Sonoma State University
Department of Electrical Engineering
Course Syllabus – Fall 2014

Course:	**ES485 / CES544- Wireless Communications Systems**

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Office Hours:	By Appointment (see office hours) – I am not available on Fridays.

Text and References:	Required: Wireless Communications and Networks, by William Stallings. Second Edition; ISBN-10: 0131918354 – eBay; Amazon

Optional:
- Introduction to Wireless Systems by Bruce A. Black, Philip S. DiPiazza , Bruce A. Ferguson, David R. Voltmer, and Frederick C. Berry
- ZigBee Wireless Networks and Transceivers by Shahin Farahani
- Wireless Telecommunications Systems and Networks, by Gary J. Mullett. ISBN-10: 1401886590; Publisher: Thomson Delmar Learning; 1 edition (September 6, 2005)
- Also see Related eBooks in SSU Library (must be SSU student)
- Links to more resources are available at the discussion group

Grading Plan:	Exams (Midterm & Final) Homework/Lab/Projects Quiz/In-class Exercises	35% 40% 20/5%

Grading:	95 - 100 A 90 – 94 A- 87 – 89 B+ 84 – 86 B 80 – 83 B- 74 – 76 C	70 – 73 C- 77 – 79 C+ 67 – 69 D+ 64 – 66 D 60 – 63 D- < 60 F	

Course Description

Wireless communications has been one of the leading driving forces for the global telecommunications industry since the late 1980s. Wireless seems having kept its growth momentum into the 1st decade of 21st century in the Internet era. Many attentions have been paid to enable wireless systems to aid the Internet's expansion.

This course covers fundamental techniques in design and operation of first, second, and third generation wireless cellular networks, including medium access techniques, radio propagation models, error control techniques, handoff, power control, common air protocols (AMPS, IS-95, IS-136, GSM, GPRS, EDGE, WCDMA,cdma2000, etc.), radio resource and network management. As an example for the future wireless networks, WLAN, WiMAX, IEEE 802.11 and Bluetooth LANs, and Ad hock Sensor Networks are discussed in detail since they are expected to have a large impact on future world. In this course students also become familiar with spread spectrum, antennas and propagation, error control and coding. This course is intended for students who have taken a course in computer networks.

Reminder:
ES485/CES544 a 3 credit hour course requiring an average of 12 hours of study per week!

Basic Outline of Course

Introduction.	Wireless Comes of Age. The Cellular Revolution. The Global Cellular Network. Broadband. The Trouble with Wireless. Outline of the Book. Internet and Web Resources.
Transmission Fundamentals.	Signals for Conveying Information. Analog and Digital Data Transmission. Channel Capacity. Transmission Media. Multiplexing.
Communication Networks.	LANs, MANs, and WANs. Switching Techniques. Circuit-Switching. Packet-Switching. Asynchronous Transfer Mode.
Protocols and the TCP/IP Suite.	The Need for a Protocol Architecture. The TCP/IP Protocol Architecture. The OSI Protocol Architecture. Internetworking.
Antennas and Propagation.	Antennas. Propagation Modes. Line-of-Sight Transmission. Fading in the Mobile Environment
Signal Encoding Techniques.	Signal Encoding Criteria. Digital Data, Analog Signals. Analog Data, Analog Signals. Analog Data, Digital Signals.
Spread Spectrum.	The Concept of Spread Spectrum. Frequency Hopping Spread Spectrum. Direct Sequence Spread Spectrum. Code-Division Multiple Access. Generation of Spreading Sequences.
Coding and Error Control.	Error Detection. Block Error Correction Codes. Convolutional Codes. Automatic Repeat Request.
WIRELESS NETWORKING.	
Satellite Communications.	Satellite Parameters and Configurations. Capacity Allocation—Frequency Division. Capacity Allocation—Time Division.
Cellular Wireless Networks.	Principles of Cellular Networks. First Generation Analog. Second Generation TDMA. Second Generation CDMA. Third Generation Systems.
Cordless Systems and Wireless Local Loop.	Cordless Systems. Wireless Local Loop. IEEE 802.16 Fixed Broadband Wireless Access Standard.
Mobile IP and Wireless Access Protocol.	Mobile IP. Wireless Application Protocol.
WIRELESS LANS.	
Wireless LAN Technology.	Overview. Infrared LANs. Spread Spectrum LANs. Narrowband Microwave LANs
IEEE 802.11 Wireless LAN Standard.	IEEE 802 Protocol Architecture. IEEE 802.11 Architecture and Services. IEEE 802.11 Medium Access Control. IEEE 802.11 Physical Layer.
Bluetooth, WIFI WiMAX, Mobile-FI Zigbee, Bluetooth, UWB	Overview. Radio Specifications. Baseband Specification. Link Manager Specification. Logical Link Control and Adaptation Protocol.

POLICIES

CLASSROOM CONDUCTS: In order to create an appropriate environment for teaching and learning, students must show respect for their instructor and fellow students. Listed below are a few guidelines for classroom behavior. Students are expected to follow these rules to ensure that the learning environment is not compromised.

