DEVRY INSTITUTE OF TECHNOLOGY
ELECTRONIC COMMUNICATIONS EET368

INSTRUCTOR: Tom Wheeler (OFFICE ROOM 208) 941-0430 x5211
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TEXT: Miller, *Modern Electronic Communication* (7th ed, Prentice-Hall)

CREDIT HOURS: 4.0

Course Major Topics:

I. SYSTEMS; SIGNAL ANALYSIS; MODULATION; AM PRINCIPLES

II. RADIO FREQUENCY TECHNIQUES; AM TRANSMISSION AND RECEPTION

III. FREQUENCY SYNTHESIS; FM THEORY AND PRACTICE

This course is an introduction to the world of electronic communciations. Practical and mathematical aspects of communication systems will be explored, with emphasis on the system level of operation, as well as practical applications of the technology. An overview of basic RF design techniques is also included.

I. ATTENDANCE:

Daily class attendance is required. Unexcused absence in excess of 8 hours will result in a grade of "F" for this course.

II. HOMEWORK

Homework is normally due ONE WEEK from the assigned date, at the beginning (xx00 UTC) of the class. Late homework is not accepted unless mitigating circumstances are present. If this is the case, BRING DOCUMENTATION (court papers, note on doctor's letterhead, etc.)

Homework carries the weight of one major exam (100 points) in the course. Failure to do homework will do severe damage to 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.

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.

ALL WORK MUST BE DIRECTLY TURNED INTO THE INSTRUCTOR. DO NOT TURN IN ANY PAPERS TO ROOM 208.

III. 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 point each, total 200 points

Quizzes/Homework.....Normalized to 100 points

Final Exam .....150 points

450 points total for course

NOTE: There is one "drop test." The lowest grade from the three major exams is not counted. Only ONE examination will be dropped during the term. All students must take the final exam.

DETERMINATION OF LETTER GRADE FOR THIS COURSE:

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

IV. PLAGIARISM AND OTHER FORMS OF CHEATING

Copying the work of another, and claiming it to be your own is plagiarism. 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.

Please do not turn in any work that is not your own! If in doubt, ask the instructor. Here are some ways to avoid any problems:

- Don't share your computer files (text, OrCAD, etc) with anyone else.
- Don't share a diskette (or other media) with another student; it's too easy to get files mixed up.
- Don't copy answers from a neighbor. If you don't understand how to do it, ask!
- Decline any request from fellow students for a copy of your work. Anybody needing help should ask the instructor.

V. MISCELLANEOUS INFORMATION

EMERGENCY PROCEDURES - Each classroom has a plaque (located near the door) with instructions for evacuation in the event of an emergency. In any public place, you should be aware of what to do in an emergency situation. The instructor will remain in charge of your class group should the situation arise.

VI. Lesson Plan Outlines

READING ASSIGNMENTS

Note: Chapter numbers refer to the course textbook.

UNIT I

SYSTEMS, NOISE,
SIGNAL ANALYSIS: Ch 1, p.p. 3-43
Handout "Fourier Analysis"

MODULATION/AM PRINCIPLES: Ch 2, p.p. 69-83

UNIT II

RADIO FREQUENCY TECHNIQUES: Ch 1, p.p. 35-43
OSCILLATORS: Ch 1, p.p. 44-50

AM TRANSMISSION AND RECEPTION: Ch 2, p.p. 83-101
Ch 3, p.p. 115-155

UNIT III

PHASE LOCKED LOOPS: Ch 6, p.p. 231-233; Ch 7, p.p. 309-321
Handout "PLL Dynamics"

FM THEORY AND PRACTICE: Ch 5, p.p. 201-245
Ch 6, p.p. 255-285

HOMEWORK ASSIGNMENTS

ASSIGNMENT NUMBER	DESCRIPTION
1.	HANDOUT - FOURIER ANALYSIS PROBLEMS
2.	TEXT CH1 QUESTIONS 1-5,15-20,22-25
3.	TEXT CH2 QUESTIONS 1-7,9-13,15-22 (Note: Textbook answer for #22 is wrong; see notes in website homework key.)
4.	TEXT CH2 QUESTIONS 23-32,34-39,41,44,45,48
5.	TEXT CH3 QUESTIONS 1-9,11-17,20-31
6.	TEXT CH5 QUESTIONS 1-3,5,6,9-24,27,28,35,37,40,42
7.	TEXT CH6 QUESTIONS 1-17,22,23-25

Note: Keys to some homeworks are available on the instructor's web site for your reference.

