EEO331: Introduction to Semiconductor Devices
Spring 2017

2016-2017 Catalog Description:

The principles of semiconductor devices. Energy bands, transport properties and generation recombination phenomena in bulk semiconductors are covered first, followed by junctions between semiconductors and metal-semiconductor. The principles of operation of diodes, transistors, light detectors, and light emitting devices based on an understanding of the character of physical phenomena in semiconductors. Provides background for subsequent courses in in electronics.

Course Designation: Required

Text Books: *"An Introduction to Semiconductor Devices"* Donald Neamen, McGraw Hill, 2006, ISBN 9780072987560

Prerequisites: Physics II and Calculus IV

Credit Hours: 3 credits

Coordinator: Ridha Kamoua

Goals:

To teach properties, models, and concepts associated with semiconductor devices. Provides detailed insight into the internal workings of basic semiconductor devices such as the pn-junction diode, Bipolar Junction Transistor, and MOSFET. Systematically develops the analytical tools needed to solve practical device problems.

Course Learning Outcomes:

1. Course Learning Outcome	SOs	Assessment Method
2. knowledge of semiconductor bonding and energy band models	a	Exams, final, and homework
3. knowledge of semiconductor carrier properties and statistics	a	Exams, final, and homework
4. knowledge of semiconductor carrier action	a	Exams, final, and homework
5. ability to apply standard device models to explain/calculate critical internal parameters and standard characteristics of the pn-junction diode	a,e	Exams, final, and homework
6. ability to apply standard device models to explain/calculate critical internal parameters and standard characteristics of the Metal-Oxide-Semiconductor Field Effect Transistor	a,e	Exams, final, and homework
7. ability to apply standard device models to explain/calculate critical internal parameters	a,e	Exams, final, and homework

and standard characteristics of the Bipolar Junction Transistor		

Topics Covered:

Week 1.	Course introduction, semiconductor materials and models.
Week 2.	Carrier properties and statistics.
Week 3.	Density of states, semiconductor doping
Week 4.	Carrier action: drift, diffusion and recombination-generation.
Week 5.	Equations of state, minority carrier continuity equation, quasi Fermi-levels.
Week 5.	pn Junction. pn junction diodes. Electrostatics.
Week 6.	Pn junction: I-V characteristics, small signal model, transients *Midterm 1*
Week 7.	Breakdown, deviations from the ideal diode, BJT fundamentals
Week 8.	BJT I-V characteristics, current gain factors
Week 9.	Nonideal effects, *Midterm 2*
Week 10.	MOS Capacitor
Week 11.	MOS Capacitor, flat band voltage, threshold voltage.
Week 12.	C-V characteristics, MOSFET principle of operation
Week 13.	MOSFET quantitative I-V analysis, substrate bias
Week 14.	MOSFET fabrication, review

Class/laboratory Schedule: 3 lecture hours per week

Student Outcomes:

a	b	c	d	e	f	g	h	i	j	k
60%				**40%**						

Document Prepared by: Ridha Kamoua on 5/24/2017