# THE OHIO STATE UNIVERSITY

COLLEGE OF ENGINEERING

## **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
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#### **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