WEST VIRGINIA UNIVERSITY
COLLEGE OF ENGINEERING AND MINERAL RESOURCES
DEPARTMENT OF COMPUTER SCIENCE AND ELECTRICAL ENGINEERING

CPE 462: Wireless Networking
Fall 2014
3 credit hours

Class Info: Meeting times: 2 pm-3:15pm
            Location: ESB 211

Instructor: Brian Woerner
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            Office: ESB 825
            Office phone: 293-9141

Office Hours: Times: T,Th 3:30-4:30 PM, MWF 2-3pm

Catalog Description:
            Design and analysis of modern wireless data networks, with an emphasis on the
            physical, link, medium access control, and network layers. Survey of digital
            modulation techniques, wireless channel models, antennas, spread spectrum, carrier
            sense multiple access, routing for ad-hoc networks, error control coding, and
            automatic repeat request strategies.

Objectives: To provide students with a general understanding of the principles of modern wireless
            networking and the application of these principles to current and next-generation
            wireless networking standards.

Outcomes: At the end of the semester you should:
            - Have a basic understanding of the wireless channels and why wireless networks
              are different than conventional wireline networks.
            - Describe the principle technologies used in wireless networks, including:
                - Digital modulation and detection.
                - Spread spectrum.
                - Coding and error control.
                - Multiple-access and medium access control.
            - Plan a simple wireless network and compute how many subscribers it can support.
            - Describe routing strategies for wireless ad-hoc networks.
            - Describe the salient features of modern wireless networking standards, including
              IEEE 802.11, Bluetooth, and the major 2-G/3-G/4-G cellular telephony standards.

Prerequisites: EE 327 (I/O relationship of LTI systems) and STAT 215 (probability and random
            variables).

Recommended Texts:

- T. S. Rappaport, Wireless Communications: Principles and Practice, 2nd edition, Prentice-Hall, 2002, ISBN 0-13-142232-0.

- J.D. Gibson, *The Mobile Communications Handbook*, CRC Press, chapters 10, 11, 18, 21, and 32. *Available online at no cost through the WVU library.*

Assessment:

In-class quizzes	20%	
Design Project	30%	
Mid-Term Exam	25%	
Final Exam	25%	

Homework Assignments: Approximately 5 homework assignments will be given at a rate of approximately one every other week, for the first 2/3 of the semester. The assignments will be mostly traditional problems that can be worked with paper, pencil, and a calculator. The homeworks will not be graded, but will be useful preparation for quizzes and exams.

Design Project Assignment: A multi-part semester-long project will challenge teams of 3 or 4 students to design an economically-viable wireless cellular network. You will begin by incorporating a virtual company, which will be seeded with virtual money. Initially, you will use your funds to bid on spectrum during an in-class spectrum auction. Once your spectrum is in hand, you will design your network by selecting from among several alternative transmission technologies, placing base stations in your service area, and allocating frequency channels to base stations. You will evaluate the number of paying subscribers that can be supported for a particular quality-of-service, and based on the number of subscribers will determine the rate of return on the initial investment. Software to help plan and analyze the network will be developed during the course of the semester.

Quizes: There will be approximately 6-8 quizzes, based on homeworks and topics covered in class. Each quiz will consist of 2-3 short answer questions on concepts from the previous week. Quizzes will last approximately 10-15 minutes, and we will discuss answers following each quiz. Quizzes missed due to excused absences will be compensated for by pro-rating the remaining quizzes.

Exams: There will be one mid-term and one final exam. The mid-term will be held in class and will be worth 25% of the course grade. The final exam held Monday, December 15, from 3 pm – 5 pm, and will be worth 25% of the semester grade. The final exam will be comprehensive. The exams will be closed book, but you may bring a calculator and a two-sided pages of notes. You will be asked to sign the honor pledge: "I have neither given nor received unauthorized aid on this examination."

Honor Code: You may confer with your colleagues on interpretation and approach to design problems, but the *solutions* must be your own groups. Turning in a handwritten copy or a photocopy of someone else's solution (another student, author's solution manual, instructor's solution from a previous year) is considered an honor code violation. Using someone else's computer code or plots is considered an honor code violation. Anything that you write (e.g paper summary/reflection) must be in your own words.

All Exams and Quizzes must be your own unaided work. **Failure to comply with these guidelines will be interpreted as an honor code violation and dealt with following University procedures.**

Days of Special Concern: *WVU recognizes the diversity of its students and the needs of those who wish to be absent from class to participate in Days of Special Concern, which are listed in the Schedule of Courses. Students should notify their instructors by the end of the second week of classes or prior to the first Day of Special Concern, whichever is earlier, regarding Day of Special Concern observances that will affect their attendance. Further, students must abide by the attendance policy of their instructors as stated on their syllabi. Faculty will make reasonable accommodation for tests or field trips that a student misses as a result of observing a Day of Special Concern.*

Social Justice Statement: *West Virginia University is committed to social justice. I concur with that commitment and expect to maintain a positive learning environment based upon open communication, mutual respect, and non-discrimination. Our University does not discriminate on the basis of race, sex, age, disability, veteran status, religion, sexual orientation, color or national origin. Any suggestions as to how to further such a positive and open environment in this class will be appreciated and given serious consideration.*

If you are a person with a disability and anticipate needing any type of accommodation in order to participate in this class, please advise me and make appropriate arrangements with the Office of Disability Services (293-6700).

Lecture Topics (Dates and topics subject to change)

Lecture #	Topic	Corresponding Chapters from Rappaport Book
1	Course policies and introduction	-
2	Evolution of Wireless Standards – Review of Probability	Chapters 1, Chapter 2
3	The Cellular Concept	Chapter 3
4	The Cellular Concept – including security issues	Chapter 3
5	Propagation & Path Loss	Chapter 4
6	Propagation & Path Loss	Chapter 4
7	Link Budgets	Chapter 4
8	Link Budgets	Chapter 4
9	Multipath Fading	Chapter 5
10	Multipath Fading	Chapter 5
11	Transceiver Design and Modulation	Chapter 6
12	Transceiver Design and Modulation	Chapter 6
13	Transceiver Design and Modulation	Chapter 6
14	Transceiver Design and Modulation	Chapter 6
15	Diversity Techniques	Chapter 7
16	Diversity Techniques	Chapter 7
17	Review for Mid-Term	
18	Mid-Term Exam	
19	Error Correction Coding	Chapter 7
20	Error Correction Coding	Chapter 7
21	Multiple Access	Chapter 8
22	Multiple Access	Chapter 8
23	Networks and Protocols	Chapter 9
24	Networks and Protocols	Chapter 9
25	Network Security	Chapter 9
26	Network Security	Chapter 9
27	OFDM	-
28	Wi-Max	-
29	Wi-Max	-
30	Course Summary Review for Final	-