RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electronics & Communication Engineering, VII-Semester

Departmental Elective EC- 702 (B) INFORMATION THEORY AND CODING

Course Objective: The course aims to introduce information theory, fundamentals of error control coding techniques and their applications, importance of various communication channels, utilization of codes for error detection and correction as well as for practical applications.

Prerequisite: Digital communication and its applications, Probability theory

Course Description: This course will first introduce the basic concepts of information theory, leading to the different coding theorems and then various channel capacity theorem. Afterwards, the course will consider error control coding techniques and various codes for applications.

Course Outcomes: Upon completing this course, the student will be able to:

1. Acquire the knowledge in measurement of information and errors.
2. Know the application of coding theorem for efficient utilization of communication resources.
3. Understand the utilization of various communication channels for communication system.
4. Design the block and cyclic codes for error correction and detection in communication systems
5. Know the significance of source and channel codes in various applications.

SYLLABUS

UNIT1 Information Theory: Introduction to uncertainty, entropy and its properties, entropy of binary memoryless source and its extension to discrete memory-less source, Measure of information, Information content ofmessage, Average Information content of symbols. Self information, Mutualinformation and its properties,

UNIT 2 Coding theorem:Source coding theorem, prefix coding, Shannon's Encoding Algorithm, Shannon Fano Encoding Algorithm,Huffman coding, Extended Huffman coding,Arithmetic Coding, Lempel-Ziv Coding, Run Length Encoding.

UNIT 3 Information Channels: Communication Channels, Channel Models, Channel Matrix, Joint probability Matrix, Discrete memory less channels, Binary symmetric channeland its channel capacity, channel coding theorem, and its application to Binary Erasure Channel, Shannon's theorem on channel capacity, capacity of channel of infinite bandwidth, Continuous Channels.

UNIT 4 Error Control Coding:Introduction, Examples of Error control coding, methods of Controlling Errors, Typesof Errors, types of Codes, Linear Block Codes: matrix description of Linear BlockCodes, Error Detection and Error Correction Capabilities of Linear Block Codes, Probability of undetected error for linear block code in BSC, hamming Codes and their applications,

Cyclic Codes:Cyclic codes and its basic properties, Encoding using an (n-k) BitShift register, Generator & parity check matrix of cyclic codes, encoding & decoding circuits, syndrome computation, error detection and correction,

UNIT 5 Introduction to BCH codes, its encoding & decoding, error location & correction. Convolution Codes:Introduction to convolution codes, its construction, Convolution Encoder, Time domain approach, Transform domainapproach, Code Tree, Trellis and State Diagram, Viterbi algorithm: Introduction of theorem for maximum likelihood decoding.

Reference Books:

1. Digital Communication -by Haykins Simon Wiley Publ.
2. Error control Coding: Theory and Application, - by Shu Lin and Cosstlello, PHI
3. Digital Communication - by Sklar, Pearson Education
4. Error Correcting Codes - by Peterson W., MIT Press
5. Digital Communication - by Proakis,TMH
6. Information Theory, Coding and Cryptography – By Ranjan Bose, TMH
7. Communication Systems – By Singh and Sapre, TMH