CNT3162 - Wireless Communication for IoT

Three Credits, Four and a half hours, Engineering Topic.

Instructor: Dr. Ahmed Ibrahim.

Textbook: Fundamentals of Wireless Communication (Recommended – Course materials provided in course is sufficient to succeed in course) By: David Tse and Pramod Viswanath, Cambridge University Press (2005) ISBN: 0521845270

Specific Course Information:

This is an undergraduate-level course that covers the fundamental concepts of wireless communications for the Internet of Things (IoT) framework. The course presents an overview on how things can communicate with each other over the air. Since the course is intended to serve students with a background in engineering, basic computer programming skills are expected. These include the MATLAB software. Topics covered include communication systems, radio wave propagation, link budget analysis, wireless fading channels, wireless channel capacity, digital modulation, multiuser communication, and IoT communication protocols. This course will consist of 3 modules. Module availability is open and can be completed at the student's individual pace. Communication will take place primarily via email and professor announcements. At the end of the course, you would have learned the underlying concepts that enable the over-the-air communication among the IoT framework nodes.

Specific Goals for the Course

a. Specific outcomes of instruction

Upon successful completion of this course, the student will:

1.Explain the functionalities of the basic elements of communication systems

2.Compare the nature of the variations of wireless channels due to either multipath reflections or mobility

3.Analyze the link budget of communication systems

4.Analyze the capacity region of wireless channels

5.Design digital modulation and demodulation schemes

6.Assess the error rate performance of digital communications in additive white Gaussian noise (AWGN) and Rayleigh fading channels

7.Assess the performance of orthogonal multiuser multiplexing schemes against the optimal capacity regions in both the downlink and uplink communication scenarios.

8.Evaluate link budget analysis, capacity region of wireless channels, digital modulation and demodulation schemes using MATLAB code.

b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

In this course the student will have to show

(a) an ability to apply knowledge of mathematics, science, and engineering (N/A)

(b) an ability to design and conduct experiments (simulations), as well as to analyze, interpret data (N/A)

(c) an ability to design a system, component, or process to meet desired needs (N/A)

(d) an ability to function in multi-disciplinary teams (N/A)

(e) an ability to identify, formulate, and solve engineering problems (homework) (N/A)
(f) an understanding of professional and ethical responsibility (N/A)
(g) an ability to communicate effectively (through project reports) (N/A)
(h) the broad education necessary to understand the impact of engineering solutions in a global and societal context (N/A)
(i) a recognition of the need, and an ability to engage in life-long learning (N/A)
(j) a knowledge of contemporary issues (N/A)
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (N/A)
(l) a knowledge of probability and statistics (N/A)

Brief list of the topics to be covered

1.Learn how to explain the functionalities of the basic elements of communication systems
2.Learn how to compare the nature of the variations of wireless channels due to either multipath reflections or mobility
3.Learn how to analyze the link budget of communication systems
4.Learn how to analyze the capacity region of wireless channels
5.Learn how to design digital modulation and demodulation schemes
6.Learn how to assess the error rate performance of digital communications in additive white Gaussian noise (AWGN) and Rayleigh fading channels
7.Learn how to assess the performance of orthogonal multiuser multiplexing schemes against the optimal capacity regions in both the downlink and uplink communication scenarios.
8.Learn how to evaluate link budget analysis, capacity region of wireless channels, digital modulation and demodulation schemes using MATLAB code.

GRADING:

Course Requirements	Weight
Quizzes	20%
Practice Assignments	15%
Term project	10%
Discussion Board	15%
Midterm Exam	20%
Final Exam	20%
Overall Grade	100%

Conversion of Numerical Grade to Letter Grad

95<= A <=100	80 <= B-< 82	F: Below 60
90<= A- < 94	70<= C < 76	
83 <= B < 86	60 <= D < 69	