



# GUJARAT TECHNOLOGICAL UNIVERSITY

**Master of Engineering**

**Subject Code: 3722323**

**Semester – II**

**Subject Name: Information Theory and Coding**

**Type of course: Elective**

**Prerequisite:** Probability Theory, Computer Networks

**Rationale:** The objective of this course is to provide an insight to information coding techniques, error correction mechanism. Various compression techniques for text, video and image are covered for thorough knowledge of efficient information conveying systems.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

**Content:**

Sr. No.	Content	Total Hrs	% Weightage
1	Information and entropy information measures, Shannon's concept of Information. Channel coding, channel mutual information capacity (BW)	8	17%
2	Theorem for discrete memory less channel, information capacity theorem, Error detecting and error correcting codes	9	19%
3	Types of codes: block codes, Hamming and Lee metrics, description of linear block codes, parity check Codes, cyclic code, Masking techniques	8	17%
4	Compression: loss less and lossy, Huffman codes, LZW algorithm, Binary Image compression schemes, run length encoding, CCITT group 3 1-D Compression, CCITT group 3 2D compression, CCITT group 4 2-D Compression.	10	20%
5	Convolutional codes, sequential decoding. Video image Compression: CITT H261 Video coding algorithm, audio (speech) Compression. Cryptography and cipher.	9	19%
6	Case study of CCITT group 3 1-DCompression, CCITT group 3 2D compression.	4	8%
	<b>Total</b>	<b>48</b>	<b>100%</b>



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## Reference Books:

1. Fundamentals in information theory and coding, Monica Borda, Springer.
2. Communication Systems: Analog and digital, Singh and Sapre, TataMcGraw Hill.
3. Multimedia Communications Fred Halsall.
4. Information Theory, Coding and Cryptography R Bose.
5. Multimedia system Design Prabhat K Andleigh and Kiran Thakrar.

## Course Outcomes:

At the end of the module the student will be able to:

Sr. No.	CO statement	Marks % Weightage
CO-1	Introduce the principles and applications of information theory.	15%
CO-2	Study how information is measured in terms of probability and entropy.	20%
CO-3	Learn coding schemes, including error correcting codes, The Fourier perspective; and extensions to wavelets, complexity, compression, and efficient coding of audio-visual information.	40%
CO-4	Apply linear block codes for error detection and correction.	10%
CO-5	Apply convolution codes for performance analysis & cyclic codes for error detection and correction.	15%

## List of Experiments:

1. To perform entropy on the input given as a paragraph.
2. To perform joint entropy and mutual entropy of the given information.
3. To implement error detection technique.
4. To implement error correcting code technique which uses Shannon's Theorem.
5. To implement Lossless compression method
6. To implement Lossy compression method
7. To perform Huffman code on the given input code.
8. To implement LZW algorithm.
9. Case Study on video image and audio compression.

## Major Equipment: ---

**List of Open Source Software/learning website:** C, C++, Python

<https://nptel.ac.in/courses/117108097/Learning%20Material%20-%20ITC.pdf>