

## **EC 238 - Electronics (1)**

### **CREDIT HOURS**

3 Hours

### **CONTACT HOURS (Hours/week)**

Lecture: 2; Tutorial: 2; Lab: 2

### **COURSE COORDINATOR**

Prof. Khaled Shahata

### **TEXT BOOK:**

Boylestad, Nashelsky, "Electronic Devices and Circuit Theory", 1991.

### **COURSE DESCRIPTION:**

Semiconductors - p-n junction - diode current components - junction capacitance - junction diode as a circuit element - special p-n junctions - bipolar junction transistor and field effect transistor: structure, operation – I-V characteristics - large and small analysis.

### **PREREQUISITE:**

EE 231

### **RELATION OF COURSE TO PROGRAM:**

Required

### **COURSE INSTRUCTION OUTCOMES:**

The student gains knowledge on different electronic devices used in constructing modern electronic circuits: diodes – bipolar junction transistor and field effect transistor, and their performance with special emphasis on some practical applications.

### **TOPICS COVERED:**

- Types of solids: conductor, insulator, semiconductor.
- Conduction and valence bands, energy gap, covalent bond – Semiconductor types – Doping of semiconductors.
- Mobility and conductivity in semiconductors (intrinsic and extrinsic) – Hole and electron concentration - Drift current.
- Diffusion and drift currents – Built-in voltage in a p-n junction – Depletion layer in a p-n junction.
- p-n junction diode - Forward and reverse bias - Diode as a circuit element.
- Half wave and full wave rectifier - Smoothing circuits - Clipping circuits - Clamping circuits.
- Special diodes: Zener diodes - Light emitting diodes (LEDs) – Photodiodes - Varactor diodes - Solar cells.
- Bipolar Junction Transistor (BJT): construction – types – symbol - energy band diagram– operation - dc equivalent circuit.

- BJT: dc solution and biasing circuits - bias stability.
- BJT: I-V Characteristics of BJT - Load line - Operating point – h-parameters.
- BJT: Small signal analysis – ac equivalent circuit – Transistor amplifier - Voltage and current gains.
- Field Effect Transistor (FET): (1) Junction FET (JFET): construction – symbol – operation – I-V characteristics - JFET biasing circuits.
- Metal oxide semiconductor FET: MOSFET: construction – symbol – operation.
- I-V Characteristics of MOSFET, Enhancement and depletion modes, E-MOSFET: construction, operation and I-V characteristics - ac solution of all FET types.
- Complementary MOSFET (CMOS): symbol - operation - Logic gates using CMOS.

**CONTRIBUTION OF COURSE TO MEET THE REQUIREMENTS OF CRITERION 5:**

<b>Professional Component Content</b>			
<b>Math and Basic Sciences</b>	<b>Engineering Topics</b>	<b>General Education</b>	<b>Engineering Design</b>
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**RELATIONSHIP OF COURSE TO STUDENT OUTCOMES:**

<b>Student Outcomes</b>		<b>Course Outcomes</b>
<b>a.</b>	An ability to apply knowledge of mathematics, science, and engineering.	✓
<b>b.</b>	An ability to design and conduct experiments, analyze and interpret data.	
<b>c.</b>	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.	✓
<b>d.</b>	An ability to function on multi-disciplinary teams.	
<b>e.</b>	An ability to identify, formulate, and solve engineering problems.	
<b>f.</b>	An understanding of professional and ethical responsibility.	✓
<b>g.</b>	An ability to communicate effectively.	
<b>h.</b>	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	
<b>i.</b>	A recognition of the need for, and an ability to engage in life-long learning.	✓
<b>j.</b>	A knowledge of contemporary issues within and outside the electrical engineering profession.	
<b>k.</b>	An ability to use the techniques, skills, and modern engineering tools necessary for electrical engineering practice.	