

## ELEG 3214 – ELECTRONICS I

### Credits and Contact Hours

Four credit hours, 45 hours of instructor contact

### Instructor's Name

Omar Manasreh

### Textbook

Microelectronic Circuits, Sixth Edition, Adel S. Sedra and Kenneth C. Smith, Oxford University Press, 2010

### Specific Course Information

- a. Catalog description: Introduction to electronic systems and signal processing, operational amplifiers, diodes, non-linear circuit applications, MOSFETS, and BJTs. Accompanied the lectures is a practical lab consists of five experiments. Prerequisite: ELEG 2113 and ELEG 2903 and PHYS 2074 co-requisites: MATH 2574.
- b. Pre-requisites or co-requisites:
  1. AC and DC electric circuits analysis
  2. Complex numbers
  3. Introduction to diodes and transistors gates
  4. A/D and D/A converters
  5. Electricity and magnetism
  6. Differential and integral calculus for several variables
  7. Vector calculus
- c. Required or Technical Elective: Required

### Specific Goals for the Course

1. Specific outcomes of instructions:
  - Basic concepts in electronic devices and basic circuits.
  - Operational amplifiers and their terminal characteristics, simple applications, and limitations.
  - Fundamental properties of doped semiconductor materials.
  - Fundamental concepts of pn junction diodes and their terminal characteristics, models, basic circuits, and applications.
  - Metal-oxide-semiconductor field effect transistors (MOSFETs) and their operation and basic circuits. In particular the students will be exposed to the full operation of three different single state amplifiers, CMOS operation, biasing of the device, and models, such as hybrid- $\pi$  and T-model.
  - Bipolar junction transistors (BJTs) and their operation and basic circuits and their use in analog systems.

- Biasing methods for MOSFETs and BJTs, Bode plots, signal amplifications, and basic digital-logic inverter circuits.
- To understand the operation of basic electronic circuits.
- To be able to design, simulate, and measure (or test) the circuits.
- To help you communicate your work by writing technical lab-report.

2. Indicate the student outcomes listed in Criterion 3 addressed by the course

<b>OUTCOME</b>	<b>HOW IT WAS ADDRESSED</b>
<b>(a)</b>	The students make use of basic circuit concepts to analyze discrete electronic devices such as diodes, operational amplifiers, MOSFETs and BJTs.
<b>(b)</b>	The students gain knowledge in designing single stage amplifiers based on MOSFETs and BJTs
<b>(c)</b>	Students make use of electronic circuits to design inverters, amplifiers and switches.
<b>(d)</b>	NA
<b>(e)</b>	Homework, quizzes, and tests are designed to guide students to solve engineering problems, such as amplifiers, CMOS gates, and rectifiers.
<b>(f)</b>	Students gain knowledge from invited speakers and apply it to understand the ethical responsibilities of an engineer.
<b>(g)</b>	Students learn in this part to prepare lab reports to promote their ability to communicate effectively, especially in written communication.
<b>(h)</b>	Not addressed
<b>(i)</b>	Students learn the basic blocks needed to engage them in designing electronic systems throughout their careers.
<b>(j)</b>	Not addressed
<b>(k)</b>	Students will be trained to use modern engineering tools in particular those tools needed to simulate devices and understanding device physics. Among these tools are PSPICE and MATLAB.

### List of Topics

1. Frequency response, low and high frequency networks
2. Operational amplifiers
2. Introduction to doped semiconductor materials.
3. The pn junction diodes and their applications
4. MOSFETs, inverters, and single state amplifiers
5. BJTs, inverters, and single stage amplifiers

### List of Labs (Lab time: 170 min.)

1. Lab: Experiment #1: Netlist manipulation in PSPICE.
2. Lab: Experiment #2: Diode behavior and application.
3. Lab: Experiment #3: MOSFET and common source amplifier
4. Lab: Experiment #4: BJT and common emitter amplifier
5. Lab: Experiment #5: Tutorial on circuit layout in Cadence and preparation for IC design in Electronics II Labs.