SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY
SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

Course name:	COMMUNICATION SYSTEMS II
Code No.:	ELN 245-6
Program:	ELECTRONIC TECHNICIAN
Semester:	FOUR
Date:	January 5, 1996
Author:	PETER SZILAGYI
Previous outline dated:	January, 1994

Approved: _____ _____
Dean Date

Communication Systems II	ELN-245
Total credit hours	96
Prerequisites	ELN-237

I. PHILOSOPHY/GOALS

This course is a continuation of ELN-237, which covered RF circuits and modulation. ELN-245 starts with the coverage of the more sophisticated topic of Communications Techniques. Transmission lines, Antennas and Wave Propagation will round of the study of the principles and circuits used in analog RF communications.

The second part of the course is spent with the study of the NTSC standards, Black and White, and Colour Television transmitters and receivers. The television system is used as a significant communication system, which embraces the applications of all of the principles studied so far in ELN-237 and the first part of ELN-245.

II. STUDENT PERFORMANCE OBJECTIVES

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

1. Understand the block diagram, and operate a highly sophisticated communications receiver, provided with a variety of communications techniques.

2. Understand the definition of Standing Waves, Travelling Waves, VSWR, Reflection Coefficient, Resonant and Non-resonant Lines.

3. Solve impedance matching problems, using the Smith chart.

4. Recall the mechanism of wave reflection, refraction, and diffraction. Recall the effects of the environment on wave propagation. Recall the various modes of wave propagation.

5. Identify and explain the functioning of basic antenna types, antenna arrays, and feed lines.

6. Apply the National Television System Committee (NTSC) standards. Read the schematic and block diagram of a vidicon camera and a colour TV receiver. Use the oscilloscope and the spectrum analyzer to display video signals.

   It is not the goal of this course, to train you as a TV repairmen !

III. TOPICS TO BE COVERED

1. Communications Techniques.
2. Transmission Lines, Antennas and Propagation.
3. Television.

IV. LEARNING ACTIVITIES

REQUIRED RESOURCES

BLOCK 1: COMMUNICATIONS TECHNIQUES.

Upon successful completion of this unit, the student will be able to recall and understand

1.1 Methods of image frequency rejection:
- double conversion.
- up conversion.
- preselectors.

1.2 Special techniques, such as
- auxiliary AGC.
- delayed AGC.
- bandspread.
- variable sensitivity.
- variable selectivity.
- noise limiter.
- metering and the S meter.
- squelch (muting).

3.3 Receiver noise and dynamic range.

3.4 Frequency synthesis:
- the basic synthesizer.
- programmable division.
- synthesizer alternatives.
- two-modulus prescaler.
- CB radio synthesizers.

3.5 Principles of faximile transmission.

3.6 Communications Transceivers:
- USB, LSB, AM, CW, FM.

3.7 Spread spectrum techniques:
- frequency hoping.
- time hoping.
- direct sequence.

3.8 Cellular telephony topics:
- frequency reuse.
- cell splitting.
- system operation.
- Rayleigh fading.

TEXT:
MODERN ELECTRONIC COMMUNICATION,
GARY M. MILLER

Fourt edition.
(Third edition is also acceptable)

BLOCK 2: TRANSMISSION LINES, ANTENNAS AND PROPAGATION.

Upon successful completion of this unit, the student will be able to recall and understand the following topics:

MILLER: MODERN ELECTRONIC COMMUNICATION

2.1 Transmission lines.
- types of transmission lines.
- electrical characteristics of lines.
- propagation of DC voltages.
- travelling waves on nonresonant lines.
- resonant lines (standing waves, reflection coefficient Γ, VSWR.
- quarter wavelength transformers.
- the Smith-chart and its applications.
- impedance matching and stub tuners.
- discrete circuit simulations with transmission lines.
- baluns, filters, slotted lines.
- time domain reflectometry (TDR).

2.2 Wave propagation:
- electrical to electromagnetic conversion.
- wavefronts.
- characteristic impedance of free space.
- reflection, refraction and diffraction.
- ground and space wave propagation.
- tropospheric ducting.
- sky wave propagation.
- ionospheric layers.
- tropospheric scatter.

2.3 Antennas:
- basic antenna theory.
- Hertz antenna.
- impedance, radiation pattern, gain, radiation resistance, ground effects.
- antenna efficiency.
- electrical versus physical length.
- antenna feed-lines (resonant, nonresonant, delta match, quarter wavelength match).
- Marcony antenna (radiation pattern, counterpoise).
- loaded antennas (loading coil, top loading).
- antenna arrays (Yagi, collinear array, broadside array, Marcony array).
- special purpose antennas (log-periodic, loop, ferrite loop, folded dipole, slot antennas).

BLOCK 3: TELEVISION.

