

Winter 2010

**Analysis and Design of RF Circuits and Systems**

**Instructor:** Behzad Razavi  
 56-147D, Eng. IV  
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 Office Hours: MW, 10:30-12:00

**Time:** MW, 4:00-5:50 pm

**Place:** BL 5273

**Use of laptops is prohibited during lectures (and exams).**

**Prerequisites:** EE215A (Preferably with a grade of A- or higher)

**Credit:** 4 Units

**Grading:** Midterm 30%  
 Final 30%  
 Homeworks 20% (Late HW Policy: 25% deduction per day)  
 Final Project 20%

**Course Textbook:**

B. Razavi, *RF Microelectronics*, Prentice-Hall, 1998.

**Reference Book:**

T. H. Lee, *The Design of Radio-Frequency CMOS Circuits*, Cambridge University Press, 2004.

**Audit Policy:** Individuals can audit if they do not collect the handouts.

**Important Dates:**

Mon. Jan. 11	<b>HW#1 Due</b>
Wed. Jan. 20	<b>HW#2 Due</b>
Mon. Feb. 1	<b>HW#3 Due</b>
Wed. Feb. 10	<b>HW#4 Due</b>
Mon. Feb. 15	<b>Midterm Exam</b>
Fri.. March 12	<b>Final Project Due</b>
Mon. March 15, 8:00-11:00 am	<b>Final Exam</b>

## Outline

- Basic Concepts
  - Harmonic and Intermodulation Distortion, Third Intercept Point, Cascaded Stages
  - Intersymbol Interference and Nyquist Signaling
  - Random Processes and Noise, PDF, PSD, Noise Figure, Cascaded Stages
  - Sensitivity and Dynamic Range
- Communications Background
  - Analog and Digital Modulation, AM, FM, QPSK Family, FSK, GMSK
  - Bandwidth and Power Efficiency
  - Multiple Access Techniques (FDMA, TDMA, CDMA)
  - Wireless Standards (IS-54, GSM, DECT, IS-95)
- RF Transceiver Architectures
  - Heterodyne, Homodyne, and Image-Reject Receivers
  - Two-Step and Direct-Conversion Transmitters
- Low-Noise Amplifiers and Mixers
  - Bipolar and CMOS LNAs
  - Passive vs. Active Mixers
  - DSB and SSB Noise Figures
  - CMOS Mixers
- Oscillators
  - Basic LC Oscillator Topologies
  - Phase Noise
  - Phase Noise Mechanisms
  - CMOS VCOs
  - Quadrature Signal Generation
- Frequency Synthesizers
  - Phase-Locked Loops (Loop Dynamics, Building Blocks, Types I and II)
  - Phase-Locked Synthesizer Architectures (Integer-N, Fractional-N, Dual-Loop)
  - Direct Digital Synthesis
  - Frequency Dividers and Prescalers