

SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

COURSE TITLE : DIGITAL AND DATA COMMUNICATION
CODE NO. : ELN 305 - 6
PROGRAM : ELECTRONIC TECHNOLOGY
SEMESTER : FIVE
DATE : OCTOBER, 1987
AUTHOR : PETER SZILAGYI

NEW _____

REVISION #1 _____

APPROVED *P. Szilagyi*

88/01/08

Philosophy/Goals:

A third course in Electronic Communications at a technology level.

The concepts of multichannel voice communication over analog and digital telephone equipment and data communication over multichannel analog equipment are studied.

The mathematical skills needed to understand multichannel, digital and data communications, are developed within the course.

Laboratory projects and experiments develop the practical experience needed to reinforce the above concepts.

Method Of Assessment

- 4 written tests
- lab reports and seminars

Textbooks:

"Digital, Analog And Data Communications" by William Sinnema (Reston)

Reference Books:

Network Analysis by Van Valkenburg

Principles of Communications Systems by Taub and Schilling

Test #3

4.1-1	Information content and capacity	17
4.2	Pulse transmission over bandlimited systems	
4.3	coding	
	test #4	

Total Block IV		7
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General Objectives : - In Depth Frequency Domain Analysis Of Analog And Digital Telecommunication Signals.

- To acquaint the student with the widespread telephone network and with the principles and applications of the more recent Digital Communication schemes.

TOPICS:

Block I : Spectral Analysis

1.1 Fourier Series And Signal Spectra

- periodic functions
- frequency content
- fundamental and harmonic
- dirichlet conditions
- Fourier series
- truncated series
- amplitude and phase spectrum
- evaluation of Fourier coefficients
- odd and even functions
- Fourier series of square waves, triangular waves and sawtooth waves.
- the exponential form of the Fourier series
- line spectra of various waveforms
- the power spectrum of periodic signals

1.2 Fourier Integral And Continuous Spectra

- spectrum envelope for a recurring pulse
- the $(\sin x)/x$ function
- the Fourier integral and transform
- single sided and two sided spectra
- continuous spectra
- bandwidth, pulse duration and rise time

Block II : Voice And Data Communication Over Analog Systems

2.1 Introduction

- The Basic Communication System
- Psophometric and C-Message Weighting Curves
- Voice Bandwidth
- FDM and TDM
- Simplex and Duplex Communication

2.2 Selected Telephone Network Concepts

- the telephone network
- the 500 type telephone set
- subscriber to trunk circuit interfacing
- DTMF telephones

- Bandwidth limiting of a pulse train
- 20 MA loop
- USART
- ASK
- FSK
- PSK, BPSK, DPSK
- QUAM
- (FIA) RS-232-C specifications
- EIA-232-D specifications
- modem chips

Block III : Pulse And Digital Modulation

3.1 Analog Pulse Modulation

- time sampling techniques
- the sampling theorem
- frequency spectrum of natural sampled waveform
- line spectrum of the switching function
- aliasing
- flat top (sample and hold) sampling
- frequency spectrum of sample and hold signal
- filter characteristics
- time division multiplexing
- IC analog multiplexer
- generation, transmission, recovery and conversion of PAM, PDM (PWM) and PPM signals

3.2 Digital Modulation

- simple delta modulation
- companded delta modulation
- CVSD modulation
- pulse code modulation
- quantizing (linear and nonlinear)
- encoding, code transmission, reception, code regeneration, decoding of samples
- aperture time
- logarithmic, A law and U law companding
- codecs
- 24 channel system frame alignment
- PCM terminal equipment
- line pulse format
- north american multiplex hierarchy
- measurement of quantization noise

3.3 Effects Of Noise And Distortion On Digital Transmission

- quantization noise
- gaussian noise
- transient noise
- gain hits, dropouts, phase jitter, phase hits
- peak to average ratio test

Block IV : Information Theory

4.1 Information Content And Capacity

- binary digit (bit)
- information content
- two level and multilevel systems
- information capacity
- bandwidth and bit rate

4.2 Pulse Transmission Over Bandlimited Systems

- the unit impulse
- ideal (brickwall) filter frequency response
- intersymbol interference
- time response of an impulse train after bandlimiting
- effect of filtering on a pulse of finite duration
- the eye diagram
- the raised cosine channel response
- partial response techniques
- duobinary technique
- encoding and decoding of a duobinary signal
- duobinary system with precoding
- modified duobinary encoder
- modified duobinary SSB radio

BIQUINARY, GRAY

- error detection and correction
- hamming distance
- cyclic codes
- hamming codes
- channel throughput and efficiency