SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

Course Title:	Communications Systems II
Code No.:	ELN 245-6
Program:	Electronic Technician / TECHNOLOGY
Semester:	Four
Date:	1991 May 29
Author:	Peter Szilagyi

New: _____ Revision: #3

Approved: W Filipow. A — Coordinator — May 29/91 — Date

Approved: L P Chaput — Dean — 91/06/03 — Date

COMMUNICATIONS SYSTEMS ELN 245

PHILOSOPHY/GOALS:

ELN 245 is a continuation of ELN 237. Since the student is now familiar with communications circuits and modulation, the more sophisticated topic of Communications Techniques will be covered. Transmission Lines, Antennas and 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 television system, as a significant communication system and a review of all principles covered so fare.

TEXTBOOKS:

1) Modern Electronic Communications, third edition, Gary M. Miller
2) Basic Television and Video Systems, fifth edition, Bernard Grobe

REFERENCE BOOKS:

1) Communications Receivers, Ulrich L.Rohde, TK6563.R57
2) Receiving Systems Design, Stephen J. Erst, TK6563.E77
3) Electronic Transmission Technology, William Sinnema, TK7876.S573

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COURSE STRUCTURE:

The course is organized in three blocks; Block 1 and 2 are covered before the march break, Block 3 after the march break.
There are 4 theory and 3 laboratory hours per week, for 16 weeks.

Block 1: Communications Techniques.....12 hours
Block 2: Transmission Lines, Antennas and Propagation.....20 hours
Block 3: Television.....32 hours

Total theory (including tests).....64 hours

Laboratory experiments and projects:

1) Communications Receiver Operation.....3 hours
2) Phase Locked Loops.....6 hours
3) PLL FM detectors.....3 hours
4) Transmission Lines experiment.....3 hours
5) Monochrome CCTV Cameras.....6 hours
6) Colour TV Experiment 1.....3 hours
7) Colour TV Experiment 2.....3 hours
8) Colour TV Experiment 3.....3 hours
9) Colour TV EXperiment 4.....3 hours
10) Wideband IF Amplifier alignment.....3 hours
11) Frequency Domain analysis of the video signal.....3 hours
12) Measurements and Study of a Cable TV Converter.....3 hours
13) Lab. Project: Build a H/V Sync Separator.....6 hours

Total Laboratory:.....48 hours

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Block I: Communications Techniques:

1) Image Frequency Rejection
   - Double Conversion
   - Up Conversion
   - Preselector

2) Special Technigues
   - Auxiliary AGC
   - Delayed AGC
   - Bandspread
   - Variable Sensitivity
   - Variable Selectivity
   - Noise Limiter
   - Metering. The S meter.
   - Squelch (Muting).

3) Receiver Noise, Sensitivity and Dynamic Range.

4) Frequency Synthesis
   - Basic Synthesizer
   - Programmable Division
   - Synthesizer Alternatives
   - Two-Modulus Prescaler
   - CB Synthesizer

5) Faximile

6) Communications Transcievers (USB, LSB, AM, CW, FM)

7) Spread Spectrum Techniques
   - Frequency Hoping
   - Time Hoping
   - Direct Sequence

8) Cellular Telephone
   - Frequency Reuse
   - Cell Splitting
   - System Operation
   - Rayleigh Fading

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Block II: Transmission Lines, Antennas and Propagation

1) Transmission Lines
   - Types of Transmission Lines
   - Electrical Characteristics (Characteristic Impedance, Losses)
   - Propagation of DC Voltages (Velocity, Wavelength, Delay)
   - Nonresonant Line (Traveling Waves)
   - Resonant Lines (Standing Waves, VSWR, Reflection Coefficient)
   - Quarter Wavelength Transformer
   - The Smith Chart
   - Matching Using the Smith Chart. Stab Tuners.
   - Discrete Circuit Simulation with transmission lines.
   - Transmission Lines Applications: Baluns, Filters, Slotted Lines
   - Time Domain Reflectometry.

2) Wave Propagation.
   - Electrical to Electromagnetic Conversion
   - Wavefronts
   - Characteristic Impedance of Free space
   - The Effects of the Environment on Wave Propagation (Reflection, Refraction,Diffraction)
   - Ground and Space Wave Propagation.
   - Trophospheric Ducting
   - Sky Wave Propagation
   - Ionospheric Layers. Effects of the Ionosphere on the Sky Wave.
   - Trophospheric Scatter

3) Antennas.
   - Basic Antenna Theory
   - Hertz Antenna (Impedance, Radiation Pattern, Gain)
   - Radiation Resistance (Effects of antenna length, ground effects)
   - Antenna Efficiency
   - Electrical versus Physical length
   - Antenna Feed Lines (Resonant, Nonresonant, Delta match, Quarter Wavelength match)
   - Marconi Antenna (Radiation Pattern, Counterpoise)
   - Loaded Antennas (Loading Coil, Top-Loading)
   - Antenna Arrays (Hertz with Parasitic Element, Yagi-Uda, Driven Collinear Array, Broadside Array, Marconi Array)
   - Special purpose antennas (Log-Periodic, Loop, Ferrite Loop, Folded Dipole, Slot Antennas)

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Block III: Television

1) Applications of Television
   - Video, Audio, TV and Radio Signals
   - Closed Circuit TV

2) The Television Picture
   - Picture Elements
   - Horizontal and Vertical Scanning and Synchronization
   - Frame and Field Frequencies
   - Picture Qualities
   - Standards of transmission

3) Television Cameras
   - Basic Operation. Types of Camera Tubes
   - Vidicon Cameras. Adjustments, Gamma Correction
   - Colour Cameras

4) Picture Tubes
   - Picture Tube Construction (Electron Gun, Focus, Deflection, Shadow Masc, Phosphore mascing)
   - Tricolor Picture Tube

5) Setup Adjustments for Colour Picture Tubes.
   - Beam Landing and Colour Purity
   - Static and Dynamic Convergence
   - Degaussing
   - Pincussion Correction
   - Video Signal Drive
   - Gray Scale tracking

6) Scanning and Synchronizing
   - Interlaced Scanning
   - Sawtooth Current Waveform
   - Flicker
   - Sync Pulses
   - Scanning, Synchronizing and Blanking Frequencies

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, DC Component

8) Colour TV Circuits and signals
   - R, G, B Video Signals
   - Definition of Terms
   - Encoding and Decoding Colour Information
   - The "Y" and "C", R-Y, G-Y, B-Y, I and Q Signals
   - Colorplex Composite Video Signal
   - Colour Resolution and Bandwidth
   - Colour Subcarrier Frequency

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)

10) Television Transmission
   - Negative AM
   - Vestigial Sideband
   - TV TRansmission Standards

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

12) Raster Circuits and Sync
   - Sync Separator, Vertical Integrator, Horizontal Differentiator
   - Gen-Lock System
   - Horizontal and Vertical Amplifiers
   - Power Supplies

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

14) Computer Monitors
   - Analog and TTL Monitors
   - Monochrome and Colour Monitors
   - Hercules, CGA, EGA, VGA, Super VGA Standards

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 autstanding performance.....A+ (90-100)%
- Autstanding performance.....A (80- 90)%
- Above average performance.....B (65- 80)%
- Satisfactory performance.....C (55- 65)%
- 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.

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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.

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