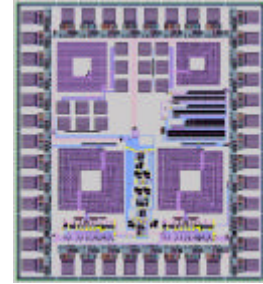


EECE 690/890
Digital Radio Hardware Design
Spring 2000



Instructors: Bill Kuhn
265 Rathbone Hall
532-4649

Office Hours: Tues, Thurs 2:30 - 5:00 PM (except during bi-weekly Thurs faculty meetings)
Others by appointment

Prerequisites: IC Design (EECE696) *OR* Comm Circuits (EECE662)
Recommended: Linear Systems or other course discussing Fourier transforms.

Text: Behzad Razavi, *RF Microelectronics*, Prentice Hall Communications Engineering and Emerging Technologies Series, 1998.

References: A number of additional textbooks which could prove useful will be placed in RA297.

Course Description:

This course will cover the design of modern wireless communication systems ranging from cellular telephones to wireless local area networks. The course will cover these topics at the system level, discussing digital modulation and radio systems, and at the component level, discussing implementation of circuit level building blocks such as radio frequency amplifiers, mixers, filters, synthesizers, and demodulators.

Sponsored in part by the National Science Foundation, a main goal of the course is to allow students to participate in research and development efforts that can contribute to new knowledge in the radio frequency integrated circuit (RFIC) design field. To do this we will work in teams to design radio transceiver circuits at the IC level, using modern Electronic Design Automation tools such as those donated to the department by Hewlett Packard (now Agilent) and Mentor Graphics. The IC(s) designed will be submitted for fabrication in a unique Silicon-on-Sapphire process and/or a modern sub-micron CMOS process. All students will participate in constructing a class web page highlighting their designs. Students who will be here the following semester will also have the opportunity to test the fabricated circuits and to participate in writing research papers discussing the results. Throughout the course, we will work with industry contacts (e.g. Motorola, Texas Instruments, and Garmin International) to help focus our efforts and possibly open up internship and/or employment opportunities.

Homeworks, Exams, and Projects

Homeworks: During the first portion of the semester, we will cover background topics important for later project work. To assure that everyone has a good grounding in this material, there will be several homework assignments during this period.

Midterm: At about the middle of the semester, there will be an open-book midterm exam covering the material presented in lectures and practiced in the homeworks.

Projects: The remainder of the semester will be primarily devoted to project work, (with a few homeworks on lecture topics covered during the period).

Final Exam: In place of a traditional in-class final exam, you will be required to document your project work in the form of a tutorial or research paper (4 to 10 pages), and to 'publish' this paper on the web for future classes to use.

Grading: Weighting of the individual components of your grade will be computed as follows:

{ Homework assignments	30 %	(lowest homework dropped)
{ Midterm Exam	20 %	
{ Project assignments	30 %	
{ Final Exam	20 %	

The final grading curve is subject to the discretion of the instructor but will generally follow the classical assignment pattern: 90% - 100% = A, 80% - 90% = B, etc.

Late Work: To receive full credit, you must turn in your work on the due dates. Late work (without official documentation of illness, or other significant circumstances outside your control) will be prorated as follows*:

{ < 48 hrs.	90 % maximum credit
{ 48 - 96 hrs.	80 % maximum credit
{ > 96 hrs.	70 % maximum credit

* Note that the midterm is treated as a standard exam and must be taken at the scheduled time.

Undergraduate versus Graduate Credit

890 Credit: This course is offered for both undergraduate (690), and graduate (890) credit. If you are an undergraduate student, you should register for EECE690 only. If you are a graduate student, you may register for 690 or 890, depending on your program of study and graduation requirements.

Those enrolled at the 890 level may be required to do a few additional assignments that involve more in-depth analysis than those enrolled for 690 credit.

Disabilities:

If you have any condition, such as a physical or learning disability, which will make it difficult for you to carry out the work as outlined or which will require academic accommodations, please notify me in the first two weeks of the course.

The All-New Kansas State University Honor Code:

Beginning Fall 1999, KSU is instituting a new honor code system. The essentials are stated below. Please see www.ksu.edu/honor to learn more.

The Honor System is defined by the following Code:

- a. That as K-State students they will not give or receive aid in examinations; that they will not give or receive unpermitted aid in class work, in the preparation of reports or in any other work that is to be used by the instructor as the basis of grading.
- b. That as K-State students they will do their share and take an active part in seeing to it that others as well as themselves uphold the spirit and letter of the Honor System. This includes reporting an observed dishonesty.

The Honor Pledge Statement

On all course work, assignments, or examinations done by students at Kansas State University, the following pledge is either required or implied:

On my honor as a student I have neither given nor received unauthorized aid on this assignment.

This statement means that the student understands and has complied with the requirements of the assignment as set forth by the instructor

Digital Radio Microelectronics Design
Course Topics (Tentative)

<i>Week</i>	<i>Topics</i>	<i>Reading</i>
1	Course Overview and Introduction to Radio Design	Chapter 1
<i>Part I Digital Wireless Hardware Design</i>		
2	Radio Waves Antennas and Propagation	Notes
3	Receiving antennas, effective area, and received power in dBm Introduction to RF circuits (LNAs, oscillators, mixers, and filters)	Notes
4	Radio Hardware Performance Limitations: Circuit nonlinearities and receiver large signal performance Circuit noise and receiver small signal performance	Chapter 2
5	Bandpass filtering, power consumption, and receiver dynamic range Modeling and simulation of LC circuits in IC processes	Chapter 2
6	Design and performance of on-chip bandpass filters Design and performance of on-chip oscillators	Notes
7	Transceiver architectures	Chapter 5
8	Review and Midterm Exam	-
9	Project discussions and assignments	Chap 6,7,8 as needed
<i>Part II Digital Wireless System Design</i>		
10	Modulation of digital radio signals	Chapter 3
11	Demodulation of digital radio signals	Chapter 3
12	Source and Channel coding	Notes
13	Multiple access and duplexing	Chapter 4
14	Wireless standards (cellular, PCS, and Bluetooth)	Chapter 4 www.bluetooth.com
15	Project design reviews	-
16	Final Exam (designs, papers, and web pages due)	