Department of Electrical and Computer Engineering

New Jersey Institute of Technology

ECE 425 – Wireless Communication Systems (3 credits, 3 contact hours, elective course)

Instructor: Dr**.** Alexander Haimovich

Textbooks: T. S. Rappaport, Wireless Communications. ISBN: 0130422320

Catalog Course Description:

Introduction to wireless system design and engineering. Develops an understanding and appreciation of the wireless engineering problems such as cellular layout design, resource allocation, mobility management, capacity and performance and signaling load calculations. Introduces physical layer building blocks such as modulation, synchronization, coding, diversity, equalization, and spreading.

Course Description:

This is a course on the fundamental of wireless communication systems and techniques. Topics include wireless systems and standards, the cellular concept, wireless propagation, co-channel interference, digital modulation over fading channels, antenna diversity, spread spectrum techniques, TDMA, GSM and CDMA cellular architectures, handoff, 1G through 5G systems. The course provides a general background for advanced courses on wireless communication systems and networks.

Prerequisites: ECE 421 or ECE 481

Specific course learning outcomes (CLOs):

The students will be able to:

1. Understand the history and progression of Wireless Communications from early systems to 1G through 5G.
2. Understand the language and terms of Wireless Communications.
3. Understand and design the basic building blocks of a Wireless Communications System.
   This includes, wave propagation, the cellular concept, signal to interference, trunking, modulation and fading.
4. Understand multiple access and duplexing.
5. Understand the structure and standards related to AMPS, USDC, GSM, CDMA and LTE.

Relevant student outcomes (ABET criterion 3):

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics (CLO 1-5)

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 (CLO 3)

7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies (CLO 1-5).

Lecture:

- Read the Text Book assignments for Lectures one week in advance.
- Hand in Homework assignment questions and problems one week after assigned. These may be hand written, but must be neat and legible. No credit is given for late homework.
- Students will demonstrate Homework solutions in class on the due date. This will count towards Class Participation.

Technical Paper:

- A Technical Paper will be assigned during the second week. The eligible topics will be assigned at that time.
- This Report will be handed in during the 14th week of class.
- A 10-minute Oral Presentation will be given with a Power Point Presentation as your Final Exam.
- The Paper must be 3 to 5 pages, typed, single spaced.
- Pictures, graphs, diagrams, etc. may and should be included, but are additional to the 3 to 5 pages.
- A separate Bibliography is to be provided. You should reference a minimum of 2 Text Books and 5 Technical Articles.

Extra Credit:

- IEEE Seminar

Tests:

- Three Tests will be given during the semester.
- You will be given 90 minutes to complete each Test.
- A brief review will be given the week before Tests.
- Calculators will be permitted.
- All tests are closed book and notes. However, a one-page (8 1/2 x 11") formula sheet will be allowed.

Grading:

• Homework:	10 %
• Class Participation:	10%
• Tests (3):	45 %
• Technical Paper Milestones	10%
• Technical Paper/Final	15 %
• Seminar	10%

Attendance:

- Attendance will be taken before each class.
- You will find that poor attendance will negatively impact your ability to grasp the material presented in this course.

Rules:

- Arrive to class on time. If you plan to be late or miss a class, call me or send me an e-mail in advance.
- Turn off your cell phone prior to arrive to class. Use of cell phones in class is forbidden.

Agenda:

	Week	**Topic**
Lecture:		
	1	Introduction
		Chapter 1 (Introduction to Wireless Communication Systems)
	2	Chapter 2 (Modern Wireless Communication Systems)
		Assign Technical Paper
	3	Chapter 3 (The Cellular Concept)
		Technical Paper Title due
	4	Chapter 3 (The Cellular Concept)
		Test 1
	5	Chapter 4 (Large-Scale Path Loss)
	6	Chapter 5 (Small-Scale Path Loss)
	7	Chapter 6 (Modulation Techniques)
		Technical Paper Abstract due
	8	Chapter 6 (Modulation Techniques)
	9	**Test 2**
	10	Chapter 7.10 to 7.12 (Diversity)
		Technical Paper Outline due
	11	Chapter 8 (Speech Coding)
	12	Chapter 9 (Multiple Access Techniques)
	13	Chapter 9 (Multiple Access Techniques)
	14	Chapter 11(Wireless Systems and Standards)
	15	LTE and 5G (Notes)
		Technical Paper due
		Test 3
	15	**Final-Technical Paper Presentation**
	16	**Final-Technical Paper Presentation**