NIRMA UNIVERSITY
Institute of Technology
B Tech, Computer Science and Engineering
Semester-VI
Department Elective-II

L	T	P	C
3	0	2	4

Course Code	2CSDE64
Course Title	Information Theory and Coding

Course Outcomes:

At the end of the course, students will be able to -

1. interpret and summarize the role of information theory and linear algebra in source coding and channel coding
2. make use of various error control encoding and decoding techniques
3. implement various error control techniques
4. analyze the performance of error control codes.

Syllabus:

Teaching Hours: 45

Unit – I — **10**

Information Theory: Introduction, Measure of information, Information content of message, Average Information content of symbols in Long Independent sequences, Average Information content of symbols in Long dependent sequences, Markov Statistical Model of Information Sources, Entropy and Information rate of Mark off Sources

Unit - II — **10**

Source Coding: Source coding theorem, Kraft McMillan Inequality property – Encoding of the Source Output, Shannon FanoCodes, Huffman codes, Arithmetic Coding, Lempel – Ziv Algorithm

Unit - III — **09**

Information Channels: Communication Channels, Channel Models, Channel Matrix, Joint probability Matrix, Binary Symmetric Channel, System Entropies, Mutual Information, Channel Capacity, Channel Capacity of :Binary Symmetric Channel, Binary Erasure Channel, Muroga's Theorem

Unit - IV — **08**

Error Control Coding: Introduction, Examples of Error control coding, methods of Controlling Errors, Types of Errors, types of Codes, Linear Block Codes: matrix description of Linear Block Codes, Error Detection and Error Correction Capabilities of Linear Block Codes, Single Error Correcting hamming Codes, Table lookup Decoding using Standard Array.Binary Cyclic Codes: Algebraic Structure of Cyclic Codes, Encoding using an (n-k) Bit Shift register, Syndrome Calculation, Error Detection and Correction

Unit - V **08**

Some Important Cyclic Codes: Golay Codes, BCH Codes, Convolution Codes: Convolution Encoder, Time domain approach, Transform domain approach, Code Tree, Trellis and State Diagram, The Viterbi Algorithm)

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Laboratory Work:

Laboratory work will be based on above syllabus with minimum 10 experiments to be incorporated.

Suggested Readings^:

1. T. M. Cover, J. A. Thomas, "Elements of information theory", Wiley
2. Reza, "An Introduction to Information Theory", Dover
3. R. W. Hamming, "Coding and information theory," Prentice Hall Inc
4. Gravano Salvatore, "Error Correcting Codes" , Oxford University Press
5. Ranjan Bose, "Information Theory and Coding", TMH
6. R. Hill, "A First Course in Coding Theory", Oxford University Press

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

^this is not an exhaustive list