The University of Jordan
School of Engineering
Electrical Engineering Department
2nd Semester – A.Y. 2020/2021

Course: **Electronics (II) – 0903361 (3 Cr. – Required Course)**

Instructor: Dr. Hani Jamleh
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Office Hours: Will be posted soon

Course website: http://elearning.ju.edu.jo/

Catalog description: Amplification. Biasing of transistor (BJT and FET). Single-stage amplifier. Cascaded BJT and FET amplifiers. Composite transistor stages. Operational amplifiers and Applications: Differential amplifier. Operational amplifier architectures. Gain with active load. DC level shifting. Output stage. Offset voltages and currents. Frequency response of amplifiers. The high-frequency response of all amplifier configurations. The low-frequency response of all amplifier configurations. The frequency response of cascaded stages. Feedback Amplifiers. Properties of negative-feedback amplifiers. Properties of feedback amplifier topologies. Analysis of feedback amplifiers.

Prerequisites by course: **EE** **0903261** Electronics (I) (pre-requisite)

Prerequisites by topic: Students are assumed to have a background in the following topics:
- Electrical circuit analysis techniques.
- Two port networks, frequency response, and Bode plot.
- Semiconductor fundamentals: p-n junction principle of operation and circuit analysis, diode circuits, BJT & FET transistor circuits DC analysis and low frequency model.

Textbook: **Microelectronics Circuit Analysis and Design by Donald A Neamen, McGraw-Hill Education, 4th edition, 2009.**

References:

1. Microelectronic Circuits by Adel S. Sedra and Kenneth C. Smith, Oxford University Press, 7th edition, 2015.
2. Electronic Devices and Circuit Theory by Robert L. Boylestad and Louis Nashelsky, 11th edition, Pearson, 2012.
3. Microelectronic Circuit Design by Richard C Jaeger and Travis Blalock, 5th edition, Pearson, 2015.
4. Electronics Fundamentals: A Systems Approach by by Thomas L. Floyd and David M. Buchla, 1st edition,Pearson, 2013.

5. Schaum's Outline of Electronic Devices and Circuits by Jimmie J. Cathey, McGraw-Hill Education, 2nd Edition, 2002.
6. Semiconductor Physics And Devices: Basic Principles by Donald A. Neamen, McGraw-Hill, 4th Edition, 2011.
7. The Art of Electronics by Paul Horowitz and Winfield Hill, Cambridge University Press, 3rd edition, 2015.

Schedule: 16 Weeks, 42 lectures (50 minutes each) plus exams.

Course goals: The overall objective is to introduce the student to amplifier analysis and design (including frequency response analysis) using various types of transistors and the Op-Amp.

Course learning outcomes (CLO) and relation to ABET student outcomes (SO):

Upon successful completion of this course, a student will: **[SO]**

1. Be able to analyze and design single and multistage BJT & FET amplifiers. **[1, 2]**
2. Be able to predict the frequency response of different amplifier types and its major influencing factors. **[1]**
3. Be able to analyze and utilize operational amplifiers and differential amplifiers in various applications. **[1]**
4. Recognize and be able to analyze the various feedback topologies. **[1]**

Course topics:

Hrs

1. BJT Amplifiers: AC equivalent circuit of BJT transistors, linear analysis of BJT amplifier circuits, BJT amplifier configurations: common emitter, common collector, common base, multistage BJT amplifiers configurations: cascaded stages. **6**
2. FET Amplifiers: AC equivalent circuit of FET transistors, linear analysis of FET amplifier circuits, FET amplifier configurations: common drain, common source, common gate, multistage FET amplifiers configurations: cascaded stages. **6**
3. Frequency Response: Open circuit and short circuit time constants, Bode plot, lower and upper 3 dB corner frequencies, mid-band band-width, coupling capacitors effect, load capacitors effect, bypass capacitors effect, combined capacitors effect, frequency response of BJT amplifier circuits, frequency response of FET amplifier circuits. **9**
4. Operational Amplifiers: Ideal Op-Amp parameters and operation, inverting Op-Amp, summing amplifier, non-inverting Op-Amp, Op-Amp applications: current-to-voltage converter, voltage-to-current converter, difference amplifier, integrator and differentiator, non-linear circuit applications. **8**
5. Differential and Multistage Amplifiers: Definition of differential amplifiers, basic BJT & FET differential pair: DC transfer characteristics, small signal equivalent circuit and analysis, differential and common-mode gains, Common-Mode Rejection Ratio (CMRR). **6**
6. Feedback and Stability: Concepts of negative and positive feedback, Feedback topologies, Feedback effects on amplifier gain, bandwidth, input and output resistance, feedback and amplifier stability. **7**

Ground rules: Attendance is required and highly encouraged. To that end, attendance will be taken every lecture. Eating and drinking are not allowed during class, and cell phones must be set to silent mode. All exams (including the final exam) should be considered cumulative. Exams are closed book. No scratch paper is allowed. You will be held responsible for all reading material assigned, even if it is not explicitly covered in lecture notes.

Assessment & grading policy:

Assignments	0%	Quizzes	0%
First Exam	30%	Projects	0%
Midterm Exam	30%	Lab Reports	0%
Final Exam	40%	Presentation	0%
		Total	**100%**

Last Revised: March 2021