ELECTRICAL, COMPUTER, AND SYSTEMS ENGINEERING DEPARTMENT

ABET COURSE SYLLABUS

ECSE 4250: Integrated Circuits Processes and Design

Course Catalog Description: The theoretical and practical aspects of techniques utilized in the fabrication of silicon-based microcircuits. Imperfections in semiconductors, crystal growth, solid solubility, alloying and diffusion, ion implantation, oxide masking, epitaxy, metallization, etching, and photolithography. Fabrication techniques for bipolar and MOS-microcircuits, and the electrical performance of devices based on these techniques. Microcircuit design and layout. Prerequisite: ECSE-2210. Fall term annually.

Pre-Requisite Courses: ECSE 2210 Microelectronics Technology

Co-Requisite Courses: None

Prerequisites by Topic:

1. Fundamentals of crystal lattice structure
2. Semiconductor doping
3. PN junction diode
4. Metal-semiconductor contact (Schottky diode)
5. MOS capacitor
6. MOSFET and MOSFET operation

Textbook: (and/or other required material) S. A. Campbell, "The Science and Engineering of Microelectronic Fabrication" Oxford University Press.

References: Course web site gives syllabus, schedule, homework assignments and class notes expanding on the topics covered in the text.

Course Coordinator: I. Bhat

Overall Educational Objective: To understand the physics and technology of the basic processes required for fabricating an integrated circuits.

Course Learning Outcomes:

1. Understand crystal planes and lattices and crystal growth
2. Understand basic semiconductor processes such as diffusion, ion implantation, oxidation and photolithography
3. Simulate the IC processes using SUPREM simulation tool
4. Understand the processes required to make integrated circuits including wet and dry etching, isolation technology, ohmic contact and MOS and BJT processes

How Course Outcomes are Assessed:

2 Tests	70%
10 Homework Assignments	15%
1 term paper	15%

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	Tests, HW, term paper
Basic disciplines in Electrical Engineering	N	
Depth in Electrical Engineering	H	Tests, HW, term paper
Basic disciplines in Computer & Sys. Eng.	N	
Depth in Computer and Systems Eng.	M	Tests, HW, term paper
Electromagnetics, electromechanics, power semiconductors	N	
Power system behavior	N	

Electrical energy conversion	N	
Conduct experiments and interpret data	N	
Identify, formulate and solve problems	M	HW ,term paper
Design a system, component or process	M	HW ,term paper
Communicate in written and oral form	M	HW ,term paper
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. Crystal lattice structure and crystal planes (2)
2. Si crystal growth (2)
3. Dopant incorporation: diffusion and ion implantation (4)
4. Silicon oxidation (2)
5. Photolithography (2)
6. Vacuum science and plasma (1)
7. Wet and dry etching (2)
8. Thin film depositon: vacuum evaporation and sputtering (2)
9. Chemical vapor deposition (1)
10. Isolation technology (1)
11. Ohmic contact and metallization (2)
12. MOS processes (2)
13. BJT processes (2)

Computer Usage: Students use SURPEM simulation tool

Laboratory Experiences: Students visit IC fabrication labs twice during the semester

Design Experiences: Occasional (Homework)

Independent Learning Experiences: N/A

Class/Lab Schedule: T, F 2:00 – 3:20

Contribution to the Professional Component:

(a) College-level mathematics and basic sciences: 0 credit hours
(b) Engineering Topics (Science and/or Design): 3 credit hours
(c) General Education: 0 credit hours

Prepared by:	I. Bhat
Date:	April 6, 2006