The University of Jordan
School of Engineering
Department of Mechatronics Engineering
First Semester – A.Y. 2019/2020

Course: Electronics for Mechatronics - 0908222 (3 Cr. – Core Course)

Instructor:
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Catalog Data: Solid state theory, semiconductors, PN junctions; basic diode circuits. Basic power supplies. Half wave and full wave basic rectifier circuits. Bipolar Junction transistor, types of BJTs, BJT transistor biasing. MOS Field Effect Transistors; N-type and P-type MOSFETs, biasing, Current Voltage characteristics and CMOS technology. Small signal equivelant circuits of MOSFETs and BJTs. Operational amplifiers and applications; Ideal Op Amp and different Op Amp configurations. Modern Applications of semiconductors devices: State of the art semiconductors applications

Prerequisites by Course: Electrical Circuits I (0903211).

Prerequisites By Topic: Students are assumed to have sufficient knowledge pertaining to the following:
1. Basic electrical elements.
2. Electrical cricuits analysis.
3. AC and DC power sources.

Textbook:
- Donald A. Neamen. Microelectronics: Circuit Analysis and Design, 4th Edition, Mc-Graw-Hill.

References:
- Adel S. Sedra and Kenneth Carless Smith. Microelectronic circuits, 7th Edition, Oxford university press, 2014.
- Robert L. Boylestad and Louis Nashelsky. Electronic Devices and Circuit Theory, 11th Edition, Prentice Hall, 2012.
- Sima Dimitrijev. Principles of Semiconducotr Device, 2nd Edition, Oxford University Press, 2011.

Schedule & Duration: 15 Weeks, 45 lectures (60 minutes each) plus exams.

Minimum Student Material: Text book, class handouts and class notes.

Instructional Methods
1. Lecture
2. Problem solving sessions.

Minimum College Facilities: Classroom with whiteboard and projection display facilities, library.

Course Objectives: The overall course objective is to introduce the student to semiconductor devices, specifically circuit analysis, design, and applications of:
1. Diodes circuits.
2. BJT basic structure and operation, DC biasing, small-signal circuit model, and possible amplifier configurations.
3. FET types, basic structure and operation, DC biasing, small-signal circuit model, and possible amplifier configurations.
4. Operational Amplifiers and configurations: Ideal Op Amp, inverters, non-inverter, difference Op Amp, Integrators and Differentiators.
5. Modern and state of the art semiconductors applications.

Course Learning Outcomes and Relation to ABET Student Outcomes:

Upon successful completion of this course, a student should:

1. Describe semiconductor materials, types and properties. (1)
2. Describe the operation of diodes, BJTs, FETs. (1)
3. Explain the concepts of small- and large-signal analyses. (1)
4. Analyze and design basic amlifier configurations. (1)
5. Analyze and design various Op-amp configurations. (1)

Course Topics:

	Topic Description	Hrs
1.	**Introduction to semiconductor devices:** introduction to semiconductor materials. To know the difference between intrinsic and extrinsic semiconductors. To study the PN junction and the PN junction diode and its characteristics.	4
2	**PN junction diode applications:** study and and design half wave and full wave rectifiers, bridges, filters, zener diodes, clipper and clamper circuits.	9
3.	**Bipolar Junction Transistor (BJT):** define the BJT and its mode of operations and to understand basing and small signal model.	6
4.	**Field Effect Transistor (FET):** to understand FETs and the different types of FETs, and to analyse different circuitse containing FETs and MOSFETs.	6
5.	**BJT amplifiers:** to understand the analysis and design of BJT single-stage amplifiers.	5
6.	**FET amplifiers:** to understand the analysis and design of FET single-stage amplifiers.	5
7.	**Operational Amplifiers:** to understand the analysis and design Op-Amps circuits**.**	2

Ground Rules:

- **Attendance:**

Students are expected to attend EVERY CLASS SESSION and they are responsible for all material, announcements, schedule changes, etc., discussed in class. The university policy regarding the attendance will be strictly adhered to.

Assessments:

Exams.

Grading policy:

First Exam on November 10	**25 %**
Second Exam on December 17	**25 %**
Final Exam	**50 %**
Total	**100 %**

Last Updated:

Sep, 2019