EE 40458/60558 **Microwave Circuit Design and Measurements Laboratory**

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http://www.nd.edu/~hscdlab

Text: David M. Pozar, *Microwave Engineering, 3rd. ed.*, John Wiley & Sons, 2005.

Supplementary reading:

Guillermo Gonzalez, *Microwave Transistor Amplifiers, 2nd. ed.*, Prentice-Hall, 1997.

Class notes, handouts. Additional material is also available on the course web page at http://www.nd.edu/~hscdlab

Prerequisites: EE 30348, EE 30358 or consent of instructor

Catalog Description: (2-3-3)

This course is an introduction to microwave circuit design and analysis techniques, with particular emphasis on applications for modern microwave communication and sensing systems. An integrated laboratory experience provides exposure to fundamental measurement techniques for device and circuit characterization at microwave frequencies. Students will develop an enhanced understanding of circuit design and analysis principles as applied to modern microwave circuits, as well as gain familiarity with design techniques for both hand analysis and computer-aided design. An appreciation for basic measurement techniques for characterization of microwave devices, circuits, and systems through laboratory experiments will also be developed.

Course Outline:

- Review of electromagnetics; Maxwell's equations, plane wave solutions, transmission lines. Introduction to ADS microwave CAD software
- Types of transmission lines and their properties; coaxial lines, rectangular waveguides, microstrip.
- Network analysis; scattering matrix, transmission matrix formulations. Flow graphs, Mason's rule.
- Matching networks: lumped element designs and limitations, single and double-stub tuned designs. Quarter-wavelength transformers, multisection matching transformers.
- Active microwave circuit design, characteristics of microwave transistors.
- Amplifier design; gain and stability, design for noise figure. Single-stage amplifier design.
- Noise in microwave circuits; dynamic range and noise sources, equivalent noise temperature, system noise figure considerations

Laboratory and Design Project: (11 laboratory sessions)

1. High frequency performance of circuit components
2. Measurement basics with slotted line and time-domain reflectometer
3. Scalar network analyzer measurements
4. Vector network analyzer operation and error correction
5. Scattering parameter measurements of active devices
6. Matching network design, fabrication, and characterization
7. Amplifier design using s-parameters
8. Characterization of microwave amplifiers

Homework:

Homework will be assigned and collected (approximately) weekly.

Examinations:

1 in-class midterm examination, cumulative final exam

Grading:		
	Homework	20 %
	Mid-term exam	25 %
	Laboratory (includes design project)	25 %
	Final exam	30 %