ECE 6531 (Proposed): Fundamentals of Semiconductor Devices

Course Description

An overview of the physics, design, and engineering of semiconductor electronic and optoelectronic devices. Applications of silicon, compound semiconductor, and nanotechnology will be covered.

Prior Course Number: 831
Transcript Abbreviation: Fund Semicond Dev
Grading Plan: Letter Grade
Course Deliveries: Classroom
Course Levels: Graduate
Student Ranks: 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: 5530 (730), or Grad standing in Engineering, Biological Sciences, or Math and Physical Sciences.
Exclusions: Not open to people with credit for 5531.
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 advanced semiconductor device physics
Learn to design semiconductor devices
Learn performance limits of state-of-the-art semiconductor devices and approaches for overcoming them

Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Device applications of semiconductors	1.0							
Transport in heterojunctions	3.0							
Photodiodes and optoelectronic integrated circuits	3.0							
Solar cells - an introduction	3.0							
Light emitting diodes	3.0							
Laser diodes - an introduction	1.0							
Heterojunction FET - HEMT	5.0							
Long-channel MOSFET models	1.0							
Sub-micron MOSFET - threshold volt, sub-threshold current, scaling, hot carriers	2.0							
Bipolar junction transistors	3.0							
Heterojunction bipolar transistors	3.0							
Tunnel diodes, resonant tunneling diodes	3.0							
Wide-bandgap semiconductors - transport physics and optical properties	3.0							
High-frequency and high power wide-bandgap electronics	3.0							
Optical devices based on wide-bandgap semiconductors	3.0							

Representative Assignments

Homework

Grades

Aspect	Percent
Homework	20%
Two mid-term examinations	40%
Final examination	40%

Representative Textbooks and Other Course Materials

Title	Author
Semiconductor Device Physics and Design	Umesh Mishra and Jasprit Singh

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.

Course Contribution		College Outcome
	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.

Additional Notes or Comments

currected prereq from 4530 to 5530. Updated prereq, exclusion, goals, and topics to university format.

Removed exclusion 10/9/12.

Renumbered from 5531 11/21/13

Prepared by: Betty Lise Anderson