

**ABET COURSE SYLLABUS****ECSE 2210: Microelectronics Technology**

- Course Catalog Description:** An introductory survey of microelectronics technology emphasizing physical properties of semiconductors, device and circuit fabrication, semiconductor device operation, IC layout and design, and related CAD software. Topics include semiconductor crystals; energy bands; electrons and holes; dopant impurities; fabrication and operation of diodes, bipolar junction transistors, and field-effect transistors; CMOS chip layout.
- Pre-Requisite Courses:** ECSE 2010 Electric Circuits
- Co-Requisite Courses:** ECSE 2100 Fields and Waves I
- Prerequisites by Topic:**
1. Basic electrical engineering laws such as Kirchoff's current and voltage law
  2. Passive Circuit Analysis
  3. Elementary electrostatic field theory
  4. First and second order linear differential equations
  5. Basic physics and chemistry
- Textbook:** R. F. Pierret: "Semiconductor Device Fundamentals" Addison-Wesley  
(and/or other required material)
- References:** Course web site gives syllabus, schedule, teaching materials, class exercises, and homework assignments
- Course Coordinator:** I. Bhat, Z. R. Huang, and E. F. Schubert
- Overall Educational Objective:** An introductory survey of microelectronics technology emphasizing physical properties of semiconductors, physical principles of device operation, equivalent circuits useful in circuit design and fundamental limitations of semiconductor devices and principles of integrated circuit fabrication. Particular emphasis is placed on semiconductor fundamentals, p-n junctions, and MOSFETs.
- Course Learning Outcomes:**
1. Understand semiconductor materials properties
  2. Understand the operating principles of solid-state devices
  3. Analyze the fundamentals governing the operation of devices
  4. Learn how to design solid-state devices such as diodes and transistors
  5. Learn how to use semiconductor devices in different application areas
- How Course Outcomes are Assessed:**
- |                         |     |
|-------------------------|-----|
| 3 Tests                 | 50% |
| 10 Homework Assignments | 10% |
| 34 Online Quizzes       | 15% |
| Final Exam              | 25% |

**Relation to EE/CSE/EPE Outcomes**

**N = none**  
**M = moderate**  
**H = high**

Outcome	Level	Demonstrate Proficiency
	N, M, H	e.g. Exams, projects, HW
Mathematics, science and engineering	H	HW, quizzes, tests
Basic disciplines in Electrical Engineering	H	HW, quizzes, tests
Depth in Electrical Engineering	N	
Basic disciplines in Computer & Sys. Eng.	N	
Depth in Computer and Systems Eng.	N	
Electromagnetics, electromechanics, power semiconductors	M	HW, quizzes, tests

Power system behavior	N	
Electrical energy conversion	N	
Conduct experiments and interpret data	M	HW, quizzes, tests
Identify, formulate and solve problems	M	HW, quizzes, tests
Design a system, component or process	N	
Communicate in written and oral form	N	
Function as part of a multi-disciplinary team	N	
Preparation for life-long learning	N	
Ethical issues; safety, health, public welfare	N	
Humanities and social sciences	N	
Laboratory equipment and software tools	N	
Variety of instruction formats	N	

**Topics Covered:  
(number of hours or classes for each)**

1. Fundamentals of crystal lattice structure
2. Intrinsic semiconductor and semiconductor doping
3. Energy band diagram
4. Carrier action: drift, diffusion and generation and recombination
5. Density of states
6. PN junction diode
7. Metal-semiconductor contact (Schottky diode)
8. Bipolar junction transistor (BJT) and BJT operation
9. MOS capacitor
10. MOSFET and MOSFET operation
11. Microelectronic fabrication and processing
12. CMOS IC layout examples

**Computer Usage:** N/A

**Laboratory Experiences:** N/A

**Design Experiences:** Occasional, (Homework, class exercises)

**Independent Learning Experiences:** N/A

**Class/Lab Schedule:** T, W, F, 10:00am to 10:55am lecture, 10:55 to 11:50 class activity

**Contribution to the Professional Component:**

(a) College-level mathematics and basic sciences:	1.5 credit hours
(b) Engineering Topics (Science and/or Design):	2.5 credit hours
(c) General Education:	0 credit hours

<b>Prepared by:</b>	I. Bhat, Z. R. Huang, and E. F. Schubert
<b>Date:</b>	April 4, 2006