

Devi Ahilya Vishwavidhyalaya, Indore, India Institute of Engineering & Technology					III Year B.Tech. (Electronics and Telecommunication Engineering)	
Course Code & Name	Instructions Hours per Semester and Credits					
5RTPC2 DIGITAL COMMUNICATION	Classroom Instruction (CI)		Lab Instruction (LI)	Term Work (TW) and Self Learning (SL)	Total no. of Hours Per semester	Total Credits (Total Hours/30)
	L	T	P	TW+SL	120	4
	20	10	20	70		

Course Learning Objectives:

1. To provide the in-depth knowledge of various processes used in digital communication system and advantages of digital transmission over analog.
2. To learn of different digital encoding techniques.
3. To learn of different line encoding and pulse shaping techniques.
4. To learn different digital modulation techniques.
5. To learn different source encoding techniques and principle of information theory.
6. To learn different channel encoding techniques.

Prerequisites: Knowledge of Fourier analysis and random variables.

COURSE CONTENTS

UNIT-I

Advantages of digital transmission over analog transmission, Review of Fourier transforms, Energy Spectral Density, Power Spectral Density and their Properties. Wireless channel & its characteristics. Sampling & its types, Time and frequency domain representation of sampling. Time Division multiplexing, Digital encoding techniques: PCM, quantization (uniform and non-uniform), quantization noise, DPCM, ADPCM, DM, ADM and their comparison.

UNIT-II

Line coding techniques: Desirable characteristics of Line codes, NRZ and RZ forms of unipolar, polar & bipolar and bi-phase line codes and their waveforms, PSDs and comparison. Inter Symbol Interference, pulse shaping (Raised cosine spectrum, duo-binary signalling), Eye Patterns. Baseband reception and probability of error, optimum filter, matched filter, correlation receivers.

UNIT-III

Band-pass modulation and demodulation techniques: BPSK, DPSK, QPSK, MPSK, BFSK, MFSK, MSK (their generation, detection, waveforms, PSDs, signal constellation diagrams,

Performance of these systems in the presence of noise). Introduction to broadband modulation, Spread Spectrum and Orthogonal Frequency Division Multiplexing.

UNIT-IV

Information theory: Concept of amount of information, entropy of a communication system, source encoding such as Shannon-Fano, Huffman Codes. Information rate, channel capacity (its calculation for Binary Symmetric channel, Binary Erasure Channel, noiseless channels and Gaussian channel), Shannon's theorem, bandwidth and S/N trade off.

UNIT-V

Channel encoding techniques: Linear Block codes (Systematic Linear Block codes, Parity check matrix, Syndrome testing), cyclic codes, Hamming codes, BCH codes, convolution codes, their encoding and decoding operation.

Course Outcomes:

CO. No.	CO
CO1	To understand, analyze and compare different digital encoding techniques with their comparative advantages and disadvantages with design of pulse code modulation system.
CO2	To understand, analyze and compare different line coding & pulse shaping techniques with their comparative advantages and disadvantages
CO3	To understand, analyze and compare different digital modulation techniques with their comparative advantages and disadvantages
CO4	To understand, analyze and compare different source coding techniques with their comparative advantages and disadvantages. To learn the basic concepts of information theory.
CO5	To understand, analyze and compare different channel encoding techniques with their comparative advantages and disadvantages. To design linear block codes for single bit error correction.

BOOKS RECOMMENDED:

- [1]. Lathi B. P., Modern Analog and Digital Communication Systems, 4th ed., Oxford Univ. Press, 2011.
- [2]. Haykin Simon Communication System, 4th ed., Wiley Publication, 2001.
- [3]. Schaum's Outline Series, Analog and Digital Communication, 2nd ed., TMH, 2006.
- [4]. Taub & Schilling, Principles of Communication System, 4th ed., TMH, 2013.
- [5]. Dr. Bernard Sklar, Digital Communication, 4th ed. Pearson education, 2001.
- [6]. Proakis & Salehi, Digital Communication, 2nd ed., McGraw Hill, 2004.

CO-PO-PSO Relationship

[illegible]

5RTPC2.CO4	3	3	1		2							3	1	1
5RTPC2.CO5	3	3	1		2							3	2	1

LIST OF EXPERIMENTS / Simulation Programs

1. To generate sampled signal of a band limited sinusoidal signal & its reconstruction with the effect of different sampling frequencies, duty cycles of the sampling pulse train and different orders of reconstruction low pass filter.
2. To observe the two channel time division multiplexing in analog domain & digital domain and its analysis.
3. To generate & detect TDM-PCM signal with study of transmitter and receiver.
4. To study different modes of data transmission to regenerate the data at receiver or repeater and learning the significance of clock and sync signal.
5. Observation & verification of various line coding formats such as Non return to zero, Return to zero, Multilevel Binary format, Phase encoded format and their reconditioning.
6. To verify the DM output for various amplitudes and frequencies of input signal and for various clock frequencies.
7. Fourier synthesis of various waveforms such as: square wave, triangular wave, AM with suppressed carrier and AM with carrier wave using MATLAB.
8. Performance evaluation of digital communication system in presence of various digital modulation techniques (MPSK and MFSK) for $M = 2, 4, 8, 16$ and their comparison study using MATLAB.
9. For pulse code modulation with uniform quantizer, plot the variations of SNR with respect to number of quantization levels and number of encoding bits using MATLAB
10. For pulse code modulation with non-uniform quantizer, plot the variations of SNR with respect to number of quantization levels and number of encoding bits using MATLAB.