EE 4231
Solid State Physical Electronics

Curricular Designation:  CpE: Elective    EE: Elective

Catalog Description: Device physics and physical models of the most basic solid-state device structures. Major topics include the terminal characteristics and their physical origin, device design, and device applications. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Prerequisites: EE 3130

Text Book(s) and or other required Materials:
2. Relevant user manuals for the CAD tools

Prerequisites by Topic:
1. Basic concepts of semiconductor devices
2. Circuit applications of semiconductor devices
3. Atomic view of matter and radiation

Course Objectives:
1. Familiarity with the lattice structures, energy band diagrams of metals, semiconductors and insulators, direct band gap vs. indirect band gap semiconductors
2. Mastery of the carrier statistics and dynamics in intrinsic and extrinsic semiconductors
3. Mastery of the origin of current-voltage characteristics of diodes and transistors
4. Familiarity with device cross sections and device design and fabrication
5. Computer-based analysis of concepts and phenomena of solid-state electronics
Topics Covered:
1. Crystal properties of semiconductors
3. Energy Bands of Materials
4. Carriers in Intrinsic and Extrinsic semiconductors, temperature dependence
5. Drift and Diffusion of carriers, Poisson’s equation
6. PN Junctions: Diffusion and drift currents, current-voltage characteristics
7. Schottky diodes and ohmic contacts
8. Bipolar Junction Transistor: Operational behavior of BJTs
9. Field Effect Transistor: Current-voltage characteristics of FETs
10. Computer-based analysis of physical electronics concepts and phenomena

Relation of Course to Program Outcomes:

EE: Outcomes: a, e via topic(s): 1, 2, 3, 4, 5, 6, 7, 8 and 9
Outcome: k via topic(s): 10

CpE: Outcomes: a, e via topic(s): 1, 2, 3, 4, 5, 6, 7, 8 and 9
Outcome: k via topic(s): 10

Contribution of Course to Meeting the Professional Component

EE: Engineering Topics
CpE: Engineering Topics

Class/Laboratory Schedule (note: 1 hour = 50 minutes)
Lecture: 45 hours = 3 hours / week for 15 weeks

Prepared by:
Ashok Goel, Associate Professor, February 5, 2004