ECE 406 – Introduction to Wireless Communication Systems

Credits: 3, **Contact Hours:** two 75 minute lecture session per week

Coordinator: C. Zhou, Associate Professor of ECE

Textbook: Andreas F. Molish, *Wireless Communications*, 2nd Edition, John Wiley & Sons, 2010.

2019 Catalog Data: ECE 406: Introduction to Wireless Communication Systems. Credit 3.
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 an integral part of this course. Lecture: 3 Lab: 0 Credits: 3 Satisfies: ECE Professional Elective (P)

Prerequisites or co-requisites by topic: ECE 403

Enrollment: Elective course for CPE and EE majors

Specific outcomes of instruction:
After completing ECE 406 course, the student should be able to do the following:

1. Describe characteristics of wireless time-varying channels.
2. Apply various path-loss models to calculate the received signal power or determine cell coverage
3. Determine the fading types of wireless channels, such as fast or slow fading, flat or frequency-selective fading
4. Understand the frequency reuse cellular concept
5. Calculate the co-channel interference
6. Design the cellular systems in terms of cluster size and cell capacity
7. List the techniques and properties of cellular systems in generations
8. List the techniques and protocols for wireless data networks
9. Specify the details of other wireless systems

Relationship of ECE 406 specific outcomes of instruction to student outcomes:

	Student Outcomes	**Course Goals**
1	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	1,2,3,4,5,6,7,8,9
2	An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	6
3	An ability to communicate effectively with a range of audiences	
4	An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	
5	An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	1,2,3,4,5,6,7,8,9
6	An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	
7	An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	

Topics:

- Introduction to wireless communication systems and mobile networks (1 week)
- Large-scale propagation and free-space model (1 week)
- Log-distance pathloss model and log-normal shadowing (2 weeks)
- Doppler shift and Rayleigh fading (2 week)
- Cellular fundamentals, including frequency reuse, co-channel interference, and trunking (3 weeks)
- Multiple access techniques, including FDMA, TDMA, CDMA, and OFDM (3 weeks)
- Diversity and MIMO systems (1 week)
- Wireless security (1 week)

Prepared by: C. Zhou **Date:** February 26, 2020