

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE- SEMESTER-VII EXAMINATION – WINTER 2025****Subject Code:3171615****Date:13-11-2025****Subject Name:Data Compression****Time:10:30 AM TO 01:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

**MARKS**

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|------------|--|-----------|
| <b>Q.1</b> | <b>(a)</b> Justify the need of data compression. List different measurements to measure compression algorithm.   | <b>03</b> |
|            | <b>(b)</b> Compare and contrast the relationship between modeling and coding in compression.   | <b>04</b> |
|            | <b>(c)</b> Consider a source with a six-symbol alphabet, $a_1, a_2, a_3, a_4, a_5, a_6$ , with probabilities $p_1 = 0.35, p_2 = 0.20, p_3 = 0.15, p_4 = 0.15, p_5 = 0.10, p_6 = 0.05$ .<br>a) Find the entropy of this source.<br>b) Find a Huffman code for this source.<br>c) Compute the expected code length of this Huffman code. | <b>07</b> |
| <b>Q.2</b> | <b>(a)</b> Design a Golomb code for $m = 7$ for numbers 0 to 9.  | <b>03</b> |
|            | <b>(b)</b> Determine whether the following codes are uniquely decodable:<br>(a) {0, 01, 11, 111}<br>(b) {0, 01, 110, 111}<br>(c) {0, 10, 110, 111}<br>(d) {1, 10, 110, 111}  | <b>04</b> |
|            | <b>(c)</b> Describe the encoding procedure in adaptive Huffman coding. Provide an example where a string of symbols is encoded dynamically as new symbols are introduced.  | <b>07</b> |
| <b>OR</b>  |  |           |
|            | <b>(c)</b> Explain in detail the application of Huffman coding in audio, text and lossless image compression.  | <b>07</b> |
| <b>Q.3</b> | <b>(a)</b> Explain Rice coding technique with example  | <b>03</b> |
|            | <b>(b)</b> Explain prediction with partial match (PPM)   | <b>04</b> |
|            | <b>(c)</b> Consider a source with a symbol alphabet {A, B, C, D} with probabilities $p(A) = 0.4, p(B) = 0.3, p(C) = 0.2, p(D) = 0.1$ . Decode the tag = 0.128192 for first 6 characters in sequence using arithmetic coding technique.   | <b>07</b> |
| <b>OR</b>  |  |           |
| <b>Q.3</b> | <b>(a)</b> Explain Tunstall coding technique with example.   | <b>03</b> |
|            | <b>(b)</b> Explain the Burrows-Wheeler Transform (BWT)   | <b>04</b> |
|            | <b>(c)</b> Consider a source with a symbol alphabet {A, B, C, D} with probabilities $p(A) = 0.4, p(B) = 0.3, p(C) = 0.2, p(D) = 0.1$ . Generate the tag value for string ABCABD using arithmetic coding procedure.   | <b>07</b> |
| <b>Q.4</b> | <b>(a)</b> Explain sampling and quantization in brief.   | <b>03</b> |
|            | <b>(b)</b> Differentiate static dictionary and dynamic dictionary in compression.  | <b>04</b> |
|            | <b>(c)</b> Explain the procedure of encoding and decoding using LZ78 approach with an example.   | <b>07</b> |

**OR**

- Q.4** (a) Explain the advantages of vector quantization over scalar quantization. **03**  
(b) Explain move-to-front coding with example. **04**  
(c) Explain the procedure of encoding and decoding using LZ77 approach with an example. **07**

- Q.5** (a) Explain adaptive quantization in brief. **03**  
(b) Explain entropy coded quantization in brief. **04**  
(c) Explain old JPEG standard in detail. **07**

**OR**

- Q.5** (a) Explain non-uniform quantization in brief. **03**  
(b) Explain the Linde-Buzo-Gray algorithm in brief (LBZ). **04**  
(c) Explain CALIC technique in detail. **07**

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