Instructor: Professor Neil Goldsman  
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Course Description: This is an advanced course in analog integrated radio frequency circuit design using CMOS technologies. The course will focus on advanced amplifier concepts, frequency conversion, tuning, transmission, matching, and low-noise techniques. Implementation of AM, FM and digital modulation techniques will be discussed. Advanced applications of CAD tools will be covered.

Prerequisite: ENEE 611 or equivalent

Recommended Texts: There is not a required text for this course. The following recommended texts will provide background for the course.

*The Design of CMOS Radio-Frequency Integrated Circuits* by Thomas H. Lee

*VLSI for Wireless Communication* by Bosco Leung

*Analysis and Design of Analog Integrated Circuits* by Grey, Hurst, Lewis and Meyer

*Fields and Waves in Communication Electronics* by Ramo, Whinnery and Van Duzer

Course Contents:

1. Communication System Topologies and Modulation
2. Transmission Lines and Impedance Matching
3. Low Noise RF Amplifiers
4. Layout and CAD for RF CMOS Circuits
5. Noise
6. Multipliers and Mixers
7. Oscillators
8. Phase-Locked Loops
9. AM and FM Transceiver Topology Details

Project: Students are also responsible for projects, where you will work in pairs to design and layout application specific integrated circuits. Project examples include phase-locked loops, Gilbert-cell multipliers, oscillators, transmitters and receivers. Students will be required to submit a written report, as well as give an oral presentation, describing the project in detail.

Grading: Grading will be based on: one exam (40%), one project(30%), homework(25%) and class participation(5%).