

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

COURSE OUTLINE

Course Title: COMMUNICATION SYSTEMS II
Code No.: ELN 245-5
Program: ELECTRONIC ENGINEERING TECHNOLOGY
Semester: FOUR
Date: JANUARY 1986
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New: _____ Revision: X

APPROVED:

J.P. Crozitto
Chairperson

_____ Date

Goals:

A second course in analog electronic communications at a technology level. Phase, Locked Loops and Frequency Synthesizers are studied and the generation and reception of FM monoural and stereo signals.

In the second part of the course, a most representative communication system, the TV system is studied, monochrome and colour TV and computer monitors as well.

Communications Systems I, Electronics I and II are prerequisites to this course.

Method of Assessment

- 4 written tests
- Lab reports and practical test

Textbooks Basic Television and Video Systems by Bernard Grob
 Modern Electronic Communication by Miller

Topic Description

Hours

Block 1 : FM and Stereo Transmitters and Receivers

1.1	FM Noise Analysis	2
1.2	Direct FM Generation	2
1.3	Indirect FM Generation	2
1.4	Stereo FM Broadcasting	1
1.5	FM Receivers	2
1.6	FM Detectors	2
1.7	FM Stereo Decoders	1
	Test #1	1

	Total Block 1	13

Block 2 : Phase Locked Loop And Frequency Syntheses

2.1	PLL	3
2.2	Frequency Synthesis	3
2.3	PLL And Synthesis Applications	3
	Test #2	1

	Total Block 2	10

Block 3 : Television Principles

3.1	Applications of Television	1
3.2	The Television Picture	1
3.3	Television Cameras	2

Block 3 Continued

3.4	Picture Tubes and Adjustments	2
3.5	Scanning and Synchronising	2
3.6	The Video-Complex Signal	2
3.7	Colour TV Circuits and Signals	3
	Test #3	1

	Total Block 3	14

Block 4 : Television Transmission and Reception

4.1	Video Test Signals	1
4.2	TV Transmission	2
4.3	TV Receivers and Monitors	4
4.4	Cable Television	1
4.5	TV Test Instruments and Servicing	2
	Test #4	1

	Total Block 4	11

General Objectives: After the successful completion of ELN245 the student will have gained a knowledge of some representative communications systems and hands-on experience in adjusting, testing and trouble shooting of FM radio receivers and colour television receivers.

Specific Objectives: When the student has successfully completes this course, he should be knowledgeable in the following topics:

Block 1: FM and Stereo Transmitters and Receivers

1.1 FM Noise Analysis

- noise suppression of AM and FM compared
- frequency deviation caused by noise
- S/N ratio and phase shift
- capture effect
- preemphasis
- Dolby Dynamic Preemphasis

1.2 Direct FM Generation

- varactor diode method
- reactance modulator
- voltage controlled oscillator
- weakness of the direct method
- Crosby modulator

1.3 Indirect FM Generation

- FM via PM
- the Armstrong modulator
- wide band deviation
- phasorial analysis of the indirect FM transmitter
- frequency stability of FM transmitters

1.4 Stereo FM

- the composite modulating signal
- compatibility of monaural and stereo systems
- frequency division multiplexing of the L and R signals
- components of a stereo FM generator
- 1 KHZ pilot carrier

1.5 FM Receivers

- block diagram
- RF amplifiers
- 10.7MHz IF amplifiers
- limiter and AGC
- sensitivity of FM receivers

1.6 FM Detectors

- FM discriminator characteristic
- slope detector
- Foster Seely discriminator
- phase relations in the discriminator

1.6 Continued

- ratio detector
- phase relations in the ratio detector

1.7 FM Stereo Decoders

- block diagram of a mono - stereo receiver
- L + R low pass filter
- L - R band pass filter
- pilot carrier filter
- matrix and deemphasis network
- stereo signal processing
- composite stereo and SCA signal
- SCA decoder

Block 2: Phase Locked Loop and Frequency Synthesis

2.1 The Phase Locked Loop

- the components of the PLL: phase detector, VCO and low pass filter
- PLL capture and lock
- waveforms in a PLL
- linear integrated circuit PLL NE560 and NE565

