Engineering Faculty Document No. 70-07
March 27, 2008

TO: The Engineering Faculty
FROM: The Faculty of the School of Electrical and Computer Engineering
RE: New Course: ECE 50407

The faculty of the School of Electrical and Computer Engineering has approved the following new course. This action is now submitted to the Engineering Faculty with a recommendation for approval.

ECE 50407 RF and Microwave Wireless Components
Sem: 2. Class: 3; Lab: 1; Credit: 4.
Prerequisite: ECE 44100

This course is an introduction to the high frequency portion of wireless systems. The course will utilize both electromagnetic and circuit theory combined with a measurement laboratory to give students a grasp of the concepts necessary to understand high frequency wireless systems. Microwave simulation software will be used to design components focusing on the antennas, passive components, active circuits, and packaging of wireless systems. Noise, propagation, and modulation will also be introduced to put the relevance of the component design in the context of a wireless system.

Reason: High frequency circuit design requires an understanding of the underlying electromagnetic phenomenon as well as an appreciation for the system that the component is going to work in. This course will prepare students to understand the fundamentals in RF and microwave circuit design. This course is increasingly important as speeds of circuits become faster and microwave effects are more predominant. Modern wireless engineers will need these basics and we need to educate our students on the basics of high frequency design. This course has been offered as ECE 59500 in Spring 2004, Spring 2006, Spring 2008, and Spring 2009 with enrollments of ~20 - 25 students per offering

M. J. T. Smith, Head
School of Electrical and Computer Engineering

Supporting Documentation

Required Text: David Pozar, "Microwave and RF Design of Wireless Systems", Wiley Publishing, 2001. ISNB 0-471-32282-2.

Recommended References: David Pozar, "Microwave Engineering", version 2, Wiley Publishing, ISBN 0471170968.

Course Outcomes:

A student who successfully fulfills the course requirements will have demonstrated:

i. The design will center on the creation of wireless radio systems, focusing on WLAN radio components
ii. Synthesis will be performed in the creation of filters and antennas using microwave software in conjunction with hand analysis.
iii. Fabrication will be performed utilizing the results of the synthesis of the filters and antennas.
iv. Measurement will be performed on the fabricated structures.

Assessment of Outcomes:

This will be done through specific exam questions, presentations, and demonstrations of working designs in the laboratory.

Engineering Design Content:

The laboratory portion of the course covers the creation of a wireless system. Individual designs are created through full wave and equivalent circuit representations using state of the art microwave software. The students design state of the art microwave components including antennas, filters, and amplifiers. This involves the analysis of specifications, review of design choices, and proper execution of the chosen design plan. The projects start with specifications and end with testing of the fabricated devices with full analysis of the results.

Engineering Design Considerations:

This course covers topics in the implications of design choices for microwave and RF systems. These include good design practices and best practices for safe wireless component creation. They also overview the required tolerances to have a usable design and real-world fabrication challenges to make a real system a viable solution. Particularly considered are the effects of small wavelengths and electromagnetic fields on design choices.

Weeks	*Principal Topics*
1	Introduction and Receiver Overview
2	Transmission Lines
3	S-parameters, Network Analysis, and Matching
4	Antenna System Requirements
5	Basic Antennas
6	Propagation and Fading
7	Propagation and Fading
8	Noise and Distortion in a Microwave System
9	Lumped Element Filters
10	Lumped Element Filters and Microwave Realization of Filters
11	Amplifier Basics
12	Amplifier Design Using S-parameters
13	Oscillators
14	Phase Locked Loops/Synthesizers
15	Modulation Overview and Receiver Architectures Revisited