



C. U. SHAH UNIVERSITY
Wadhwan City

FACULTY OF: - Technology and Engineering
DEPARTMENT OF: - Information Technology
SEMESTER: - VII
CODE: - 4TE07DCO1
NAME: – Data Compression

Teaching & Evaluation Scheme: -

Subject Code	Subject Name	Teaching Scheme (Hours)				Credits	Evaluation Scheme								
		Th	Tu	Pr	Total		Theory				Practical (Marks)				Total
							Sessional Exam		University Exam		Internal		University		
							Marks	Hours	Marks	Hours	Pr/Viva	TW	Pr		
4TE07DCO1	Data Compression	3	0	2	5	4	30	1.5	70	3.0	-	20	30	150	

Objectives:

The learning objectives of this course are to:

- Introduce the students to the fundamentals of data compression.
- Enhance student’s ability to understand and conduct mathematical proofs for data compression and related data compression algorithms.

Prerequisites:

- Basics of computer architecture, algorithm and mathematics.

Course outline:

Sr. No.	Course Contents	Total Hrs.
1	Compression Techniques: Lossless Compression, Lossy Compression, Measures of Performance.	3
2	Mathematical Preliminaries for Lossless Compression Models: Physical Models, Probability Models, Markov Models, Composite Source Model, Coding, Uniquely Decodable Codes, Prefix Codes, Algorithmic Information Theory, Minimum Description Length Principle.	6
3	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.	6

	Applications of Huffman Coding: Lossless Image Compression, Text Compression, Audio Compression.	
4	Arithmetic Coding: Introduction ,Coding a Sequence ,Generating a Tag , Deciphering the Tag ,Generating a Binary Code ,Uniqueness and Efficiency of the Arithmetic Code, Algorithm Implementation ,Integer Implementation , Comparison of Huffman and Arithmetic Coding ,Adaptive Arithmetic Coding	5
5	Dictionary Techniques: Static Dictionary, Diagram Coding ,Adaptive Dictionary, The LZ77 Approach ,The LZ78 Approach .Applications :File Compression—UNIX compress Image Compression, The Graphics Interchange Format (GIF) Image Compression, Portable Network Graphics (PNG) , Compression over Modems—V.42 bis	6
6	Predictive Coding: 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 ,Lossless Image Compression ,CALIC, JPEG-LS, Multi-resolution Approaches ,Facsimile Encoding ,Dynamic Markov Compression.	6
7	Mathematical Preliminaries for Lossy Coding: Distortion criteria, Models, The Quantization Problem ,Uniform Quantizer ,Adaptive Quantization , Forward Adaptive Quantization ,Backward Adaptive Quantization, Nonuniform Quantization pdf-Optimized Quantization ,Commanded Quantization	6
8	Vector Quantization: Advantages of Vector Quantization, over Scalar Quantization ,The Linde-Buzo-Gray Algorithm ,Initializing the LBG Algorithm, The Empty Cell Problem ,Use of LBG for Image Compression , Tree-Structured Vector Quantizers ,Design of Tree-Structured Vector Quantizers, Pruned Tree-Structured Vector Quantizers ,Structured Vector Quantizers, Pyramid Vector Quantization, Polar and Spherical Vector Quantizers ,Lattice Vector Quantizers	10
	Total	48

Learning Outcomes:

After completing this course, students will be able to:

- Understand and apply various coding techniques for compression.
- Differentiate between Lossy and Lossless compression.

Books Recommended:

1. The Data Compression Book, Second Edition by **Mark Nelson and Jaean Loup Gailly**, BPB publication, 2011.
2. Data Compression, Second Edition by **Khalid sayood** Elsevier.(20 books available in library and soft copy is also available)
3. Data Compression by **David Salomon**, Springer Publication, 4th Edition.