EE 403
RF CMOS Circuits
Professor Hassan Bajwa

OFFICE: Tech 154,

OFFICE HOURS: 4:30-5:30 TUE, WED & TH;

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CLASS HOURS: Thursday 06:00PM - 08:30PM, Mandeville Hall, Room 3

Objective: The objective of the course is introduction of fundamental concepts of RF circuit designing. Students will learn about designing of RF transceiver-receivers at architectural, circuits and device level.

Textbook: (REQUIRED)
The design of CMOS radio-frequency integrated circuits, Thomas H. Lee. Cambridge ; New York, NY, USA : Cambridge University Press, 1998.

Reference: (Optional)
RF microelectronics, Behzad Razavi. Upper Saddle River, NJ : Prentice Hall, c1998

Tentative Syllabus

No	Topics	
1	Communication Systems Overview ➢ History of wireless communication ➢ Shannon modulation and Propagation ➢ Introduction of communication circuits ➢ Transmitter Receiver design overview	1Wk
2	Communication electronics Review of BTS and MOS ➢ Current Mirrors Basic current mirror ➢ Amplifiers (Common-source, common-drain, common-gate amplifiers) ➢ Differential Amplifiers -- Common mode and differential gain, Small signal analysis ➢ Output Stages (Power amplification, MOS power amplifiers, efficiency)	2Wk
3	RLC Networks ➢ Parallel RLC Tank ➢ Serial RLC Network ➢ RLC Network and Impedance Transformers ➢ Characteristics of passive IC Components at high frequency ➢ Interconnect options at high frequency	1Wk
4	Distributed Systems and Smith Charts ➢ Lumped and Distributed Regime ➢ Transmission lines ➢ Smith Chart ➢ S parameters	1Wk
5	Noise ➢ Thermal Noise ➢ Short Noise ➢ Flicker Noise	1Wk

6	LNA Design	2Wk
	➢ MOSFET Two-Port Noise parameters	
	➢ LNA Topologies	
	➢ Power Match vs. Noise Match	
	➢ Examples	
7	Mixer Design	1Wk
	➢ Mixer fundamentals	
	➢ Linear Mixers	
	➢ Examples	
8	RF Amplifier Design	2Wk
	➢ Amplifier Classes	
	➢ Power Amplifier	
	➢ Modulation of Power Amplifier	
9	PLL	1Wk
	➢ History	
	➢ Linearized PLL Models	
	➢ Noise properties of PLL	
10	Oscillator and Synchronizer	1Wk
	➢ Resonator	
	➢ Tuned Oscillators	
	➢ Negative Resistance Oscillator	

- ➢ Noise in communication circuits
- ➢ Noise modeling

Assessment

Tentative schedule for the assignments and exams:

Assessment procedure	Date	Proportion
Homework	TBA	5%
Midterm	October 17th	20%
Final	Final Examination Week	25%
Projects (CMOS LNA design, Mixers, Oscillators, Filters etc.)	TBA	50%

Midterm and final: Both midterm and final are in-class open book exams (only text book and handwritten class notes are allowed). The final is a cumulative test exam

Project: Each student is required to submit atleast three projects during the semester. Each project report include detailed literature search and hand calculations. Simulation results in general agree with hand calculation results, if results are not as expected student need to explain his or her results in detail. Reports format will be provided during the semester.

Homework: I encourage every one to take the homework very seriously as they will help you prepare for the exams Homework is due at the beginning of class , I will not accept any homework after I start the lecture.

Cheating

Cheating includes and is not limited to looking at a neighbor's answer sheet during an in-class exam, copying the solution of assignment. You are encouraged to discuss homework problems with you class mates but every students is expected to solve problems by themselves.