DEVRY UNIVERSITY
WIRELESS COMMUNICATIONS
ECT281

INSTRUCTOR: Tom Wheeler (Office: Room 200) 941-0430 x5211
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TEXT: Blake, Wireless Communication Technology (Current edition), Delmar
Wheeler, Telephony (Handout), Prentice Hall

CREDIT HOURS: 4.0

PREREQUISITES: ECT-261, ECT261L

UNIT	TOPIC
I	Transmission Lines, Antennas
II	Waves, Fields, Link Budgets
III	Satellites, Cellular and PCS Telephony, DSL

This course provides system-level understanding of wireless systems including cellular and satellite communications. Topics include cellular and mobile radio architectures using analog and digital modulation and multiplexing technologies (FDMA, TDMA, CDMA, and GSM), and the troubleshooting of cellular systems. The wireless-wireline interface, required for understanding how calls between wireless systems and the existing public switching telephone networks (PSTNs) are completed, and the asynchronous digital subscriber line (ADSL) technology used for transmitting multimedia, are explained.

Earn your amateur radio license and get extra credit for ECT-281!

An amateur radio license is an excellent first step in electronic communications. Amateur radio is a fascinating hobby, and possession of a "ham" license is a strong demonstration of your commitment to the profession for potential employers. Morse code is no longer required for the Technician license.

Recommended Text: ARRL, Now You're Talking (Current ed.)
Text available through Radio Shack and Associated Radio (381-5900).

50 points of homework credit will be added for obtaining the Technician license. The license must be obtained during the term; to obtain credit, simply take the written test (offered several times each month in Kansas City), and show the instructor the CSCE given by the VE team.

If you already possess an amateur license, you may earn credit by upgrading, as follows: Tech Plus, 10 points; General, 25 points; Extra, 50 points. Point values are not cumulative; in other words, upgrading from General to Extra earns 50 points, not 75.

ATTENDANCE

Daily class attendance is required. *You are responsible for the material presented in all class sessions, regardless of your presence or absence*. Absence of more than 8 class sessions is cause for dismissal from the course, with a grade of F. You are expected to be on time for every class meeting. If you will not be able to make it to class on time, please call the instructor in advance to make arrangements.

HOMEWORK

Homework is due at the beginning of class (xx00 UTC). *Late homework is not accepted for any reason*. Homework carries the weight of one major exam (100 points) in the course. Failure to do homework will severely damage your grade.

Homework Performance Standards

- For problems involving calculations, all work must be shown. If a numerical answer is obtained without doing a calculation, state clearly that this is the case. For example: "By inspection, the potential is 25 Volts."

- When showing work for numerical problems, all defining equations will be stated first. The last step in the problem will be substitution of values into the equations. For example:

  Given V = 20V and R = 5 Ohms, find the current I.

  $I = \frac{V}{R}$ (Comment: The defining equation, Ohm's law, is stated.)

  $I = \frac{20V}{5\Omega} = \underline{\underline{4A}}$ (Comment: Note that units are clearly displayed for the answer.)

- When a numerical answer is given, it must be boxed or underlined and have correct units attached.

- Any written responses must be complete sentences.

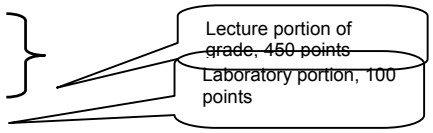
- No credit will be given for any problems that have not been worked according to these instructions, or any additional instructions given by the instructor.

- The homework solutions are intended as an example of proper work. You can access them from the instructor's web site.

GRADING

There are 3 major exams, an unspecified number of quizzes given at random intervals, various homework assignments, and a final examination given in the 15th week of the course.Your grade will be determined as follows:

2 Highest Major Exams @ 100 points each: 200 points
Quizzes/Homework : 100 points
Final Exam (Comprehensive): 150 points
Laboratory 100 points
550 points total for course



Important:

- *There is one drop test. The lowest grade from the three major exams is not counted. <u>There are no "make-up" exams given</u>. Only one examination will be dropped during the term. All students must take the final exam.*

- *To earn a passing grade in this course, a passing grade percentage is required in both the laboratory and lecture portions of the course. 60% is the minimum passing percentage. A minimum of 60 points is required to pass lab, and 270 points is required to pass lecture.*

DETERMINATION OF LETTER GRADE FOR THIS COURSE

90 - 100 % = A 80 - 89 % = B 70 - 79 % = C 60 - 69 % = D
<60 % = F

PLAGIARISM AND OTHER FORMS OF CHEATING

Copying the work of another, and claiming it to be your own is <u>plagiarism</u>. This includes (but is not limited to) copying others homework, copying from a lab manual or textbook, or collusion. The minimum penalty for cheating in any form is a grade of zero for the element involved; in some cases, failure of the course and/or expulsion from the Institute will also result. *All cases of misconduct will be documented and forwarded to Student Services for disciplinary consideration*. The DeVry Student Handbook contains complete information on this topic.

MISCELLANEOUS INFORMATION

EMERGENCY PROCEDURES - Each classroom has a plaque (located near the door) with instructions for evacuation in the event of an emergency. The instructor will remain in charge of your class group should the situation arise.

FOOD and DRINK are not allowed in the classrooms and labs at DeVry.

