III B.Tech II Semester

15AEC31 - DIGITAL COMMUNICATION SYSTEMS

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Course Objectives:

1. *The students to be able to understand, analyze, and design fundamental digital communication systems.*
2. *To know various coding techniques such as source coding, line coding, and channel coding.*
3. *To understand various digital modulation techniques and their applications.*
4. *The course focuses on developing a thorough understanding of digital communication systems by using a series of specific examples and problems.*

UNIT – I

Source Coding Systems: Introduction, sampling process, quantization, quantization noise,conditions for optimality of quantizers, encoding, Pulse-Code Modulation (PCM), Line codes, Differential encoding, Regeneration, Decoding & Filtering, Noise considerations in PCM systems, Time-Division Multiplexing (TDM), Synchronization, Delta modulation (DM), Differential PCM (DPCM), Processing gain, Adaptive DPCM (ADPCM), Comparison of the above systems.

UNIT – II

Baseband Pulse Transmission: Introduction, Matched filter receiver, Properties of Matched filter,Matched filter for rectangular pulse, Error rate due to noise, Inter-symbol Interference (ISI) and its mitigation, Nyquist criterion for distortion less baseband binary transmission, ideal Nyquist channel, Raised cosine filter & its spectrum, Correlative coding – Duo binary & Modified duo binary signaling schemes, Partial response signaling, Baseband M-array PAM transmission, Eye diagrams.

UNIT – III

Signal Space Analysis: Introduction, Geometric representation of signals, Gram-Schmidtorthogonalization procedure, Conversion of the Continuous AWGN channel into a vector channel, Coherent detection of signals in noise, Correlation receiver, Equivalence of correlation and Matched filter receivers, Probability of error, Signal constellation diagram.

UNIT – IV

Digital Modulation Techniques: Types of digital modulation, wave forms for amplitude, frequency and phase shift keying. Method of generation and detection of coherent & non-coherent binary ASK, FSK & PSK, differential phase shift keying, Quadrature modulation techniques (QAM, QPSK and MSK), Signal to Noise Ratio (SNR) and Bit Error Rate (BER) for digital modulation.M-array PSK, M-array quadrature amplitude modulation (M-array QAM), Comparison of power bandwidth requirements for all the above schemes.

UNIT – V

Channel Coding: Error Detection & Correction - Repetition & Parity Check Codes,Interleaving, Code Vectors and Hamming Distance, Timing and Frequency Synchronization, Forward Error Correction (FEC) Systems, Automatic Retransmission Query (ARQ) Systems, Linear Block Codes – Matrix Representation of Block Codes, Convolutional Codes – Convolution Encoding, Decoding Methods and Maximum Likelihood(ML) decoding and Maximum a Posteriori(MAP) decoding., Basics of MultipleAccessTechniques (TDMA,FDMA and CDMA)

***Course Outcomes**: At the end of the course, the students should be able to:*

a. *Able to understand basic sapling and quantization techniques and source coding systems.*
b. *Know the difference between source coding, channel coding, and line coding techniques and apply their concepts in the analysis and design of digital communication systems.*
c. *Able to explain generation and detection of various digital modulation techniques.*
d. *Understand the basic principles of baseband and pass band digital modulation schemes.*
e. *Analyze probability of error performance of digital systems and are able to design digital communication systems.*
f. *Understand the basics of information theory and error correcting codes.*

TEXT BOOKS:

1. Simon Haykin, "Analog Communication Systems," 4th Edition, Wiley India Edition, 2011
2. Bernard Sklar, "Digital Communications", 2nd edition, Prentice-Hall PTR, 2001.

REFERENCES:

1. J. G. Proakis, M Salehi, Gerhard Bauch, "Modern Communication Systems Using MATLAB," 3rd Edition, CENGAGE, 2013.
2. A. Bruce Carlson, & Paul B. Crilly, "Communication Systems – An Introduction to Signals & Noise in Electrical Communication", 5th Edition, McGraw-Hill International Edition, 2010.