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

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

3. Carmen Menoni


5. Course Information
   a. Fundamentals of semiconductor electron, hole states and motion: bandgap, effective 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, intrinsic 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