III Year–II Semester

L	T	P	C
3	0	0	3

20EC6318: INFORMATION THEORY AND CODING

Course Objectives:

- To introduce the concept of Information.
- To understand the concept of various theorems proposed by Shannon for efficient data compression and reliable transmission.
- To give idea on Linear Block codes for reliable data transmission.
- To study Cyclic codes and BCH codes.
- To familiarize with Convolution codes.

Unit-1: Introduction to Information Theory

Introduction to Information Theory: Discrete Messages, Concept of Amount of Information and its Properties, Average Information, Mutual Information and its Properties, Entropy and its Properties, Marginal, Conditional and Joint Entropies, Relation among Entropies, Information Rate.

Unit-2: Source Coding and Channel Capacity

Source Coding: Differential Entropy, Gaussian channels, Noiseless coding theorem, Shannon-Hartley theorem, Shanon-Fano Coding, Huffman Coding, Efficiency Calculations, and redundancy.

Channel Capacity: Binary symmetric channel (BSC), Binary erasure channel (BEC) – capacity of band limited Gaussian channels, Bandwidth –S/N Trade off, Shannon's limit.

Unit-3: Linear Block Codes

Linear Block Codes: Introduction, Codes for Error Detection and Correction – Linear Block Codes, Matrix Description of Linear Block Codes, Syndrome and error detection, Minimum Distance of A Block Code, Error Detection and Error Correction Capabilities of Linear Block Codes, Probability of an Undetected Error for Linear Codes over a BSC, Parity Check Coding, Generator and Parity Check Matrices, Standard Array and Syndrome Decoding, Hamming Codes.

Unit-4: Cyclic and BCH Codes

Cyclic Codes: polynomial and matrix descriptions, generation of cyclic codes, Generator and Parity-check Matrices, Encoding, Syndrome Computation and Error Detection, decoding of cyclic codes.

BCH Codes: Minimum distance and BCH bounds, Construction and decoding of BCH codes, Reed Solomon codes, Syndrome Calculation.

Unit-5: Convolution Codes

Convolution Codes: Introduction, Encoding of Convolution Codes, Structural and Distance Properties, Time Domain Approach, Transform Domain Approach. Graphical Approach: State, Tree and Trellis Diagram, Transfer function and minimum free distance, Maximum likelihood decoding of convolutional codes, The Viterbi Algorithm, Sequential decoding.

Course Outcomes:

A student who successfully fulfils this course requirement will be able to:

S. No	Course Outcome	BTL
1.	Learn measurement of Information.	L2
2.	Analyze various Source coding techniques.	L3
3.	Obtain knowledge in designing Block codes.	L2
4.	Compute Cyclic codes and BCH codes.	L3
5.	Compute Convolution codes.	L3

Correlation of Cos with POs & PSOs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	1	-	-	-	-	-	-	-	-	-	3	-
CO 2	3	2	2	-	-	-	-	-	-	-	-	-	3	-
CO 3	3	2	2	-	-	-	-	-	-	-	-	-	3	-
CO 4	2	2	3	-	-	-	-	-	-	-	-	-	2	-
CO 5	2	2	3	-	-	-	-	-	-	-	-	-	2	-

Text Books:

1. Principles of Communication Systems – H. Taub and D. Schilling, TMH, 2003.
2. J S Chitode, Information Theory and Coding, Technical Publications, Pune, 2009.
3. P S Sathya Narayana, Concepts of Information Theory & Coding, Dynaram Publications, 2005.
4. Error Correcting Coding Theory-Man Young Rhee, McGraw – Hill Publishing 1989.

Reference Books:

1. Simon Haykin: Digital Communication Systems, Wiley India, 2013.
2. Error Control Coding- Fundamentals and Applications –Shu Lin, Daniel J.Costello,Jr, Prentice Hall, Inc 2014.
3. Kelbert & Suhov, Information theory and coding by examples, Cambridge University Press, 2013.
4. Digital Communications- Fundamentals and Application, Bernard Sklar, PE.
5. Information Theory, Coding and Cryptography – Ranjan Bose, 2nd Edition, 2009, TMH.