Portland State University 3 Quarter Sequence in RF Design

ECE 531 Microwave Circuit Design I: September 2008 Syllabus
Instructor: Richard Campbell

Here is the outline of the course:

- Review Wave Equation, reflection and transmission
- Review of transmission lines. Characteristic impedance, standing waves and wave propagation
- Scattering Parameters: Emphasis on physical interpretations of elements of S-matrix.
- Smith Chart: Theory and practice. Design of narrow band matching networks using the Smith Chart
- Radio Frequency Prototype Design and Construction
- Microwave building blocks: amplifier; frequency mixer; filter; oscillator
- Software tools for dealing with above topics.

Other information:


Pre-requisites by topic:

- Maxwell's equations in general form, boundary conditions on differential equations, electromagnetic wave equations
- Familiarity with transmission lines, waveguides and resonators, and antennas
- Basic semiconductor device operation (p-n junction, BJT, MOSFET)
- Pre-requisite course: EE 331/332 or equivalent
- A working knowledge or exposure to transmission line concepts is assumed

Grading: mid-terms (50%), study exercises (25%), design projects (25%), Class attendance is expected-the project grade will depend on interactions in class. Text readings and problems will be suggested but not graded.

Computer Usage: Free Linear Technology SwitcherCadIII (LTSpice) will be used in the study exercises and project for design support and analysis. Use of other software tools is encouraged, but LT Spice is required.

If you are a student with a documented disability and registered with the Disability Resource Center, please contact the instructor at the beginning of the course to set up appropriate academic accommodations, e.g. taking quizzes in the Disability Resource Center. You are required to self-identify and request accommodations to be eligible for services. DRC can be reached at (503) 725-4150.
Here is the outline of the course:

• Designing a working prototype system at the component level
• Active Devices at microwave frequencies
• Passive Devices at microwave frequencies
• Frequency Scaling
• Hands-on Radio Frequency Prototype Design and Construction
• Measurements of prototype circuits: amplifier; frequency mixer; filter; oscillator
• Measurements vs. Simulation
• Design and Measurement of working RF project
• Study of working GaAs RFIC: schematic; layout; fabrication

Other information:


Pre-requisites by topic:

• Maxwell's equations in general form, boundary conditions on differential equations, electromagnetic wave equations
• Familiarity with transmission lines, the Smith Chart, and S-Parameters
• Basic semiconductor device operation (p-n junction, BJT, MOSFET)
• Pre-requisite course: EE 531 or equivalent

Grading: mid-terms (50%), study exercises (25%), final design projects (25%),
Class attendance is expected—the class is a design team.
Text readings and problems will be suggested but not graded.
Computer Usage: Free Linear Technology SwitcherCadIII (LTSpice) will be used
in the study exercises and project for design support and analysis. ICED RFIC
layout tool will be introduced.

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Disability Resource Center, please contact the instructor at the beginning of the
course to set up appropriate academic accommodations, e.g. taking quizzes in
the Disability Resource Center. You are required to self-identify and request
accommodations to be eligible for services. DRC can be reached at (503) 725-
4150.
Here is the outline of the course, not necessarily in chronological order:

• Detailed analysis and simulations of Reference RFIC Designs
• Design of Experiments using on-chip and off-chip hooks
• Selection of Specifications to Optimize
• Small-signal vs. Large Signal Design and Measurement
• Modification of ICED Reference Design Layouts
• RFIC Measurements: amplifier; frequency mixer; filter; oscillator
• Measurements vs. Simulation
• Fabrication of next-generation Reference RFICs
• Measurement of class RFICs
• Critical Design Review

Other information:


Pre-requisites by topic:

• Design of RF Circuits at the component level
• Familiarity with transmission lines, the Smith Chart, and S-Parameters
• Basic semiconductor device operation (p-n junction, BJT, MOSFET)
• Pre-requisite course: EE 531, 532 or equivalent

Grading: 3 study exercises (50%), Critical Design Review final design projects (50%), Class attendance is expected--the class is the design team. Class members will have different responsibilities, and are required to share results. Text readings and problems will be suggested but not graded.

Computer Usage: Free Linear Technology SwitcherCadIII (LTSpice) will be used in the study exercises and project for design support and analysis. Agilent ADS, ICED RFIC layout tool, HFSS, and electromagnetic analysis will be used to support design activities.

If you are a student with a documented disability and registered with the Disability Resource Center, please contact the instructor at the beginning of the course to set up appropriate academic accommodations, e.g. taking quizzes in the Disability Resource Center. You are required to self-identify and request accommodations to be eligible for services. DRC can be reached at (503) 725-4150.