**ELEN 4570 - Wireless Communications**

**Class Schedule:** 3 Credit course, meeting the equivalent of three 50 minute class periods per week.

**Course Coordinator:** James E. Richie

**Course Materials:**

**Required:** T. S. Rappaport, Wireless Communications Principles and Practice, 2nd Edition, Prentice-Hall, 1996.

**Course Description:**

Fundamentals, analysis and design of cell systems, including trunking theory and grade of service. Large scale and small scale path loss analysis and modeling. Overview of modulation techniques, including amplitude and frequency modulation, and digital modulation techniques.

**Prerequisites:** ELEN 3020 and ELEN 3110

**Selected Elective** in the Electromagnetic Fields and Communication area.

**Contribution to Professional Component:** Engineering Science 50 %

Engineering Design 50 %

**Course Goals:**

To enable the students to understand, analyze, and design the variety of features necessary for a successful wireless communication system, including cell concepts, channel modeling, large scale and small scale path loss, and effective modulation techniques.

**Course Objectives:**

*By the end of this course, you should be able to....*

1. analyze and design a cell system for frequency reuse including interference and handoff considerations.
2. estimate the capacity and grade of service of a system using Erlang trunking theory.
3. analyze and design cell systems that utilize techniques to improve capacity (such as cell splitting and sectoring).
4. compute the path loss associated with a wireless communications channel using several techniques, including the two-ray model and the knife-edge diffraction model.
5. perform practical link budget design for cell systems using the log-distance path loss models.
6. analyze the power delay profile for wireless channels.
7. extract channel parameters from the power delay profile.
8. extract fading statistics for wireless channels.
9. explain analog and digital modulation schemes as applied to wireless systems, including linear/non-linear schemes, and the design tradeoffs inherent with these schemes.

**Contribution to Program Objectives:** Partial fulfillment of Criterion 3 objectives: A, C, E, G, K

**Course Topics: In the text**

Introduction to Wireless Systems Chapter 1

Modern Wireless Systems Chapter 2

Cell System Concepts and Design Chapter 3

Frequency Reuse

Channel Assignment and Handoffs

Interference and System Capacity

Trunking and Grade of Service

Cell Splitting and Sectoring

Large Scale Path Loss Chapter 4

Introduction to Propagation

Two-Ray Model and Knife-Edge Diffraction

Practical Link Budget Design using Log-Distance Model

Indoor and Outdoor Propagation Models

Small Scale Path Loss Chapter 5

Impulse Response Model for the Wireless Channel

Power Delay Profiles and Channel Parameters

Types of Small Scale Fading

Probability Density Functions and Channel Parameters

Modulation Techniques for Mobile Radio Chapter 6

AM and FM

Digital Modulation, Pulse Shaping Techniques

Linear Digital Modulation Techniques

Constant Envelope Digital Modulation Techniques

Spread Spectrum Techniques

Last modified: December 4, 2017