

B.E. Information Technology
Third Year Second Semester Exam 2025

Multimedia Coding & Communications

Time: 3 hours

Full Marks: 100

Different parts under the same CO should be answered together.

CO1 [22]	Answer any FIVE [5.5 x 4 = 22]
	1. Describe 8-bit Gray Level Images. 2. What is multimedia authoring? Mention different multimedia authoring metaphors and explain each of them in brief. 3. Briefly illustrate about MIDI message. 4. Explain different phases of multimedia presentation. 5. What is Dithering and what is the relation of it with half-tone printing? 6. Explain GIF 87 file format in detail with suitable diagrams.
CO2 [36]	Answer Question 7 and any FOUR from the rest. [4 + (8 x 4) = 36]
	7. Illustrate with an example, how arithmetic coding overcomes Huffman's problem. 8. Execute LZW compression and decompression algorithm on the string "MISSISSIPPI" where the value of the string table is [M-1, S-2, I-3, P-4]. 9. A 4-symbol alphabet has the following probabilities $P(a_1) = 0.1$, $P(a_2) = 0.5$, $P(a_3) = 0.25$, $P(a_4) = 0.15$ and following codes are assigned to the symbols $a_1 = 110$, $a_2 = 0$, $a_3 = 10$, $a_4 = 111$. What is the average code word length, Entropy, and Efficiency for this source? 10. Construct a Shannon-fano tree and Hauffman tree for the word "APPLE". The code in real decimal numbers for the word "APPLE" formed out of a 4-symbol alphabet – "A", "P", "L" and "E" having probabilities 0.2, 0.4, 0.2, and 0.2 respectively. Compare the codeword length, its entropy, and coding efficiency expressed for the same word by both schemes.

[Turn over

11. Below is a greyscale image X where grey levels are ordered from 0 to 6. X is represented using the following matrix:

0 0 0 0 0 0 0 0
 0 0 1 1 2 3 3 3
 0 1 1 3 3 3 4 4
 0 1 3 3 5 5 4 4
 0 2 3 3 5 5 5 4
 0 0 2 3 3 4 6 6
 0 0 0 2 2 3 4 4
 X = $\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$

Show the step by step execution of the Huffman coding to compress the image. Also, calculate the compression achieved using the Huffman coding.

12. Execute encoding and decoding of the arithmetic coding on the symbol "CAEE\$" using the following probability distribution:

Symbol	Probability	Range
A	0.2	[0, 0.2)
B	0.1	[0.2, 0.3)
C	0.2	[0.3, 0.5)
D	0.05	[0.5, 0.55)
E	0.3	[0.55, 0.85)
F	0.05	[0.85, 0.9)
\$	0.1	[0.9, 1.0)

CO3
[20]

Answer any TWO

[10 x 2 = 20]

13.

- What is quantization? What are the different forms of quantization in lossy compression?
- Explain Rate-Distortion Theory and mention why it plays an important role in lossy compression techniques.

14. Explain transform coding and wavelet-based coding used in lossy compression techniques.

	15. A given 4 x 4 image array and its corresponding reconstructed image array obtained through a lossy compression scheme are given below: <table><tr><td>148</td><td>129</td><td>133</td><td>89</td><td rowspan="5"></td><td>146</td><td>130</td><td>133</td><td>85</td></tr><tr><td>153</td><td>138</td><td>103</td><td>84</td><td>155</td><td>139</td><td>105</td><td>84</td></tr><tr><td>155</td><td>141</td><td>92</td><td>78</td><td>154</td><td>142</td><td>98</td><td>80</td></tr><tr><td>162</td><td>139</td><td>86</td><td>81</td><td>162</td><td>139</td><td>84</td><td>78</td></tr><tr><td colspan="4">Original Image</td><td colspan="4">Reconstructed Image</td></tr></table> Calculate the (a) <i>MSE</i>, (b) <i>SNR</i> and (c) <i>PSNR</i> of the reconstructed image array.	148	129	133	89		146	130	133	85	153	138	103	84	155	139	105	84	155	141	92	78	154	142	98	80	162	139	86	81	162	139	84	78	Original Image				Reconstructed Image			
148	129	133	89		146		130	133	85																																	
153	138	103	84		155		139	105	84																																	
155	141	92	78		154		142	98	80																																	
162	139	86	81		162		139	84	78																																	
Original Image					Reconstructed Image																																					
CO4 [14]	16. Differentiate between the following terms (any THREE): [3 x 3 = 9] a. MP3 vs MPEG b. JPEG LS Standard vs JPEG 200 Standard c. Frequency Masking vs Temporal Masking d. Motion Compression vs Motion Estimation 17. Discuss the significance of DCT for JPEG Image compression. [5]																																									
CO5 [8]	18. Write short note on (any TWO): [4x2 = 8] e. Multimedia data quality f. Multiplexing g. Multimedia over IP h. Multimedia over ATM networks																																									