HOMEWORK / READING ASSIGNMENTS

All assignments refer to the course textbook. Worked problems are available on the instructor's web site (`http://faculty.kc.devry.edu/twheeler`).

Reading Topics:

UNIT I: Chapters 6 and 8
UNIT II: Chapter 7
UNIT III: Chapters 12, 11, 5

Homework Assignments (color coded by unit):

Assignment Number	Description
1	Chapter 6 Problems 1-8
2	Chapter 6 Problems 11-17
3	Chapter 8 Problems 1-10
4	Chapter 7 Questions 1-10
5	Chapter 7 Problems 1-11
6	Chapter 12 Questions 1-16
7	Chapter 12 Problems 1,2,3,4,6,7,10,11,12
8	Chapter 11 Questions 1-10
9	Chapter 11 Questions 11-30
10	Chapter 5 Questions 28-29 Chapter 5 Problems 3-9

TERMINAL OBJECTIVES FOR ECT281

1. Given the parameters for the various contributors and detractors to terrestrial wireless RF links, perform link calculations using simple algebraic equations to include the transmitter effective radiated power (ERP), path loss, and receiver antenna gain.
2. Given the applications for wireless communications such as cordless telephones, cellular radio, personal radio, wireless office telephone systems, messaging services, Local Multipoint Distribution Services (LMDS), and telemetry applications, compare and contrast how wireless technology meets the requirements for each and identify allocated spectrum, bandwidth, power, and typical range for each application.
3. Given the elements of a mobile analog cellular system including the handset, the base station and mobile telephone switching office (MTSO), discuss the history of cellular radio, develop a diagram of the RF interface and discuss operation of the cell system major elements.
4. Given the objectives of providing continuous and reliable coverage at every point within a cellular service providers assigned area, diagram the methods used to assure coverage in both urban and remote coverage areas.
5. Given the established standards for the North American analog cellular system using FDMA (frequency division multiple access), diagram the major elements and describe cell size, frequency allocation, clusters, cell splitting, capacity, hand-off, frequency reuse, frequency multiplexing, access methods, channel rate and bandwidth, carrier spacing, and cellular efficiency.
6. Given the objective to develop a digital cellular system with approximately ten times the capacity of the analog AMPS system and realize significant improvements in reliability and voice clarity, review the IS-54 standard that led to the development of D-AMPS (Digital Advanced Mobile Phone Services).
7. Describe and contrast the subsequent development of IS-136 (enhanced IS-54) using TDMA (time division multiple access) and the establishment of IS-95 using CDMA (code division multiple access).
8. Given the basic premises of packet switching, describe and diagram how CDPD uses existing cellular and PCS systems to provide connectionless communications and compare the efficiency of CDPD transmission over other systems.
9. Compare and contrast the tradeoffs between a satellites orbital height and the number of satellites required for global coverage. Include a discussion various communications satellite programs used for global transmission and reception of voice, data and video.
10. Given a block diagram of a cellular system including the mobile units, cell site, mobile telephone switching office (MTSO) and the interface connections to the PSTN, describe the sequencing involved in a call originating at a telephone within the PSTN system to a mobile phone and conversely, a call originating at a mobile phone to a telephone within the PSTN system.
11. Given a new class of digital subscriber line (XDSL) services to provide high-speed connectivity over standard telephone lines, compare and contrast the features HDSL (high speed digital subscriber line), SDSL (symmetric digital subscriber line), ADSL (asymmetrical digital subscriber line), and VDSL (very high speed digital subscriber line).

Every class is to some extent a unique interactive experience, which may cause some variance within the stated objectives, in either content or level. Individual faculty, based on their experience and expertise, are encouraged to add objectives, as they deem appropriate, and to communicate these directly to the class. The outcomes of the course will depend on the design of the course, the quality of instruction, and the motivation and capabilities of the students, including time available for studying and the effectiveness of the effort.

ECT281/L
Mid-Term Grade Estimation Worksheet
Professor Wheeler

The following table can be used to estimate your standing in this course as of midterm. *You will be required to fill out the data in this table, and bring it to our mid-term class meeting.*

There are **no** midterm grades delivered by DeVry; by filling in the data in this table, you will compute your own midterm grade. You are responsible for keeping track of the information on this worksheet.

Laboratory Portion of Midterm Grade:

In the table below, the number of points possible for each lab is given. Write in your scores (from your returned papers).

Lab 1	Lab 2	Lab 3	Lab 4	Lab 5	Lab 6	Lab 7
100	100	100	100	100	100	100

Your midterm lab grade percentage is the sum of all the lab scores entered, divided by the number of labs assigned (probably 3 or 4 depending on schedule).

A: Lab Midterm Grade Percentage: _____

Class Midterm Grade:

Your midterm grade will consist of 100 percentage points from homework, 100 percentage points from exam #1, and 50 percentage points from laboratory. Complete the data in the table below:

Assignment	HW 1	HW 2	HW 3	HW 4	HW 5	HW 6
Possible Points	14	23	26	12	13	32
Your Score						

Note: Add only the homeworks assigned; may not include HW5 or HW 6.

B: Total Possible Points (Sum of assigned homeworks): _____

C: Homework points you've earned (Sum of your homework scores): _____

D: Your midterm homework percentage = 100 * (C/B) = _____

E: Your score on exam 1: _____

Your class midterm grade $= \dfrac{\left(\dfrac{A}{2} + D + E\right)}{2.5} =$ _____