Course Staff

- **Instructor:**
  - Prof. Dr. Mazhar Tayel
  - Dr. Mohammed M. Farag (mmorsy@ieee.org)  
    - 4th Floor ECE Building

- **TA:** Eng. Mohamed Megahed

- **Office hours:**
  - Saturday: 12:00 AM - 2:00 PM

- **Course Website:**
  - [http://eng.alexu.edu.eg/~mmorsy/Courses/Undergraduate\EE336_Semiconductor_Devices\EE336.html](http://eng.alexu.edu.eg/~mmorsy/Courses/Undergraduate\EE336_Semiconductor_Devices\EE336.html)
Course Text

- Textbook

- Reference books
  - “Semiconductor Devices – Physics and Technology”, S. M. Sze, M. K. Lee
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
Course Outline

- 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
  - p-n Junctions
- Mid-term Exam
- Semiconductor Devices:
  - Bipolar Transistors and Related Devices
  - MOS Capacitor and MOSFET
  - MESFET and Related Devices

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- Semiconductor Technology:
  - Crystal Growth and Epitaxy
  - Film Formation
  - Lithography and Etching
  - Impurity Doping
  - Integrated Devices
Course Work

- 4-5 Labs
- A Midterm exam
- A project
- A Final Exam
- Tools:
  - Pspice
The course project is a survey report about a selected topic.

The topic of the project can be selected from a suggested list of topics or desired topics (other topics can be also selected after getting the instructor approval).

The project report should be written similar to a scientific paper published in a conference.

The paper organization should be as follows: Abstract, Introduction, Body (start, progress, state of the art), CAD Tools, Conclusions and Future Work.

The report submission deadline is 1/1/2015 and maximum number of pages is 10 (IEEE conference proceedings double column format).

http://www.ieee.org/conferences_events/conferences/publishing/templates.html
Suggested Topics

- Micro-Electro Mechanical Systems (MEMS)
- Nano Technology applications in the electronic devices
- 3D MOSFETs and 3D Ics
- Photonic semiconductors
- Quantum Computing
- Ultimate limits of integrated electronics
- Integrated strategy for foundry industry
- Carbon nanotube field effect transistor
- Quantum effects in nanoscale electronic devices
- Non-silicon semiconductor devices
- Other related topics can be accepted after contacting the instructor
The project can be done individually or in a group up to 5 students maximum.

The project paper will be graded according to the following guidelines:

- Originality (no copy and paste) 40%
- Completeness of information 25%
- Quality of presentation 20%
- Organization and referencing 10%
- Innovations and others 5%
Course Grading

- Steady and persistent effort is rewarded
  - Labs: 30 marks
    - Attendance: 5 marks
    - Lab work: 10 marks
    - Lab exam: 5 marks
    - Project: 10 marks
  - Midterm exam: 30 marks (Equally distributed over the two parts)
  - Final exam: 90 marks (Equally distributed over the two parts)
Useful Links

- https://nanohub.org/
- http://www-inst.eecs.berkeley.edu/~ee130/sp13/
- https://nanohub.org/groups/ece606lundstrom