2.1 Frequency Synthesis

- basic frequency synthesizer
- programmable division
- two modulus prescalers
- limitations of the maximum synthesized frequency
- synthesizer techniques in order to increase maximum frequency (XTAL oscillator and mixer frequency multiplier, programmable divider and prescaler)

2.3 PLL and Synthesizer Applications

- PLL FM demodulator
- tracking filter
- PLL SCA decoder
- PLL FM transmitter
- citizen's band synthesizer

Block 3 : Television Principles

3.1 Applications of Television

- video, audio, TV and radio signals
- block diagram of TV broadcasting
- TV broadcast signals
- closed circuit television

3.2 The Television Picture

- picture elements
- horizontal and vertical scanning

3.2 Continued

- video signal
- motion pictures
- frame and field frequencies
- scanning frequencies
- synchronization
- blanking
- the 3.58 MHz colour signal
- picture qualities
- the 6 MHz TV broadcast channel
- standards of transmission

3.3 Television Cameras

- basic operation of a TV camera
- types of camera tubes
- the VIDICON, PLUMBICON and SATICON
- camera adjustments
- optical colour separation
- gamma correction
- single-tube colour cameras

3.4 Picture Tubes and Adjustments

- picture tube construction
- anode high voltage
- screen phosphors
- electron gun
- electrostatic focus
- magnetic deflection
- tricolour picture tubes (DELTA, IN LINE, TRINITRON)
- shadow mask
- methods of phosphor masking
- beam landing adjustments
- degaussing colour picture tubes
- convergence adjustments
- static convergence
- dynamic convergence
- pincushion
- video signal drive
- gray space tracking
- setup adjustments

3.5 Scanning and Synchronizing

- sawtooth waveform for linear scanning
- interlaced scanning
- odd line interlacing
- flicker
- raster distortions
- sync pulses
- scanning, sync and blanking frequencies

3.6 The Composite Video Signal

- construction of the composite video signal

3.6 Continued

- IRE scale of video signal amplitudes
- horizontal blanking time
- vertical blanking time
- picture information and video signal frequencies
- maximum number of picture elements
- DC component of the video signal
- gamma and contrast in the picture
- colour information in the video signal

3.7 Colour TV Circuits And Signals

- red, green and blue video signals
- colour addition
- definitions of colour TV terms
- encoding the picture information
- chrominance modulation
- decoding the picture information
- the luminance "Y" signal
- types of colour video signals
- colour sync burst
- HUE phase angles
- colour plexed composite video signal
- desaturated colours with white
- colour resolution and bandwidth
- colour subcarrier frequency
- colour TV systems

Block 4: Television Transmission and Reception

4.1 Video Test Signals

- EIA test patterns
- resolution wedges in the test pattern
- phase distortion
- test for ringing in picture
- ball chart
- EIA standard colour bar signal
- window signal
- sine squared test signals
- stair step test signals
- test signals in the vertical blanking interval
- VITS
- VIRS
- communications signals in the vertical blanking

4.2 TV Transmission

- negative modulation
- vestigial sideband
- TV broadcast channels
- standard TV channel
- FM sound signal
- TV transmission standards

4.3 TV Receivers

- functional blocks for the signal
- functional blocks for sync and deflection
- AGC
- DC power requirements
- RF section
- IF section
- video detector
- video amplifier section
- DC component of the video signal
- the 4.5 MHz sound if section
- raster and sync circuits
- sync separator, sync pulse wave form
- vertical sync integrator
- vertical deflection
- horizontal deflection
- power supplies
- colour TV receiver circuits
- producing the luminance image
- producing the R, G, B signals
- luminance delay lines
- IF gain for colour
- block diagram of the chroma section
- colour control
- colour demodulators
- colour killer circuit
- I and Q demodulators
- R-Y and B-Y demodulators
- colour resolution
- AFPC systems

4.4 Cable Television

- cable frequencies
- coax cable and characteristic impedance
- losses and gains
- cable TV converters
- scrambling and descrambling

4.5 TV Test Instruments

- high voltage measurements
- oscilloscopes for TV servicing
- colour bar generators