GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3171615
Semester – VII
Subject Name: Data Compression

Type of course: Elective

Prerequisite: None

Rationale: Information is generated and used in digital form in the form of numbers represented by bytes of data. Number of bytes required to represent multimedia data can be huge. Given the explosive growth of data that needs to be transmitted and stored, compression techniques need to be used .

Teaching and Examination Scheme:

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

Content:

Sr. No.	Content	Total Hrs
1	Introduction: Compression Techniques, Modeling and Coding Mathematical Preliminaries for Lossless Compression: Models – Physical Models, Probability Models, Markov Models Coding – Uniquely Decodable Codes, Prefix codes	3
2	Huffman coding: The Huffman Coding Algorithm – Minimum variance Huffman codes Adaptive Huffman coding – Update Procedure,Encoding Procedure,Decoding Procedure Golomb Codes Rice codes Tunstall Codes Applications of Huffman Coding – Lossless Image compression, Text compression, Audio Compression Arithmetic coding: Coding a sequence – Generating a Tag, Deciphering the Tag Generating Binary Code – Uniqueness and Efficiency of the Arithmetic code, Algorithm implementation, Integer Implementation Comparison of Huffman and Arithmetic coding Applications	12
3	Dictionaty Techniques: Static Dictionary – Diagram Coding Adaptive Dictionary – The LZ77 approach, The LZ78 Approach	7

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	Applications – Image compression		
4	Context based Compression : Prediction with partial match(ppm) – The Basic Algorithm, The Escape symbol, Length of context, The Exclusion Principle The Burrows-Wheeler Transform – Move-to-Front Coding		5
5	Lossless Image Compression: The Old JPEG Standard, CALIC, JPEG-LS		7
6	Mathematical Preliminaries for Lossy Coding: Distortion criteria – The Human Visual System, Auditory Perception Models – Probability Models, Linear System Models, Physical Models Scalar Quantization: The Quantization Problem Uniform Quantizer Adaptive Quantization – Forward Adaptive , Backward Adaptive Non uniform Quantization – pdf optimized Quantization, Companded Quantization Entropy Coded Quantization – Entropy coding of Lloyd – Max Quantizer Outputs Vector Quantization : Advantages of Vector Quantization over Scalar Quantization The Linde-Buzo-Gray Algorithm Tree structured Vector Quantization Structured Vector Quantization		8

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**40**	**10**	**10**		

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1) **Introduction to Data Compression –By Khalid Sayood, publication Elsevier**

2) The Data Compression book, By Mark Nelson,Jean Loup Gaily

3) Data Compression : The Complete Reference", By David Saloman, publication Springer

4) Data Compression Methods and Theory - by James A. Storer

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Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Understand the Mathematical Preliminaries involved in compression techniques.	15
CO-2	Use Loseless compression algorithm to compress Image, Text and Audio.	35
CO-3	Use Lossy compression algorithm considering the Criteria.	35
CO-4	Differentiate Loseless and Lossy algorithms and test appropriate algorithm for compression of given digital information.	15

List of Experiments:

1) Given the code as sequence of characters and given the probability of characters, write a program to calculate average length of each code.

2) Write a program to generate Huffman code.

3) Write a program to generate binary code for the sequence abacabb, Given the frequency count of a – 37, b-38, c-25.

4) Write a program to implement digram coding for given text file.

5) Write a program to Implement LZ77 algorithm.

6) Write a program to Implement LZ78 algorithm.

7) 8. Write a program to Implement LZW algorithm.

8) Given the sequence of characters, write a program to find unique characters, and write a program to implement ppma algorithm.