

NIRMA UNIVERSITY

Institute:	Institute of Technology, School of Technology
Name of Programme:	B.Tech. in Electronics & Communication Engineering
Course Code:	4EC401ME25
Course Title:	Data Compression Standards
Course Type:	Department Elective
Year of Introduction:	2025-26

L	T	Practical Component				C
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Course Learning Outcomes (CLOs):

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

- 1 comprehend the mathematical preliminaries involved in compression techniques (BL2)
- 2 appreciate the contribution of lossless and lossy compression standards for image, audio and video (BL3)
- 3 apply lossy compression algorithm as per the given specifications (BL3)
- 4 analyse lossless compression algorithm to compress image, text and audio. (BL4)

Unit	Contents	Teaching hours (Total 45)
Unit I	Mathematical preliminaries of data compression: Basics of information theory, rate distortion theory. models (probability, Markov, physical), vector spaces & transforms (including wavelet)	05
Unit II	Huffman coding: Algorithm, minimum variance Huffman code, extended Huffman code, adaptive Huffman code, rice code, golomb code, application of Huffman code in text, image and audio compression	10
Unit III	Arithmetic coding: Coding algorithm, comparison with Huffman code, adaptive arithmetic code	05
Unit IV	Dictionary technique: Static and adaptive dictionary coding, LZ77 and LZ78 approach, application in image compression	05
Unit V	Lossless compression: JPEG standard, run length coding, application	05
Unit VI	Lossy compression: Mathematical concepts, distortion, human auditory-visual system, scalar quantization- uniform quantization, adaptive quantization, non-uniform quantization	10
Unit VII	Case study: MPEG audio standards, linear predictive coder, MPEG video standards	05

Self Study:

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

Laboratory Work:

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

Suggested Readings/ Reference:

- 1 Sayood, K, *Data Compression*, Morgan Kauffman
- 2 Saloman, *Handbook of Data Compression*, Springer
- 3 Drew & Li, *Fundamentals of Multimedia*, Prentice Hall India

Suggested List of Experiments

Sr. No.	Name of Experiments/Exercises	Hours
1.	Write a program to count the occurrences of different letters by reading the given text file and also find the probability of each letter with number of bits required for them	02
2.	Write a program to implement Shannon-Fano Compression Algorithm	02
3.	Write a program to compress and decompress the given input string	02
4.	Write a program to implement Arithmetic Coding Compression and Decompression Algorithm	02
5.	Write a program to implement a Huffman Coding and calculate entropy	02
6.	Write a program to implement LZ77 and LZ78 algorithm.	02
7.	Write a program to implement LZSS algorithm	02
8.	Write a program to implement Speech Compression and calculate distortion	02
9.	Write a program to implement JPEG Compression and calculate distortion	02
10.	Write a program to simulate uniform and non-uniform quantization	02
11.	Write a program to simulate DPCM encoding and decoding	02
12.	Write a program to simulate 1D Discrete Cosine Transform (DCT)	02
13.	Write a program to simulate 2D Discrete Cosine Transform (DCT)	02
14.	Write a program to simulate run-length coding as used in T4 standard of facsimile.	02
15.	Write a program to read the Binary Bitmap File (.BMP) (monochrome image) and compress the using Run Length Coding and save to a file .also write a program to decompress the compressed file and recover the Binary Image File.	02