EE336
SEMICONDUCTOR DEVICES

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Course Staff

- Instructor:
  - Dr. Noha Korany
  - Dr. Mohammed M. Farag (mmorsy@ieee.org)
  - 4th Floor ECE Building
- TA:
  - Eng. Mohamed Megahed
- Office hours :
  - Thursday 2:00-3:20PM

Course Text

- Textbook
  - "Semiconductor Devices – Physics and Technology", S. M. Sze, M. K. Lee
- Reference books
  - "Solid State Electronic Devices 6th Edition", Ben Streetman, Sanjay K. Banerjee
  - "Semiconductor Device Fundamentals 2nd Edition", Robert F. Pierret

Course Objectives

- Learn and understand the following topics:
  - Semiconductor physics
    - Energy bands and carrier transportation in semiconductors
  - Semiconductor Devices
    - pn-Junction Diode, Bipolar Junction Transistor (BJT), Metal Oxide Semiconductor Field Effect Transistor (MOSFET)
  - Semiconductor Technology
    - Material growth, film formation, photolithography, and fabrication process.
- Learn to use Spice to model and simulate semiconductor devices and circuits

Outcome

- Describe fundamental principles of wafer fabrication processes in semiconductor technology
- Understand fundamental concepts of solid state physics applied to the semiconductor devices
- Explain general electrical behaviors of semiconductor devices and construct appropriate physical models
- Illustrate structural details and current-voltage characteristics of diode, BJT, and MOSFET devices
- Apply the fundamental understanding of semiconductor devices with knowledge on the limitations of physical models
- Practice modeling and simulation SPICE CAD tools to increase understanding of semiconductor devices taught in the course

Course Organization

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- Semiconductor physics:
  - Energy Bands and Carrier Concentration in Thermal Equilibrium
  - Carrier Transport Phenomena
- Mid-term Exam
- Semiconductor Devices:
  - p-n Junction
  - Bipolar Transistors and Related Devices

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- Semiconductor Technology:
  - Crystal Growth and Epitaxy
  - Film Formation
  - Lithography and Etching
  - Impurity Doping
  - Integrated Devices
- Mid-term Exam
- Semiconductor Devices:
  - MOS Capacitor and MOSFET
  - MESFET and Related Devices

Course Work

- 5-6 Labs
- A Midterm exam
- A Final Exam
- Tools:
  - Pspice

http://www.electronics-lab.com/downloads/schematic/013/

Grading

- Steady and persistent effort is rewarded
  - Labs: 30 marks
    - Attendance: 10 marks
    - Lab work: 10 marks
    - Lab exam: 10 marks
  - Midterm exam: 30 marks (Equally distributed over the two parts)
  - Final exam: 90 marks (Equally distributed over the two parts)

About the Lectures

- Lectures will make use of slides
  - Slides are great !
    - Nice pictures to explain concepts
    - Good addition for course text
    - I can annotate them with a tablet PC
    - I can switch to the tools and listings mid-lecture
  - Slides are horrible !
    - They make me teach 30% faster (really)
    - They give you the sense that this is all easy stuff (it's not)
    - They make you fall a sleep
    - They make me lazy
    - They make me waste time looking for clipart
  - Slides are a two-edged sword
    - I encourage you to be active and take notes
    - I may fall back to blackboard-based teaching occasionally