E190AK Syllabus

Spring 2018

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Welcome to E190AK! 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	T/R	Shanahan 3461
Office Hours	4:00-6:00	R	Parsons 2358
Lab Hours	In your scheduled time slot		RF Lab
Lab Tutoring Hours	By appointment		Depends

Electronic Communication

Mailing List: eng-190ak-1-2018-sp@g.hmc.edu
Class Site: http://pages.hmc.edu/mspencer/sp18/e190ak

Text

There are a few texts I'll be using as references for the class. They are listed in descending order of importance. Owning them is very optional, but the Lee books are great textbooks.

Planar Microwave Engineering, Lee
The Design of CMOS Radio-Frequency Integrated Circuits, 2E, Lee
RF Integrated Circuit Design, Razavi

Links will be provided to an assortment of online supplemental materials.

Course Description

Design and analysis high speed communication circuits, with an emphasis on microwave design, measurement techniques, and communication links.

Big picture learning goal:

- A student of this class should be able to complete a clinic project involving high speed board designs or antenna characterization.

Essential skills:

- Identify when RF theory and techniques are important
- Use common RF equipment, which includes understanding cabling effects and common output formats like smith charts
- Make a link budget for a communication system
- Design a printed circuit board with fast signals on it

Schedule

Module	Date	Tue	Thu	Out	Due
Transmission Lines	1/15	Intro + Maxwell	Near Field Probes, Lumped/Distributed		
	1/22	Fields to voltages, Microstrips, Telegrapher	Microstrips, Propagation Terminated Lines	Lab1	
	1/29	Examples of Reflection and Propagation	Propagation, VSWR and Impedance Transforms		Lab1
S Parameters and Matching	2/5	Impedance Transforms, Smith Chart Intro	Smith Chart Coordinates and Examples	Lab2	
	2/12	Smith Chart Applications,	Two Ports and S-parameters		Lab2
	2/19	Vector Network Analyzers	Filter Parameters Theory and Design	Lab3 +DP1	
	2/26	Power Transfer and S-Parameters	Power Gain and Impedance Matching		Lab3
Antennas and Propagation	3/5	Impedance Matching Networks	What Causes Radiation, Near vs. Far Field		DP1
	3/12	SPRING	BREAK		
	3/19	Midterm review, link budgets, polarization	MIDTERM IN CLASS		
Communication Links	3/26	Antenna Examples: dipoles and patches	Noise in Communication Systems	Lab4	
	4/2	More Noise, Spectrum Analyzers, Attenuators	Linearity in Communication System		Lab4
	4/9	More Linearity	Communication System Architectures	Lab5 +DP2	
Special Topics and Practice	4/16	Stability in Receivers and Transmitters	VCOs and Mixers: Noise and Linearity		Lab5
	4/23	Circuit board layout techniques	Final Review and Special Topics		DP2
	4/30	Projects Day	Presentation Day		
	5/7	FINALS WEEK	TAKE HOME EXAM		

Assignments and Grading

Quizzes:

- There will be an in-class quiz every Tuesday.
- The quiz will be carried out first individually and second as a team picked by me.
- Half of the grade for a quiz will be determined by the individual grade and the other half by your group grade.

Homework:

- One homework was issued for this class, it was extra credit.
- Some long-form homework-style problems will appear on labs.
- These homework problems should reflect your individual effort. You may consult with peers if you make a good faith effort to solve a problem on your own and attain individual mastery of the material.

Labs:

- The deliverable for each lab is a completed digital lab notebook entry. These are less formal than reports, as will be discussed in class. I suggest Evernote for keeping a notebook. Submit PDFs of your notebook to Sakai.
- Labs will be completed in self-selected pairs. Lab access will be limited to your appointment slot (discussed below).
- Lab notebooks must be completed individually even though the data may be collected in pairs.
- Labs are due Friday at 5PM on the week indicated in the table above.

Design Projects:

- Two projects will be presented to you, these are less structured than labs and offer you considerable design freedom. They are assigned over a two week period.
- Design projects are also completed with your lab partner.
- The deliverable for design projects is 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:

- Quizzes 12.5%
- Labs 12.5%
- Design #1 15%
- Design #2 15%
- Midterm 20%
- Final 20%

Lab Access

The labs will require access to radio frequency test equipment which is available in the RF lab. You will all be RF lab qualified in an early lecture. The RF lab is very small, so we need to ration access to it carefully. Each student group (of two) will have one guaranteed three hour access slot each week. Any other times should be negotiated amongst the teams, but please contact me if any conflicts occur. No more than four users may be in the RF lab at a time.

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:

- Copying text of your write-up from your lab partner
- 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 to me.

Academic Accommodations

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 I am reporting to her. 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