Course Syllabus

ECE145A Communication Electronics (Elective) 5 units

Catalog Description:
Analog communication circuits 1 MHz to 2 GHz with emphasis on receivers. S-parameter design techniques, nonideal components, distortion, low noise amplifier design and characterization, system level analysis.

Prerequisites:
ECE137AB

Text, References, and Software:
ECE145A lecture notes (http://www.ece.ucsb.edu/yuegroup/Teaching/ECE145/winter08.html)
Agilent Advanced Design System (ADS) and Sonnet Software simulation tools

Course Goals:
1. Transmission Lines and Lumped Components
   1. Use S-parameters and the Smith Chart for design of lumped element and distributed L matching networks
   2. Able to model (Agilent ADS, Sonnet) and measure (network analyzer) nonideal lumped components and transmission lines at high frequencies
2. Amplifier performance metrics
   1. Analysis of large signal limitations of amplifiers: gain compression, harmonic and intermodulation distortion.
   2. Use harmonic balance simulation to predict large signal limitations
   3. Familiar with the use of signal-to-noise ratio, noise figure, noise temperature, and the measurement and simulation of noise figure
3. Small Signal Amplifiers:
   1. Able to use network analyzer to measure gain and phase of amplifiers
   2. Derive gain, reflection, and transmission coefficients.
   3. Use S-parameters with gain and stability circles to design and build stable bandpass amplifiers.
   4. Familiar with the use of signal to noise ratio, noise figure, noise temperature, and the measurement and simulation of noise figure.
   5. Able to use two-port noise parameters, noise and available gain circles to analyze, design, build and test a low noise amplifier. Use of noise figure measurement equipment.
   6. Able to design stable DC bias circuits for amplifiers
   7. Use spectrum analyzer to measure gain compression, harmonic and intermodulation distortion.
4. Receiver Systems:
   1. Use of mixers for frequency conversion
   2. Understand MDS, images, noise figure, intercept points, dynamic range and their relationship to receiver performance.
   3. Strengths and weaknesses of direct conversion vs. superheterodyne architectures.

Class/Laboratory Hours:
Two 75 minute lectures per week. Laboratory is open by card key access. Minimum of 6 hours per week is required.

**Contribution to Program Outcomes:**

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**Professional Component:**
Lab projects 2 and 3 require the design of amplifiers with given specifications, constraints (economic and environmental) and design tradeoffs. The material builds upon biasing, feedback analysis and bandwidth estimation techniques from ECE137B.

Prepared by: C. Patrick Yue                  Date: Feb 16, 2006