Upon successful completion of this unit, the student will be able to interpret the NTSC standards and understand the following topics:

3.1 Applications of television.
- video, audio, TV and radio signals.
- closed circuit TV.

3.2 The television picture.
- picture elements.
- horizontal and vertical scanning.
- frame and field frequencies.
- picture qualities.
- standards of transmission.

3.3 Television cameras.
- basic operation, types of camera tubes.
- vidicon cameras, adjustments, gamma correction.
- colour cameras.

3.4 Picture tubes.
- construction (electron gun, focus, deflection, shadow mask, phosphor masking).
- tricolour picture tube.

3.5 Setup adjustments for picture tubes.
- beam landing and colour purity.
- static and dynamic convergence.
- degaussing.
- pincushion correction.
- video signal drive.
- grey scale tracking.

3.6 Scanning and synchronizing.
- interlaced scanning.
- sawtooth current waveform.
- flicker.
- sync pulses.
- scanning, synchronizing and blanking frequencies.

3.7 Video signal analysis.
- composite video signal.
- IRE scale.
- H and V blanking time.
- picture information, video amplitudes and frequencies.
- maximum number of picture elements.
- gamma, contrast, colour and DC component

TEXT: BASIC TELEVISION AND VIDEO SYSTEMS, by BERNARD GROBE.

Fifth edition.

3.8 Colour TV circuits and signals.
- R, G, B video signals.
- colour information encoding and decoding.
- the Y, C, R-Y, G-Y, B-Y, I and Q signals.
- colourplex composite video signal.
- colour resolution and bandwidth.
- colour subcarrier frequency.

3.9 Video Test Signals.
- EIA test pattern.
- EIA standard colour bar signal.
- sine squared test signals.
- stair step test signals.
- test signals in the vertical interval: VITS, VIRS.

3.10 Television Transmission.
- negative AM.
- vestigial sideband.
- TV transmission standards.

3.11 Television Receivers.
- the block diagram of a monochrome TV receiver.
- functional blocks: tuner, IF, sync, deflection, video detector, video amp, intercarrier sound.
- modular TV.

3.12 Raster and Sync.
- sync separator, vertical integrator, horizontal differentiator.
- gen-lock system.
- horizontal and vertical amplifiers.
- power supplies.

3.13 Colour TV receiver circuits.
- producing the Y and C signals.
- luminance delay.
- 3,58 MHz chroma circuits.
- colour BPA, colour killer, colour demodulators.
- AFPC system.

3.14 Computer monitors.
- analog and TTL monitors.
- monochrome and colour monitors.
- Hercules, CGA, EGA, VGA, super VGA standards.

BASIC TELEVISION
AND VIDEO SYSTEMS
by
BERNARD GROB

V. ADMINISTRATIVE AND EVALUATION PROCEDURES

TESTING

a) Written tests based upon theory objectives will occur following the completion of each theory block and with about a week of advance notice. Short written quizzes may occur at any time without advance notice

b) Testing of lab objectives will occur concurrent with the specific lab activity.

GRADING

a) Grading is done using the following definitions:
- Consistently outstanding performance.....A+ (90 -100)%
- Outstanding performance.....A (80 - 90)%
- Above average performance.....B (70 - 80)%
- Satisfactory performance.....C (55 - 70)%
- Unsatisfactory performance.....R (0 - 55)%

b) The grading of laboratory type objectives will be in two parts: The demonstrated ability to perform a skill function, e.g. use an instrument in a specified role or trouble shoot a circuit, will be graded "C". Failure to demonstrate the skill function will be graded "R". Subjective evaluation of lab reports, supporting theory, deportment, housekeeping etc., will be used to modify the skill function grade upward, where applicable.

c) Lab reports are due one week after the experiment was scheduled to be completed. Late reports are penalized 5% per day.

d) The grading weight will be 30% for the lab and 70% for the theory.

e) A final overall accumulated mark of 55% is the minimum requirement for course credit with the added restriction that neither the theory or the lab part of the course can be less then 55%. e) A failing grade on more then half of the theory tests during the semester leads directly to an "R" grade, regardless of the theory average.

f) Failing one third of the semesters theory tests excludes a final "A" grade, regardless the theory average.

UPGRADING

a) No upgrading tests will take place during the semester.

b) The method of upgrading is at the teachers discretion. It may consist of the rewriting of block tests, the writing of comprehensive examination, repeating laboratory experiments or repeating the course.

c) The highest mark obtainable in any make-up test is "Sufficient".

ATTENDANCE

a) Attendance for laboratory classes is compulsory.

b) Attendance at all theory classes will be recorded. Attendance is highly recommended but not mandatory.

c) Anyone with an accumulated attendance record of less then 80% at the end of the semester, and who is also in a failing condition, can expect to have to repeat the course, with no right to write a make-up test.