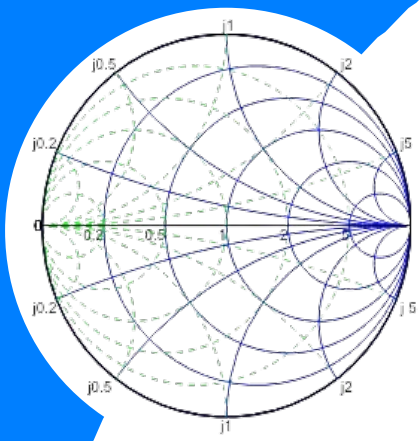
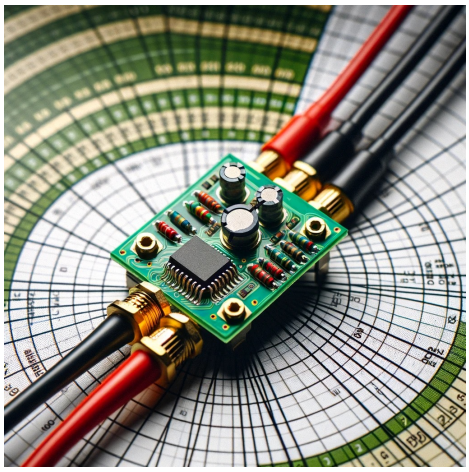
ECE-GY 9423
Comm. Circuits &Components

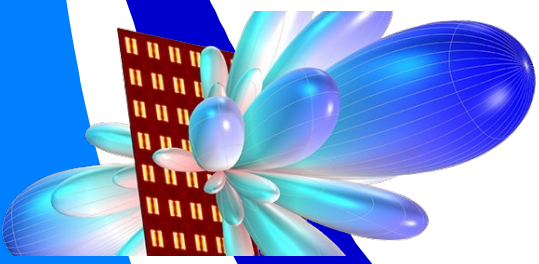
Fall 2024 Course Announcement



Advancements in integration technology have resulted in a paradigm shift in modern hardware toward system-on-chip designs. Adopting a holistic design approach with a deep understanding of working principles ranging from device to system is essential to equip future engineers with the necessary theoretical and practical comprehensive skill sets to take on emerging interdisciplinary design tasks. This cours fills the gap between microwave engineering, applied electromagnetics, and electronic circuits to fulfill these goals. Are you interested in learning about the future generation of communication circuits and systems?

ECE-GY 9423 offers a comprehensive overview of modern communication systems, with a focus on the **foundational aspects of wireless technology**, including **electronic circuits**, **components**, and **antennas**. Students will explore the operating principles of signal generation, transmission, and detection in contemporary radio systems, especially those compatible with monolithic on-chip designs. They will also develop an understanding of phased array antenna systems, transmission lines, waveguides, passive components, and microwave circuits. Through course projects and homework, students will be well-prepared for specialized tasks in advanced high-frequency RF front-end design and implementation.





There are no formal pre-requisites, but students will be expected to be comfortable with the basics of electronic circuits and operation of CMOS/BJT devices.

There will be a substantial final project converging the design flow and CAD tools necessary for microwave circuit design

Graduate students and advanced undergrads from all majors are welcome to join

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Instructor: Hamed Rahmani

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Grading Policy:

- Participation (5%)
- Simulation and HW assignments (25%)
- Midterm Exam (35%)
- Design project and Presentation (35%)

Tentative Agenda

Course Topic Outline

Week 1 (September 6th)
Syllabus overview, introduction, and course info. Review of the recent trends in communication circuits and systems and emerging applications.

Week 2
Introduction to CMOS/BJT, Biasing, small-signal model and analysis, H.F MOSFET model, AC-coupled CE stage.

Reading: Razavi Chapter 3

Week 3
Inductors and transformers, resonant circuits: quality factor, series to parallel transformation, single-tuned and double-tuned resonant circuits

Week 4
Multi-stage amplifiers and frequency analysis. Gain-bandwidth product figure of merit and technology implecations on the frequency response.

Week 5
Introduction to output stages and various class of power amplifiers, Overview of scattering parameters and impedance matching in microwave circuits.

Week 6
A high-level introduction on single-element antennas and gain/directivity followed by
Friis' transmission equation

Week 7

A high-level introduction on single-element antennas and gain/directivity followed by
Friis' transmission equation

Week 8
Introduction to phased array antenna systems and beam steering. Introduction to high-frequency on-chip routings.

Week 9 (November 1st)

*Midterm exam
Introduction to transmission lines

Week 10

Transmission lines and basics of waveguides.

* Project Selection due

Week 11

Silicon integrated co-planar waveguides, Introduction to oscillator circuits

Week 12

Oscillators and mixers

Week 13

Noise in communication systems. Modeling and analysis

Week 14 (December 13th)

*Project presentations