

ENG EC575 Semiconductor Devices

2008-2009 Catalog Data:

Prereq: ENG EC 410, ENG EC 455, and CAS PY 313 or equivalent. Fundamentals of carrier generation, transport, recombination, and storage in semiconductors. Physical principles of operation of the PN junction, metal-semiconductor contact, bipolar junction transistor, MOS capacitor, MOSFET (Metal Oxide Semiconductor Field Effect Transistor), JFET (Junction Field Effect Transistor), and bipolar junction transistor. Develops physical principles and models that are useful in the analysis and design of integrated circuits. 4 cr.

Status in the Curriculum: Elective

Class/Lab Schedule:

Lecture: 4 hours/week

Textbooks and other required materials:

Reference:

R.S. Muller and T.I. Kamins, Device Electronics for Integrated Circuits, Third Edition, Wiley

Coordinator:

Enrico Bellotti, Associate Professor, ECE

Prerequisites by topic:

Graduate Standing, SC574

Goals:

1. Study the different carrier transport models and understand their limitations in the context of semiconductor devices design and analysis.
2. Study the operation and limitations of metal-semiconductors and p-n junctions as the basic building blocks for advanced device design.
3. Study the operating principles of BJT and HBTs and understand the design parameters, performance and limitations.
4. Study the operating principles of field effects transistors and MOS structures. Analyze the performance and limitations. Understanding the effect of scaling and the impact on the large-scale integration technology.
5. Learn to apply the most important numerical simulation techniques to the design of advanced semiconductor devices.

Course Outcomes:

1. Understand the limitations of different carrier transport models and be able to apply them to the study of semiconductor electronic devices.
2. Be able to analyze metal-semiconductor and p-n junction and heterojunctions and understand their design parameters.

3. Be able to study BJT and HBT transistor structures, analyze the design parameters and calculate the device performance.
4. Be able to study HEMT transistor structures, analyze the design parameters and calculate the device performance in the context of microwave amplification circuits.
5. Be able to study MOS transistor structures, analyze the design parameters and calculate the device performance in the context of large-scale integration logic circuits.
6. Understand the impact of scaling on the technological development of large-scale integration logic circuits

Course Outcomes mapped to Program Outcomes:

	A	B	C	D	E	F	G	H	I	J	K
Program Outcomes	a	b	c	d	e	f	g	h	i	j	k
Course Outcomes	1,2,3,4,5	6	2,3,4,5,6	6	3,4,5	6	6	6	6	1,6	2,3,5
Emphasis (1-5)	5	1	3	2	4	1	4	4	1	3	5

1=not at all; 5=a great deal;

Contribution of Course to Meeting the Professional Component:

Engineering topics: 80%

Math & Basic Science: 15%

General Education: 5%

Prepared by: E. Bellotti

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