CALIFORNIA STATE POLYTECHNIC UNIVERSITY, POMONA

COLLEGE OF ENGINEERING
COURSE OUTLINE

ET Major	Course Classification: ET Core	Major Core	Tech Elect	GE	Course Title: Communication Systems/Lab Course No ETE 435/435L Prepared by: R. Cockrum Date of Last Revision: 6/23/99 Revised by: G. K. Herder Approved by:
CET ECET ET			(3/1)		

I. Course Description

ETE 435/435L Communication Systems/Lab (3/1)

The study of periodically gated, amplitude, single sideband, and frequency modulation methods involved in communication systems. Receivers and telemetry systems. 3 lecture/problems, 1 three-hour laboratory. Prerequisites: ETE 305, 310, MAT 132

II. Required Background of Experience

ETE 305 and MAT 132.

III. Detailed Description of the Course

A. Expanded Description of the Course

1. **Waveforms and signal waves, analysis and theory** (1 week)
   a. Periodic and non-periodic signals
   b. Average values of signals
   c. RMS values of signals

2. **The Fourier Series** (2 weeks)
   a. Mathematical analysis and theory of trigonometric Fourier series
   b. Applications of Fourier Theory

3. **Electrical Noise** (1 weeks)
   a. Mathematical analysis and theory of basic thermal and shot noise
   b. Mathematical analysis of signal to noise ratio

4. **Amplitude Modulation** (2 weeks)
   a. Periodically gated waveform
   b. Mathematical analysis and theory of standard AM (DSB-FC)
   c. Modulation and demodulation techniques

5. **Sideband Techniques** (1 week)
   a. Double Side Band Suppressed Carrier
   b. Single Side Band Techniques

6. **Angle Modulation** (1 week)
   a. Mathematical analysis and theory
   b. Demodulation techniques

7. **Receiving Systems** (1 week)
    a. Tuned RF
    b. Single-conversion superheterodyne

8. **Introduction to Digital Modulation Techniques** (1 week)
    a. Phase and Amplitude modulation,
    b. BPSK and QAM systems

B. Methods of instruction and evaluation

Instruction: Classroom lecture
Evaluation: Periodic exams and quizzes, homework problems, and computer assignments.

C. Expected Outcomes

Upon successful completion of this course, each student will be able to:

1. Define a periodic waveform
2. Calculate average values of periodic waveforms
3. Calculate RMS values for periodic waveforms
4. Perform Fourier Series calculations of spectral components for standard waveforms
5. Perform Fourier Series calculations of spectral components for Sinc related waveforms
6. Describe and perform calculations associated with basic AM systems
7. Describe and perform calculations associated with basic FM systems
8. Describe and perform calculations associated with basic sideband systems
9. Describe and perform calculations associated with basic receiving systems

D. Minimum Student Materials

Text, scientific calculator, access to an personal computer (IBM PC, Apple Macintosh or equivalent)

E. Minimum University Facilities

Standard classroom for lectures, with black (or white) board and overhead projector with screen. Laboratory with communications equipment.

IV. Text and References

Text: Young, Paul, Electronic Communication Techniques, 5th Edition, 1998, Macmillan Merrill, ISBN 0-02-431201-0, Required Textbook

V. Detailed Description of the laboratory

A. Typical laboratory experiments

1. Digital Storage Scope and RMS values of various waveforms.

2. Introduction to the Spectrum Analyzer.

3. Waveform Spectral Analysis using the Spectrum Analyzer.

4. Pulse Gated waveforms (Time and Frequency domain).

5. AM waveforms (Time and Frequency domain).

6. DSB-SC waveforms (Time and Frequency domain).

7. AM waveforms (Time and Frequency domain).

8. FM Demodulation

Alternate to items 4-8. Student may choose to construct, test and troubleshoot an AM/FM radio kit which has 10 sections including audio amplifier, AM and FM detectors, AM and FM IF's (multiple stages), AM and FM RF/Mixer/Antenna stages.

Instruction: Laboratory demonstrations followed by student construction projects under faculty supervision. This may include some lecture, as appropriate.
Evaluation: Total laboratory projects including experiments performed and lab reports.

B. Expected Outcomes

Upon successful completion of this laboratory, each student will be able to:

1. Understand the use of a DSO in waveform calculations.

2. Understand the operation of a Spectrum Analyzer.

3. Interpret the time and frequency domain displays of AM waveforms.

4. Interpret the time and frequency domain displays of FM waveforms.

C. Minimum Student Materials

"Tackle Box" of electronic parts; floppy diskettes; scientific calculator, access to an IBM PC or equivalent ; SPICE software.

D. Minimum University Facilities

Communication laboratory with Signal Generators, Digital Storage Oscilloscopes and Spectrum Analyzers.

E. Text and References

Text: Laboratory materials are locally prepared.
Reference: Lecture text(s).

ECET Course Outline Addendum

Course Number and Title: ETE 435/435L Communication Systems /Lab (3/1)

Computer usage:

For lecture and lab, perform waveform analysis calculation with spreadsheet program.

Use of SPICE simulator for Fourier Series Analysis.

Use of SPICE simulator for Fourier Series Analysis of AM waveforms.

Use of SPICE simulator for Fourier Series Analysis of FM waveforms..

In addition, each group is required to write a word-processed report for the laboratory exercise or radio project.

Laboratory projects:

The laboratory work associated with this course requires the use of the hardware lab for time and frequency domain analysis of basic waveforms along with AM and FM waveforms.

Oral and written communication requirements:

Word-processed laboratory semiformal (needed for each lab) and formal (1 required) following the specifications given in a locally-generated laboratory writing guide.

Calculus usage:

Integral calculus techniques are used for RMS calculations in lecture and lab. Fourier series techniques are used for frequency domain analysis.

Library usage:

No specific usage required in this course and/or laboratory

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