VII. Terminal Course Objectives

At the completion of this course, the student will be able to ...

1. List and describe each step in wireless communication.

2. Define, and explain the interrelationship between the parameters that comprise the radio communication process. These will include:

   a. Electromagnetic wavelength and frequency
   b. Information signals
   c. Carrier signals
   d. Modulation methods
   e. Detection methods
   f. Antenna systems

3. List the three forms of modulation, and give the mathematical form for each.

4. Describe, using words and or diagrams, how each system of modulation conveys information.

5. Compare and contrast the TIME and FREQUENCY domains using words and numerical examples.

6. Demonstrate the rules for preparing a spectrogram.

7. Utilize a spectrum analyzer to analyze RF circuits.

8. Given the time-domain form for a periodic waveform (graphic or symbolic):

   a. Determine harmonic content by inspection.
   b. Express the waveform in the frequency domain using Fourier series
   c. Compute the effect of filters on the waveform

9. Define the following terms in relation to AM:

   a. Modulation index
   b. Overmodulation
   c. Splatter
   d. Bandwidth
   e. Carrier
   f. Sideband
   g. Emission

10. Given the possible variables in AM transmission, mathematically solve for the desired unknown quantity or quantities.

11. Explain the relationship between bandwidth and sound quality for AM emissions.

12. List at least three rules for radio frequency design and construction.

13. Identify the class of operation of an amplifier stage.

14. Design and/or evaluate a small-signal CE, CC, or CB RF amplifier.

15. Design and/or evaluate a class C AM modulator (collector/plate injection).

16. Using mathematical methods, describe the basis for the operation of oscillator circuits.

17. Given an oscillator circuit:

    a. Identify (by name) the configuration employed.
    b. Identify the gain and feedback paths.
    c. Identify the design features that determine oscillator frequency and stability.
    d. Evaluate the circuit for frequency and stability.

18. Describe the following quartz crystal characteristics:

    a. Electrical model (and approximation)
    b. Resonance modes
    c. Quality Factor

19. Explain how a quartz crystal is employed in an oscillator circuit.

20. Describe the processes that take place in a radio receiver.

21. Describe the operation of an AM detector in both frequency and time domains.

22. Explain the operation of a superheterodyne receiver.

23. Analyze the signal flow in a typical AM superhet receiver.

24. Describe the following receiver relationships:

    a. IF frequency and receiver bandwidth
    b. IF frequency, injection mode, and image frequency
    c. Preselector bandwidth and image rejection
    d. Receiver gain and sensitivity
    e. Signal strength versus AGC control voltage
    f. Distortion products of AM detection

25. Draw the block diagram for phase-locked-loop (PLL), giving a description of the signal at each point on the diagram.

26. List and explain the three states of PLL operation.

27. Draw the block diagram of a direct-type PLL frequency synthesizer.

28. Given a block (or schematic) diagram of a PLL frequency synthesizer, predict the resulting output frequency or frequencies.

29. Define FREQUENCY MODULATION.

30. List at least two differences between AM and FM system performance.

31. Define:

a. FM modulation index
b. Deviation
c. Carson's rule
d. Percentage modulation (FCC definition for FM)
e. WB FM
f. NB FM
g. Direct FM
h. Indirect FM
i. Preemphasis and Deemphasis

32. Given the possible variables in FM transmission, solve symbolically for the unknown quantities.