L = Lecture, T = Tutorial, P = Practical, C = Credit

NIRMA UNIVERSITY
SCHOOL OF TECHNOLOGY, INSTITUTE OF TECHNOLOGY
B.Tech. Electronics & Communication Engineering
Semester - VI
Department Elective III

L	T	P	C
3	-	2	4

Course Code	**2ECDE58**
Course Title	**Information and Coding Theory**

Course Outcomes (COs):
At the end of the course, the students will be able to
1. Comprehend probability and statistics in Information Theory.
2. Evaluate the performance of source coding algorithms such as Huffman, Arithmetic and dictionary techniques.
3. Analyse BER performance with block codes and convolutional codes in AWGN.
4. Evaluate the performance of the communication system with Iterative decoding in AWGN for Turbo codes and LDPC codes.

Syllabus: **Teaching Hours:45**

UNIT 1: Information Theory **10**
Entropy, relative entropy and mutual information, channel capacity, Gaussian channel, Binary Symmetric Channel (BSC), Network information theory.

UNIT II: Source coding **05**
Lossless data compression, entropy coding, Huffman coding, Arithmetic coding, Shannon fano codes, Dictionary techniques, LZ77 and LZW techniques.

UNIT III: Channel Coding **10**
Channel capacity, Block codes, linear block codes, Hamming weight, Hamming bound, Maximum Likelihood (ML) detection, syndrome decoding, BCH and RS codes, Reed-Muller codes, soft-decision decoding algorithm and Network coding, Tradeoff between power and bandwidth.

UNIT IV: Convolutional Codes **10**
Viterbi decoding, state diagrams, Trellis diagram, catastrophic encoders, soft-decision decoding, Product codes, Trellis coded modulation.

UNIT V: Iterative Decoding **10**
Turbo codes, constituent encoder, Interleaver, Soft information, Low-Density Parity Check (LDPC) codes, MAP algorithms.

Self-Study:
The self-study content will be declared at the commencement of the semester. Around 10% of the questions will be asked from self-study content.

Laboratory Work:
Laboratory work will be based on the above syllabus with minimum of 10 experiments to be incorporated.

Suggested Readings:

1. T. M. Cover and J. A. Thomas, Elements of Information Theory, John Wiley.
2. S. Lin, D. J. Costello, Error Control Coding, Pearson Education.
3. T. K. Moon, Error Correction Coding: Mathematical Methods and Algorithms, John Wiley.
4. Khalid Sayood, Introduction to Data Compression, Morgan Kaufmann.

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