EEO315: Electronics Circuits I

Fall 2013

2013-2014 Catalog Description:

Introduction to electronics, concentrating on the fundamental devices (diode, transistor, operational amplifier, logic gate) and their basic applications; modeling techniques; elementary circuit design based on devices.

Course Designation: Required

Text Book: Donald A. Neamen, ``Microelectronics Circuit Analysis and Design," McGraw Hill, 4th Edition, 2010.

Prerequisites: Circuits and Digital Logic

Goals:

To teach students analysis and design techniques of discrete and integrated analog circuits. Applications of diodes to waveform shaping and voltage regulation. Applications of transistors to signal amplification.

Course Learning Outcomes: Students should be able to: 1) analyze and design diode circuits such as rectifiers, voltage regulators, clampers, and clippers, 2) analyze and design single-stage and multi-stage bipolar junction transistor amplifiers, 3) analyze and design single-stage and multi-stage field effect transistor amplifiers, 4) determine the low and high frequency response of amplifiers.

Topics Covered:

Week 1.	Basic concepts of semiconductor physics: electrons, holes, carrier concentration, doping, temperature effects, p-n junction, p-n diode, forward bias, reverse bias, I-V characteristics
Week 2.	Graphical analysis of diode circuits. Loadline. Analysis of circuits containing ideal diodes. Half-wave and full-wave rectifiers. Filtering.
Week 3.	Zener diode. Voltage regulation. Bipolar junction transistors (BJT).
Week 4.	BJT characteristics. Amplifier with common-emitter. DC and AC analysis. Load line.
Week 5.	Small-signal parameters. Voltage gain. Input and output impedance. Review for Test1.
Week 6.	*Test 1.* Common-collector and common-base configurations.
Week 7.	Multistage amplifiers.

Week 8.	MOSFET. Enhancement-mode and depletion-mode devices. N- and p-channel devices. MOSFET I-V characteristics.
Week 9.	Common-source amplifier. Enhancement-load and depletion-load amplifiers. Active load. Current mirror. Review for Test 2.
Week 10.	*Test 2.* Common-drain and common-gate amplifiers. MOSFET multistage amplifiers. Time constants and frequency response.
Week 11.	Review.
Week 12.	Coupling and bypass capacitors. Bode plot.
Week 13.	Miller Effect, high frequency response Review for Test 3.
Week 14.	*Test 3.* Review for Final Exam.

Class/laboratory Schedule: 3 lecture hours and 1 recitation hour per week.

Student Outcomes and Assessment	**% contribution**
✓ (a) an ability to apply knowledge of mathematics, science and engineering	40
❑ (b1) an ability to design and conduct experiments	
❑ (b2) an ability to analyze and interpret data	
✓ (c) 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	20
❑ (d) an ability to function on multi-disciplinary teams	
✓ (e) an ability to identify, formulate, and solve engineering problems	40
❑ (f) an understanding of professional and ethical responsibility	
❑ (g) an ability to communicate effectively	
❑ (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	
❑ (i) a recognition of the need for, and an ability to engage in life-long learning	
❑ (j) a knowledge of contemporary issues	
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	
❑ (l) an ability to communicate and/or collaborate effectively online	

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