationship, carrier scattering and mobility, semiconductor resistors.
    Diffusion, diffusivity
    Einstein relationship
    Band diagrams of homogeneous semiconductors