Department of Electrical and Computer Engineering

New Jersey Institute of Technology

ECE 374: Electronic Device I (3 credits, 3 contact hours, required course)

Instructor: Leonid Tsybeskov; email: tsybesko@adm.njit.edu; Tel.: 973-596-6594

Text books Jasprit Singh, Semiconductor Devices, ISBN 0-471-36245-X (main text)
S. O. Kasap, Principles of electronic materials and devices, ISBN 0-07-295791-3

Catalog Description:

This course addresses electronic devices on a fundamental level. Topics include semiconductors, structure and properties of p/n junction, Schottky barrier, BJT, MOS, MOS FET, semiconductor optoelectronics.

Prerequisite: ECE 271 **Corequisite**: none

Specific course learning outcomes (CLO): The student will be able to

1. understand major properties of semiconductor materials, explain energy band diagrams and connections with the device structures and properties;
2. understand and utilize the basic governing equations to analyze semiconductor devices; design semiconductor devices and calculate device characteristics;
3. quantitatively evaluate limitations in design of circuits based on specific semiconductor devices;
4. understand and outline major steps of semiconductor device fabrication and microelectronic industry trends.

Relevant student outcomes (ABET criterion 3):

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics (CLOs 1, 2, 3,4)
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors (CLOs 3, 4)
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions (CLOs 1, 2, 3)

Computer assisted design and course specific software:
PSpice, Multisim, Kaleidagraph

This course outline serves to provide a big picture of the course. Instructional materials such as textbooks, individual topics, and grading policy are subject to revision and changes by individual instructors.

Tentative Course Schedule	Weeks
Semiconductor microelectronics and the latest industrial revolution	1
Introduction to energy-band diagrams, density-of-states and semiconductor statistics	2-3
Semiconductors in equilibrium, charge carriers and doping	4
Carrier transport and excess carriers, drift and diffusion, carrier recombination	5
Structure and properties of the Schottky barrier	6
Structure and properties of the p/n junction, photodetectors and solar cells	7-8
Bipolar Junction Transistors (BJT): basic principles and models of operation	9
Basic properties of metal-oxide-semiconductor (MOS) structures	10
Field-effect Transistors: MOS FETs and memory devices	11-12
Introduction to CMOS technology	13
Light emitting diodes and semiconductor lasers	14

Grading policy: weekly quizzes (-25% for missing or failed QZ, QZs can be retaken only once), four home projects (up to 50 points each), two midterm examination (100 points each), and final examination (100 points).

Homeworks and projects
PSpice/Multisim - based simulations of semiconductor devices; data processing requires Kaleidagraph software

Updates and Assignments to be distributed via e-mail

Office hours, recitations and group studies: By appointment

Honor Code: The NJIT Honor Code will be upheld; any violations will be brought to the immediate attention of the Dean of Students.

Office: ECE Bldg., Room 207

Prepared by: L. Tsybeskov

This course outline serves to provide a big picture of the course. Instructional materials such as textbooks, individual topics, and grading policy are subject to revision and changes by individual instructors.