

## Introduction to Wireless Communications Systems (tentative Syllabus)

### Spring 2015

#### 1. **COURSE #:** ECE 406 (3 Crs)

**COURSE DESCRIPTION:** The course addresses the fundamentals of wireless communications and provides an overview of existing and emerging wireless communications networks. It covers radio propagation and fading models, fundamentals of cellular communications, multiple access technologies, and various wireless networks, including past and future generation networks. Simulation of wireless systems under different channel environments will be integral part of this course.

**Pre-requisites:** ECE 403

#### 2. **COURSE PURPOSE:**

Wireless communications networks is one of the fastest growing fields in the engineering world, and a tremendous interest for this topic exists among undergraduate students. The purpose of the course is to introduce the undergraduate students to the fundamentals of wireless communications and the evolution of wireless networks from the first generation to LTE and LTE advanced. When completing this course, the students should be able to understand the basic concept of wireless system design and get familiar with various wireless networks.

3.- **Textbook:** Mobile Wireless Communications. Mischa Schwartz. Paperback (2013) ISBN: 9781107412712. Cambridge University Press.

#### **References:**

The evolution to 4G cellular systems: LTE-Advanced. Ian F. Akyildiz, David M. Gutierrez-Estevez, Elias Chavarria Reyes. Broadband Wireless Networking Laboratory, School of Electrical and Computer Engineering, Georgia Institute of Technology.

Vijay K. Garg, *Wireless Communications and Networking*, Morgan Kaufmann Publishers, 2007, ISBN 978-0-12-373580-5

#### 4.- **COURSE OUTLINE:**

1. Overview of wireless communications and systems
  - Review of digital communications
  - Cellular systems from 1G to 3G
  - Wireless 4G systems
  
2. Radio propagation and propagation path-loss model
  - Free-space attenuation
  - Multipath channel characteristics
  - Signal fading statistics
  - Path-loss models

3. Fundamentals of cellular communications
  - Hexagonal cell geometry
  - Co-channel interference
  - Cellular system design
  - Sectoring using directional antennas
  
4. Multiple access techniques
  - Frequency division multiple access (FDMA)
  - Time division multiple access (TDMA)
  - Code division multiple access (CDMA)
  - Space division multiple access (SDMA)
  - Orthogonal frequency division multiplexing (OFDM)
  - Multicarrier CDMA (MC-CDMA)
  - Random access methods
  
5. Wide-area wireless networks (WANs)
  - GSM – IS-136
  - IS-95
  - UMTS
  - Cdma2000
  
6. Long Term Evolution Technologies (LTE)
  - OFDM
  - MIMO channels
  - Space Time Codes
  - LTE Advanced
  
7. Other Wireless systems
  - IEEE 802.11 WLAN (WiFi)
  - WiMAX