

## ELEN 665 (ESS)

# INTEGRATED CMOS RF CIRCUITS AND SYSTEMS

Instructor: Edgar Sánchez-Sinencio Fall 2007  
Office: 318 E. WERC Time: M/W 4:10 – 5:25 p.m.  
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### Textbooks:

Please get at least one of the two. Material will be complemented with my class notes.

- [1] B. Razavi, “RF Microelectronics,” Upper Saddle River, Prentice Hall, 1998.
- [2] T. Lee, “Design of CMOS FR Circuits,” Cambridge University Press, 1998

### References:

- [3] B. Leung, “VLSI for Wireless Communication,” Upper Saddle River, Prentice Hall, 2002.
- [4] G. Gonzalez, “Microwave Transistor Amplifiers,” 2<sup>nd</sup>. Ed., Prentice Hall, 1997.
- [5] J. Crols and M. Steyaert, “CMOS Wireless Transceiver Design,” Boston, Kluwer Academic Pub., 1997.
- [6] A. Bensky, “Short-Range Wireless Communications,” 2<sup>nd</sup> Edition, Elsevier/Newnes, Amsterdam, 2004.
- [7] R. Gilmore and L. Besser, “Practical RF Circuit Design for Modern Wireless Systems,” Norwood, Art House, 2003.
- [8] J. Rogers, C. Plett, “Radio Frequency Integrated Circuit Design,” Artech House, 2003.
- [9] V. L. Rhode, “Microwave and Wireless Synthesizers Theory and Design,” John Wiley & Sons, New York, 1997.

Class Notes: <http://amesp02.tamu.edu/~sanchez>

Objectives: To understand, analyze and design of RF integrated systems and circuits. Special attention for a top-down design approach will be given. In particular the analysis and design of key building blocks are presented. Discussion of modern applications of RFICs will be provided.

### Grading Policy:

Laboratory	20%	Homework	15%
Unannounced Quizzes	5%	Final Project	25% (due Dec. 8)
Exams	35%		

It is advisable that you are familiar with Simulink, RF-Spectre and other communication system simulators. Exams might be given on a different class date.

## ELEN 665 TENTATIVE OUTLINE AND SCHEDULE

### FALL 2007

Date	Subject	Remarks	Material
Aug. 27 & Aug. 29	Overview, Communication Basics, Transceiver Architectures	Overall bird's view of course and motivation	[1], [2], [3], [5] [6]
Sept. 3 & Sept. 5	RFID: Basics and Circuits	Fundamental concepts and standards	IEEE JSSC and IEEE MTT
Sept. 10 & Sept. 12	RF Metrics: Linearity, noise, s/n, scattering parameters, measurements.	How to compare and measure receivers. System Design Methodology	[1], [3] and class notes.
Sept. 17 & Sept. 19	Low noise amplifiers: CMOS, Bipolar and BiCMOS implementations	Structures and tradeoffs	[1], [3], [4], [7], [8]
Sept. 24 & Sept. 26	LNA, Mixers: CMOS	Mixers architectures	[1], [6], [7]
Oct. 1 & Oct. 3	Bipolar and BiCMOS mixers <i>EXAM 1</i>	Design tradeoffs	[3], [7]
Oct. 8 & Oct. 10	Volterra Series and its Applications to LNA and Mixers	How to use this high frequency analysis	[3], [7], [8] Class notes
Oct. 15 & Oct. 17	RF and Base band Filters	Passive and active implementations.	[1], [6], [7]
Oct. 22 & Oct. 24	Phase-Lock Loops, Synthesizers	Basic Structures and specs.	[1], [3], [7], [8]
Oct. 29 & Oct. 31	Voltage Controlled Oscillators	Trade-offs, topologies	[2], [3], [6]
Nov. 5 & Nov. 7	Case Studies: Bluetooth Receiver And Chameleon Receiver: Overview	How receivers meeting specs And standards are designed.	Class notes and Papers.
Nov. 12	Power Amplifiers <i>EXAM 2</i>	Basic topologies and trade- offs.	[1], [2], [8]
Nov. 19 & Nov. 21*	Power Amplifiers, Case Studies: BT, RFID	Fundamentals, Linearization technology. Receiver applications.	[2], [3], [7]
Nov. 26 & Nov. 28	Modulators and Demodulators	When ADC is not needed in transceivers	[3], [5]
Dec. 3 & 5	Oral Final Presentations	Showing what you learned!	

\* Thanksgiving, Nov. 22 & 23.

#### Americans with Disabilities Act (ADA) Policy Statement

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact the Department of Student Life, Services for Students with Disabilities, in Room 126 of the Koldus Building or call 845-1637.

#### Academic Integrity Statement

“An Aggie does not lie, cheat, or steal or tolerate those who do.”

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