E151/3 Syllabus

Fall 2017

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Welcome to E151! I am very excited about this material and very excited to have you in the class. A wide array of logistics is found below. I hope the learning goals are especially helpful, please review them and keep your eyes open for opportunities to reinforce those goals throughout the course.

Schedule

Lecture	9:35-10:50	M/W	Shanahan B450
Office Hours	5:00-6:00	T	Parsons 2358
	8:00-9:30	R	Parsons 2358
Lab Hours	1:15-4:00	T	Analog Lab
Open Lab Hours	Any time E79 is gone		Analog Lab
Lab Tutoring Hours	By appointment		Depends

Electronic Communication

Mailing List: eng-151-1-2017-fa@hmc.edu
Class Site: http://pages.hmc.edu/mspencer/fa17/e151

Text and Supplies

Optional reference text:
Analysis and Design of Analog Integrated Circuits. Grey, Hurst, Lewis and Meyer (called Grey and Meyer)

Supplies:
Breadboards will be available in the stock room. Chips and other supplies will be in the Analog Lab.

Course Description

Design and analysis of linear, analog systems, particularly multi-stage amplifiers.

Core learning goals:

- Rock solid understanding of KVL, KCL, Thevenin, series/parallel reduction, dependent sources.
- Must be able to make a small signal model from a large signal relationship.
- Extremely comfortable with 1st order dynamics in time and frequency, including AC coupling.
- Can analyze single stage amplifiers and systems comprised of single stage amplifiers.
- Familiar with amplifier design specifications, can explain, analyze and measure them.

Other learning goals:

- Reconcile simulation, analysis and experiment.
- Good Lab notebook, experimental planning and data storage practices.
- Specific circuit practices: amplifier building blocks, OCTC, ½ circuits, output stages, stability
- Understanding of analog design

Schedule

Module	Date	Mon	Wed	Lab
Review	8/28		Course Overview, Review, Thevenin	
Large Signal	9/4	Ports, Zin, Zout Op-amp examples	Introduction to Diodes	Loading and the Mystery Box
	9/11	Diodes and large signal analysis	Intro to BJT	Diodes and Biasing
Small Signal	9/18	Biasing Networks for BJT	Common Emitter Amplifier	Large Signal BJT Behavior
	9/25	Common Emitter with degeneration	Emitter Follower Amplifier	CE Amplifier and Design #1 Intro
	10/2	Common Base Amplifier + Project Q&A	Intro to MOSFET	Design #1
	10/9	Review via MOSFET Single Stage Amplifiers	MIDTERM	Office hours for midterm
Dynamics	10/16	FALL BREAK	Dynamic Model of BJT	
	10/23	Dynamics of CE, Miller Effect, OCTC	Cacodes and more OCTC	Bandwidth and Miller in CE
	10/30	Current mirrors and active loads	MOS dynamic model	Current Mirror and Design #2 Intro
Building Blocks	11/6	MOS Cascodes + Project Q&A	Translinear Circuits	Design #2
	11/13	Bandgap Reference	Differential Pair	Bandgap Reference
	11/20	More Differential Pair	SKIP FOR THANKSGIVING	Differential Stage
	11/27	Output Stages	Amplifiers in Feedback	Output Stages
	12/4	Oscillators	Review via op-amp design	Analog Oscillators

Assignments and Grading

Homework:

- Homework will be assigned each lecture, and it is due at the start of the next lecture.
- You are responsible for grading your own homework, and the self-graded homework is due the class period after the homework is due. You will receive no points if you fail to turn in a self-graded homework.
- No late homework will be accepted: the answers have to be posted for self-grading.
- The homework you turn in before self-grading should just be a photocopy/scan of your work. I will randomly audit these to look for changed answers in the self-graded version.
- Homework should reflect your individual effort. You may consult with your peers if you make a good faith effort to solve a problem on your own and attain individual mastery of the material.

Labs:

- Labs are assigned each week on Tuesday, they are due on Friday
- The deliverable for each lab is a completed lab notebook entry. As will be discussed in class, these are less formal than reports. We will use Evernote for our lab notebooks, so please create an account. Share your completed notes to mspencer@g.hmc.edu
- Labs will be completed in self-selected pairs. You will be in the same pair all semester.
- You may not collaborate with other pairs other than by discussing your work; you may not share designs and your circuit must be the work of your own hands.

Design Projects:

- Some labs will have larger design components and be significantly less structured, these are referred to as design projects.
- Design projects are also completed with your lab partner.
- In addition to the lab notebook entry documenting the design and testing process, design projects should be submitted with a brief report. This report must introduce the design process, explain the final design, describe the testing process for the circuits, compare calculated, simulated and measured performance of the design, and explain any discrepancies between these quantities.
- Design reports should be no longer than five pages, fewer is acceptable. Use IEEE citation format and ensure that every figure has a caption.
- The audience for the design report is another student of the class, you may use sophisticated technical language, and you don't need to introduce basic calculations.

Grading:

- Homeworks 10%
- Labs 20%
- Design #1 15%
- Design #2 15%
- Midterm 20%
- Final 20%

Lab Access

The projects for this class will require the use of power supplies, function generators and oscilloscopes. These tools are available in many labs at Mudd, but we will mostly use the Analog Lab. This lab will be in heavy use this semester, and we only have top billing during our 3 hour lab meeting. If you must use the lab at a different time, do so when there are no other classes in session. Never disturb equipment for other labs.

Academic Honesty

It goes without saying that I expect the honor code to be followed carefully during this class. Any instances of academic dishonesty will be handled through the honor board.

Specific academic honesty pitfalls for this class:

- Modifying your homework after solutions have been distributed
- Copying another student's design during lab
- Allowing students other than your partner to build or measure your circuits
- Unattributed schematics or reference designs (from data sheets or the internet) in lab notebooks or project reports.

Harassment

I am committed to making this class a safe space for people of all genders, sexual orientations, races, cultures, religions, disabilities, political affiliations and socioeconomic classes. Please be kind to one another and try to form an inclusive community. Please report any instances of harassment which might undermine or harm our community.

Academic Accomodations

If you would like to request academic accommodations due to temporary or permanent disability, contact Deborah Kahn: the coordinator for student disability resources. She is located in Sprague 102, and an appointment may be made with her at dkahn@hmc.edu or (909)-607-3148. Appropriate accommodations are considered after you have conferred with the Office of Student Disability Resources and presented the required documentation of your disability.

Title IX

If I learn of any potential violation of our gender-based misconduct policy (rape, sexual assault, dating violence, domestic violence or stalking) by any means, I am required to notify the HMC Title IX Coordinator, Deborah Kahn. Students can request confidentiality from the institution, which I will communicate to the Title IX Coordinator. If students want to speak to someone confidentially, the resources listed below are available. Speaking with a confidential resource does not preclude students from making a formal report to the Title IX Coordinator at a later time.

- EmPOWER Center (909) 607-2689
- Monsour Counseling Center (909) 621-8202
- McAlister Chaplains (909) 621-8685