



Semiconductor Electronic Devices

ECE 3030

Credit Hours:

3.00

Course Levels:

Undergraduate (1000-5000 level)

Course Components:

Lecture

Course Description:

Semiconductor materials and devices. Crystals; bandstructure; charge carrier statistics; excess carriers, transport; PN junction; Schottky barrier; bipolar and field-effect transistors; optoelectronic devices; nanoscale devices.

Prerequisites and Co-requisites:

Prereq: Physics 1251, 1261, or both 1240 and 1241; and Chem 1210, 1220, or 1250. Prereq or concur: Math 2415 or 2174.

Course Goals / Objectives:

- Be familiar with the fundamentals of material structure (crystal, amorphous, polycrystalline)
 - Be familiar with the fundamentals of quantum mechanics
 - Be competent in analyzing the relationships between the physical and electronic properties of semiconductors
 - Be familiar with the fundamental principles of operation of semiconductor devices
 - Master energy band diagram analysis
 - Be competent with pn junction device physics
 - Be exposed to a modern engineering simulation tool (2D device simulator)
 - Be familiar with necessary background to understand the principle of new electronic devices as new technologies develop
 - Be exposed to a modern engineering simulation tool (2D device simulator)
 - Be familiar with necessary background to understand the principle of new electronic devices as new technologies develop
-

Course Topics:

- Overview and motivation
 - Microstructure & Crystal structure
 - Electronic material synthesis, defects
 - Principles of quantum mechanics
 - Band structures
 - Semiconductor statistics and charge carrier properties
 - Excess carriers and transport
 - PN junction, metal-semiconductor junctions, Diodes
 - Field effect transistor (regular and HEMT)
 - Bipolar Junction Transistor (regular and hetero)
 - Optoelectronic Devices
 - Overview of new materials, devices, and techniques
-

Designation:

Required

Elective