ECE 5031: Semiconductor Process Technology

Course Description

Discrete and integrated circuit device design, silicon VLSI processing technologies, III-V compound semiconductor device fabrication technologies; epitaxy, doping, bandgap engineering; and device measurements and failure mechanisms.

Prior Course Number: 734, 735, and part of 632
Transcript Abbreviation: Semicon Proc Tech
Grading Plan: Letter Grade
Course Deliveries: Classroom
Course Levels: Undergrad, Graduate
Student Ranks: Junior, Senior, Masters, Doctoral
Course Offerings: Spring
Flex Scheduled Course: Never
Course Frequency: Every Year
Course Length: 14 Week
Credits: 3.0
Repeatable: No
Time Distribution: 3.0 hr Lec
Expected out-of-class hours per week: 6.0
Graded Component: Lecture
Credit by Examination: No
Admission Condition: No
Off Campus: Never
Campus Locations: Columbus
Prerequisites and Co-requisites: Prereq: 3030, or Grad standing in Engineering, Biological Sciences, or Math and Physical Sciences.
Exclusions: Not open to students with credit for 734 or 735.
Cross-Listings:

Course Rationale: Existing course.

The course is required for this unit's degrees, majors, and/or minors: No
The course is a GEC: No
The course is an elective (for this or other units) or is a service course for other units: Yes

Subject/CIP Code: 14.1001
Subsidy Level: Doctoral Course

Programs

Abbreviation	Description
CpE	Computer Engineering
EE	Electrical Engineering

Course Goals

Learn about the processing technologies used for fabrication of silicon VLSI integrated circuits
Develop an understanding of process integration for NMOS, CMOS and MOS memory IC technology
Exposed to silicon process information pertinent to the interface between process engineers and integrated circuit design engineers

Learn about processing technology of compound semiconductors
Learn about methods and techniques used for fabricating compound semiconductor devices used in communications, optoelectronics, high speed wireless applications

Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Overview of CMOS process	2.0							
Lithography contact, projection, e-beam	4.0							
Vacuum and ultra-high vacuum physics and technology	2.0							
CVD and silicon epitaxy	4.0							
Wet chemical processing	2.0							
Plasma processing (etching, sputtering, PECVD)	4.0							
Atomic layer deposition	1.0							
Ion implantation and diffusion	4.0							
Back end processing interconnects and CMP	2.0							
CMOS and MOS memory process integration	4.0							
III-V semiconductor bulk crystal growth techniques	1.0							
Semiconductor epitaxial growth methods - molecular beam epitaxy and metal organic CVD	1.0							
Ohmic contact formation for III_V and III-nitride semiconductors	2.0							
Compound semiconductor device process integration	3.0							
Schottkey contact formation for III-V and III-nitride semiconductors	2.0							
Fabrication of III-V and III-nitride semiconductor diodes and transistors	2.0							

Representative Assignments

Homework
Computer aided simulation project on semiconductor process technologies (ATLAS)

Grades

Aspect	Percent
Homework	15%
Midterm 1	25%
Midterm 2	25%
Final exam	35%

Representative Textbooks and Other Course Materials

Title	Author
Fabrication Engineering at the Micro- and Nanoscale	Stephen A. Campbell

ABET-EAC Criterion 3 Outcomes

Course Contribution		College Outcome
***	a	An ability to apply knowledge of mathematics, science, and engineering.
**	b	An ability to design and conduct experiments, as well as to analyze and interpret data.
**	c	An ability to design a system, component, or process to meet desired needs.
	d	An ability to function on multi-disciplinary teams.
**	e	An ability to identify, formulate, and solve engineering problems.
	f	An understanding of professional and ethical responsibility.
*	g	An ability to communicate effectively.
	h	The broad education necessary to understand the impact of engineering solutions in a global and societal context.
*	i	A recognition of the need for, and an ability to engage in life-long learning.
*	j	A knowledge of contemporary issues.
**	k	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

CpE ABET-EAC Criterion 9 Program Criteria Outcomes

Course Contribution		Program Outcome
***	1	an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
	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
*	3	an ability to communicate effectively with a range of audiences
	4	an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
	5	an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
**	6	an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
*	7	an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

EE ABET-EAC Criterion 9 Program Criteria Outcomes

Course Contribution		Program Outcome
***	1	an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
	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
*	3	an ability to communicate effectively with a range of audiences
	4	an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
	5	an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
**	6	an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
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Additional Notes or Comments

Change course descroption, abbreviaion, prereqs and exclusions to match university version.

Change text to Campbell 9/5/13

Updated semester of offering to every spring. 3/23/15. CED

Update topics, stars

correct typos in topics 7/6/16 BLA

edited text info, 5/10/17, CED

Changed one goal and marked new ABET outcomes per Sp19 review. Also removed 432 from prerequisites. 5/24/19. GJV

Prepared by: George Valco