ELEC 412 - Radio Frequency and Microwave Engineering
Spring 2004

Catalog Description: **Radio Frequency and Microwave Engineering, 4 hrs.**
An introduction to the design and analysis of active and passive radio frequency and microwave circuits. Topics include radio frequency and microwave circuit analysis, measurement methods, transmission line structures, matching networks, oscillators, and mixers. Computer-aided analysis and design. Three hours of lecture and one laboratory weekly. Prerequisites: MATH 311 (MATH 110B), ELEC 302 (EEE 132), ELEC 430 (EE 171). Co-requesite: ELEC 470 (EEE 170).

Textbooks:
Reinhold Ludwig and Pavel Bretchko, RF Circuit Design: Theory and Applications, Prentice Hall, 2000.

References: D. Pozar, Microwave Engineering, 2nd Ed., John Wiley & Sons, 1998.
D. Pozar, Microwave and RF Design of Wireless Systems, John Wiley & Sons, 2001.

Instructor: Ernie Kim, P.E., Associate Professor of Electrical Engineering

Learning Objectives: Students completing this course will be able to:
1. Specify and design passive radio frequency and microwave circuits.
2. Specify and design active radio frequency and microwave amplifiers.
3. Specify and design discrete and stripline matching networks.
4. Specify and design generic forms of attenuators, oscillators and mixers.
5. Design compensation or control circuits using programmable analog ICs or microcontrollers.
6. Complement their designs with state-of-the-art radio frequency & microwave simulation tools

Assessment:
1. Two interim 55 minute quizes - 30%
2. One two hour final examination - 30%
3. Assignments - 20%
4. Laboratory Reports - 20%

Topics:
1. Components of RF and microwave design (1 session)
2. Behavior of passive components (2 sessions)
3. Scattering parameters and signal flow diagrams (3 sessions)
4. Using Smith Chart for design (4 sessions)
5. Microstripline circuits (3 sessions)
6. Passive networks and RF filters (5 sessions)
7. Active RF components (2 sessions)
8. Matching networks to active components (2 sessions)
9. Transistor amplifiers (4 sessions)
10. Compensation circuits and methods using programmable analog ICs or microcontrollers (3 sessions)
10. Oscillators (4 sessions)
11. RF Design Topics (Mixers, Attenuators, AGC, TBD) (4 sessions)
12. Exams (2 classes)

Laboratory Topics:
1. Introduction to S-Parameter Design (1 week)
2. Measurement of passive components (1 week)
3. Scattering parameter measurements (1 week)
4. Introduction To HP ADS (1 week)
5. Matching Networks with HP ADS (1 week)
6. RF and microwave filter design (2 weeks)
7. RF Transistor Amplifier Design (2 weeks)

8. RF Design Topics (Oscillators, Mixers, Attenuators, AGC, design with analog ICs) (4 weeks)

Estimated ABET Category:
Engineering Science: 2.0 credits or 50%
Engineering Design: 2.0 credits or 50%

Prepared By: Ernie Kim [Rev. 3.0] Date: 24 March 2003

Late Assignments, Missed Exams and Laboratory Attendance:
Late assignments, missed exams and in-class assignments will receive a grade of zero unless prior arrangements are made with the instructor. Attendance is required for all Laboratory periods. Missed Laboratory sessions may result in a grade of *ZERO* for the Lab portion of the overall course grade.

Collaboration:
The homework assignments are intended to help you understand the material and should be done individually unless specifically instructed in class to work in teams on a program. You are welcome to get help from others but the work you hand in must be your own. Do not violate the academic integrity policy of the University.

Academic Integrity
Students are expected to maintain and demonstrate academic integrity.
Violations of academic integrity include: a) unauthorized assistance on an examination or on the design; b) falsification or invention of data; c) unauthorized collaboration on an academic exercise; d) plagiarism; e) misappropriation of research materials; f) any unauthorized access of an instructor's files or computer account; or g) any other serious violation of academic integrity as established by the instructor.

Acts of dishonesty can lead to penalties in a course such as: reduction of grade; failing grade; withdrawal from the course; a requirement that all or part of a course be retaken; and a requirement that additional work be undertaken in connection with the course. Because of the seriousness of academic dishonesty, further penalties at the level of the University community may be applied; such penalties include probation, a letter of censure, suspension, or expulsion.