ECE 404 Syllabus

Course:	ECE 404
Credit Hours:	3
Course Title:	Introduction to Solid State Devices
Course Description:	

Basic principles required to understand the operation of solid-state devices. Semiconductor device equations developed from fundamental concepts. P-N junction theory developed and applied to the analysis of devices such as varactors, detectors, solar cells, bipolar transistors, field-effect transistors. Emphasis on device physics rather than circuit applications.

Prerequisite(s): ECE 302, ECE303

Textbook(s) and/or other required material:

Solid State Electronic Devices, Ben G. Streetman and Sanjay Banerjee, 6th Edition, Prentice Hall, 2006.

Course objectives. By the end of this course, the student should be able to (use demonstrative verbs):

1.Understand and explain the fundamental principles of modern semiconductor devices. 2.Understand and describe the impact of solid-state device capabilities and limitations on electronic circuit performance.

3.Develop the basic tools with which newly developed devices and other semiconductor applications can be studied.

Topics covered:

1. Crystal Properties; fundamental characteristics of metals, semiconductors and insulators (3 lectures)

- 2. Electron and hole properties in semiconductors (4 lectures)
- 3. Quantum effects and Fermi-Dirac statistics (5 lectures)
- 4. Energy Bands and Charge Carriers (4 lectures)
- 5. Excess Carriers, Fermi levels and Quasi-Fermi levels (4 lectures)
- 6. PN Junction, Metal-Semiconductor Junction, and MOS fundamentals (9 lectures)
- 7. Field Effect Transistors (4 lectures)
- 8. Bipolar Junction Transistors (4 lectures)
- 9. Optoelectronic Devices (2 lectures)
- 10. Emerging Technologies and novel devices (1 lectures)

Class/laboratory schedule (sessions per week and duration of each session):

3 50-minutes lectures per week.

Contribution of course to meeting the requirements of Criterion 5 - other:

Contribution of course to meeting the requirements of Criterion 5 - math and basic

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sciences:

1 hour.

Contribution of course to meeting the requirements of Criterion 5 - engineering topics:

2 hours.

Contribution of course to meeting the requirements of Criterion 5 - general education:

Relationship of this	course to	program	learning	outcomes:
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Learning Outcome	Level of Instruction	Related Course Content
Outcome A	Major	Students develop a fundamental understanding of the static and dynamic behavior of P-N Junction and Metal Oxide Semiconductor structures.
Outcome B	N/A	
Outcome C	Major	Students develop fundamental understanding of the impact of material parameters and device design on performance of selected solid-state devices.
Outcome D	Intermediate	Students collaborate in developing technical approaches leading to solutions to complex problems.
Outcome E	Intermediate	Students are introduced to the wave nature of particles and study the impact of such properties on device performance.
Outcome F	N/A	
Outcome G	N/A	

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
Outcome H	Intermediate	Students learn of major historical figures in modern physics and electrical engineering and their leadership in the development of the electronics industry.
Outcome I	N/A	
Outcome J	N/A	
Outcome K	Intermediate	

Person who last prepared this description and date of preparation:

• Masnari, Nino A. (masnari) - Mar 30th, 2009 (02:27pm)