1. **Class Participation**: You are expected to be in class the entire class time. Please <u>do not</u> enter late or leave early. Rare exceptions may be made, particularly in emergency situations. Your participation in the class and lab and the discussions are very important and would help me understand how much you follow the material.
2. **Absences**: Inform the instructor in advance, if you know you are going to miss a class. Also, take responsibility for getting missed assignments from other students. Your instructor is not responsible for re-teaching the material you missed due to an absence or being late.
3. **Conversation**: Do not carry on side conversations in class.
4. **Sleep**: Do not sleep in class.
5. **Attitude:** You are expected to maintain a civil attitude in class. You may not use inappropriate or offensive commentary or body language toward the instructor or fellow students.
6. **Cell phones and iPhone:** You may not use your cell phone during class. Please turn off your cell phone upon entering the classroom.

PLAGIARISM: All forms of cheating and plagiarism are serious offenses that can result in disciplinary penalties including expulsion from the university. This includes copying assignments from the Internet! Refer to the student handbook for details. Occasionally, I will use http://www.dustball.com/cs/plagiarism.checker/ to ensure there assignments are original and free of any possible plagiarism. All students are required to sign and return a copy of the Statement of Ethics.

WITHDRAWAL: No student will be granted a withdrawal after the deadline unless under extreme circumstances. Policy regarding withdrawal is stated in the university catalog.

SPECIAL NEEDS: Any student who feels s/he may need an accommodation based on the impact of a disability should contact me privately to discuss your specific needs.

1. Be able to operate in team and work together towards a common goal.
2. Become a more self-motivated and self-learner individual.

ASSIGNMENTS

HOMEWORK: All students are required to complete homework assignments. Homework assignments require familiarity with different software tools such as Excel, and VISIO. Homework assignments must be submitted in class. Late submissions will receive 15 deduction points for each late day, including weekends. All hardcopy submissions must be stapled and have a coversheet, otherwise they will *not* be accepted. Please avoid printing your homework when class starts! Unless specified in advance, no handwritten homework will be accepted.

GRADUATE STUDENTS: Each student is expected to TWO extra assignments related to the Preserve wireless project. The preserve is 15 minutes away from the campus and you need to coordinate your time and your activities with my student assistance.

ARTICLES: Each individual student is required to have at least **four article** summery entries into the class discussion group. See the web page for dates. Each entry must describe the main point of the article/news along with **proper citation**. Four article submissions count as one quiz grade. There will be no partial credit. You will **NOT** receive credit if you are not available to talk about your article.

DISCUSSION GROUP: Students are highly encouraged to use the discussion group to discuss assignments and projects. Each student is required to register for the discussion group and log on using his/her first and last name (e.g., **Cesar Chavez** or **Angela Davis**).

ONLINE LECTURES: We will have 4-7 online lectures. Lectures will NOT be recorded and all students are expected to be available. Online lectures will start at the regular class time. The links to lecture series will be posted on Moodle and email to you via Piazza one the day before the class. Online lectures contain VIDEOs and in-class exercises. All students MUST complete in-class exercises.

EXAMS: Exams will consist of problems designed to test your understanding of the concepts covered in class and lab. Anyone missing an exam will receive a zero grade for that exam. Make-up exams will only be given with a doctor's slip stating that you were too ill on the day of the exam to attend, or documented extraordinary circumstances.

SIMULATION SOFTWARE & HARDWARE: Throughout the students are required to become familiar with a number of software and hardware tools, including the following:
1. Agilent VSA
2. Matlab to model physical characteristics of wireless networks (see References in the web page)
3. LabVIEW to program wireless ZigBEE Devices (see References in the web page)
4. OmniPeek & Wireshark (Ethereal) to analyze wireless protocols
5. ZigBee Compatible Device - In this class we will conduct one lab activity related to 801.15.4 using an XBee device. Students interested to have their own XBee device can get more information HERE.

LABS: There will be 3-4 lab experiments in this class. All students are expected to report the results individually. These labs are critical aspect of the course and must be carefully completed. Students are responsible to learn about the lab equipments.

QUIZ: We will have 4-8 quizzes in this class. The quizzes will be over the materials we covered in class <u>and</u> laboratory experiments. We start each quiz at the beginning of class.

LECTURE SERIES: It is highly advised that all students to participate in [Lecture Series at Sonoma.](#)

GRADUATE STUDENTS: Each student is expected to do several extra assignments. Please discuss with your instructor for more information. Graduate students are also expected to assist with the online lectures.

GRADING SUMMARY

Each student's final grade will be calculated according to the Grading Plan mentioned above. Please note the following:

1. All assignments must be submitted at the beginning of the class. They must be stapled and have a coversheet.
2. Late assignments (hardcopy or softcopy) will receive 15 deduction points for each late day, including weekends.
3. There will be no curving (89.2 is still a B$^+$).
4. There will be no make-ups.
5. Pay attention to the grading plan!

Please make sure you speak to me before you decide on dropping the class!

I will be available, if you are willing to learn!