

EEE 436 Fundamentals of Solid-State Devices (3) [S]

Course (Catalog) Description:

Semiconductor fundamentals, pn junctions, metal-semiconductor contacts, metal-oxide-semiconductor capacitors and field-effect transistors, bipolar junction. transistors.
Lecture. Technical Elective.

Prerequisite:

EEE 352.

Textbook:

R.F. Pierret, *Semiconductor Device Fundamentals*, 1st Edition 1995, Prentice Hall ISBN: 0201543931.

Supplemental Materials:

B.G. Streetman, *Solid State Electronic Devices*, Fourth Edition, Prentice-Hall, 1995.

Coordinator:

D.K. Schroder

Prerequisites by Topic:

1. Fundamentals of semiconductor crystal growth
2. Miller indices
3. Band diagrams
4. Carrier statistics
5. Carrier Transport
6. Physics of pn junction
7. Bipolar junction transistors
8. Schottky devices
9. MOS capacitors
10. MOS field-effect transistors

Course Objective:

Students will understand semiconductor physics and devices.

Course Outcome:

Students will demonstrate an understanding of semiconductor physics and the operation of the most common semiconductor devices (pn junctions, metal-semiconductor devices, metal oxide semiconductor devices, and bipolar junction transistors), and will be prepared for subsequent courses with this course as a prerequisite.

Course Topics:

1. Crystal growth
2. Miller indices
3. Band diagrams
4. Carrier statistics

5. Carrier transport
6. pn junctions
7. Metal-semiconductor contacts
8. Bipolar junction transistors
9. MOS capacitors
10. MOS field-effect transistors

Computer Usage:

Most of the homework problems require the use of a computer for both calculation and plotting. The students can use their computer of choice. Most commonly, personal computers are used with existing software such as Mathematica, MathCad, MATLAB, BASIC, Fortran, C, Kalaidagraph, Cricketgraph.

Laboratory Experiments: None.

Course Contribution to Engineering Science and Design:

Students have to solve a variety of problems both in homework assignments and in exams. Some of these require extensive computer calculations; others are conceptual problems.

Course Relationship to Program Outcomes:

a: To understand the physics of semiconductor devices and the theory of their operation, students must use a variety of mathematical formulations and physics-based theory. Students must apply mathematics in the solution of the homework assignments.

i: Students learn from the lectures and assigned reading material how semiconductor devices function and their place in today's electronic world.

Also, some contribution to **e** (Students need problem solving ability in the completion of their homework assignments and examinations) and **k**(Students use modern computer programs in individual homework assignments).

Person preparing this description and date of preparation: Dieter Schroder, K. Tsakalis, Apr. 2009.