

EEO 316: Integrated Electronic Devices and Circuits I

Fall 2016

2016-2017 Catalog Description:

This is an advance undergraduate circuit design course that will discuss the principles, concepts and techniques required to produce successful designs of analog integrated circuits. Fundamentals of devices, circuits and basic topologies will be reviewed. Topics considered will include design of high-performance operational amplifiers and comparators. (3 credits)

Course Designation: Technical Elective

Credit Hours: 3

Text Books: D.A. Johns and K. Martin, "Analog Integrated Circuit Design", 2nd edition, Wiley 2011.

Prerequisites: EEO271

Coordinator: **Milutin Stanaćević**

Goals: The purpose of this course is to introduce students to principles of analysis and design of analog integrated circuits, starting from single transistor circuits to the multi-stage operational amplifier design.

Course Learning Outcomes: Students should be able to:

- 1) analyze and design single-stage amplifier,
- 2) analyze and design multi-stage differential amplifiers,
- 3) analyze the frequency response of a single-stage and multi-stage amplifier.

Topics Covered:

Week 1.	Introduction to analog integrated circuits, analog IC design flow.
Week 2.	Fundamentals of pn junction, MOS transistor and passive devices.
Week 3.	Modeling of MOS transistor. Large and small signal model. Two-port amplifier analysis.
Week 4.	Single-stage amplifiers: common-source amplifier and common-source amplifier with source degeneration.
Week 5.	Single-stage amplifiers: common-drain and common-gate amplifier.
Week 6.	Current sources and mirrors.
Week 7.	Cascoded current sources and mirrors. <i>Midterm exam.</i>
Week 8.	Cascode and folded-cascode amplifiers.
Week 9.	Differential Pair. Single-ended output differential amplifier. Fully differential amplifier.

Week 10.	Operational amplifiers. Two-stage operational amplifier.
Week 11.	Cascode and folded-cascode single stage differential amplifiers.
Week 12.	Frequency response. MOS capacitances and AC model of MOS transistor.
Week 13.	Frequency response of single-stage amplifiers.
Week 14.	Stability and compensation of operational amplifiers.

Class/laboratory Schedule: 3 hours lecture per week.

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

* Assume that the total contribution of any course will be 100%. Use the right hand column to indicate the approximate percent that the left hand columns contribute to the overall course.

Document Prepared by: Milutin Stanaćević

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