ESE 324: Electronics Laboratory C

Fall 2017

2016-2017 Catalog Description:

Illustrates and expands upon advanced concepts presented in ESE 372. Experiments include analog circuits such as oscillators, voltage regulators; mixed-signal circuits such as data converters, phase-locked loops, and several experiments emphasizing the analog design issues in digital circuits such as transmission gates, registers, and dynamic logic. Laboratory fee required. Spring.

Course Designation: Required Course for EE / Elective for CE

Text Books: Microelectronic circuits by A. S. Sedra and K. C. Smith, 5th or 6th edition (recommended)

Prerequisites: ESE 211, ESE 372; ESE, ECE majors; junior standing

Coordinator: **Emre Salman**

Goals: The aim of this advanced laboratory course is to increase students' both theoretical and experimental knowledge in commonly used analog/mixed-signal blocks such as voltage converters, analog-to-digital and digital-to-analog converters, and phase-locked loops. Students will also be familiarized with analog design issues in digital blocks including delay and power tradeoffs.

Course Learning Outcomes: At the end of the course, students will have both theoretical and practical knowledge related to widely used circuit blocks in electronic systems with a wide range of applications. These circuit blocks include oscillators, data converters, DC-DC voltage converters, and phase-locked loops. Students will be able to analyze a topology, identify related tradeoffs, and modify the topology to meet the required specifications.

Topics Covered:

Week 1.	Introduction and review of MOS transistor operation
Week 2.	Transmission gate (TG) design and characterization
Week 3.	Phase detector (PD) design (comparison of TG and static CMOS)
Week 4.	Multivibrator circuits: Astable, monostable, bistable structures

Week 5.	Transistor level flip-flop design and setup/hold time characterization (Bistability)
Week 6.	Linear and nonlinear oscillators (Astability)
Week 7.	Damping theory and resonance
Week 8.	Midterm exam
Week 9.	DC-DC voltage converters (boost and buck)
Week 10.	Analog-to-digital data converters
Week 11.	Digital-to-analog data converters
Week 12.	Introduction to phase-locked loops (PLL) and design tradeoffs
Week 13.	PLL loop filter and voltage controlled oscillator
Week 14	Course summary, integration, and final exam review

Class/laboratory Schedule: 1 lecture hour per week – 3 laboratory hours per week

Student Outcomes	**% contribution***
❑ (a) an ability to apply knowledge of mathematics, science and engineering	20
❑ (b1) an ability to design and conduct experiments	20
❑ (b2) an ability to analyze and interpret data	25
❑ (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	25
❑ (d) an ability to function on multi-disciplinary teams	
❑ (e) an ability to identify, formulate, and solve engineering problems	10
❑ (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	
❑ 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.

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