K. J. Somaiya Institute of Technology, Sion, Mumbai-22
(Autonomous College Affiliated to University of Mumbai)

Carry on

~~Nov-Dec 2024~~ June 2025

B. Tech Program: Artificial Intelligence and Data Science Scheme IIB
Regular Examination: TY Semester: V
Course Code: **AIC504** and Course Name: **Information Theory and Coding**
Date of Exam: 25/11/2024   Duration: 02.30 Hours   Max. Marks: 60
30/06/2025

Instructions:
(1) All questions are compulsory.
(2) Draw neat diagrams wherever applicable.
(3) Assume suitable data, if necessary.

Q. No.	Question	Max. Marks	CO	BT level
Q 1	Solve any **two** questions out of three: (05 marks each)	10		
a)	A DMS with alphabet $X=\{S_0, S_1, S_2\}$ with respective probabilities $P_0=1/4$, $P_1=1/4$, $P_2=1/2$. The extended source is of the order 2 and prove that it follows the extension property.		CO1	U
b)	Compare Huffman code and Arithmetic Code		CO2	U
c)	Given an initial dictionary consisting of the letters a, b, r, y, #. Encode the following message using the LZW algorithm. 'a#bar#array#by#barrayar#bay' and generate tokens.		CO3	Ap
Q 2	Solve any **two** questions out of three: (05 marks each)	10		
a)	Explain process of JPEG data compression		CO4	U
b)	Explain A Law and Mu Law companding		CO5	U
c)	Explain Code tree and Trellis diagram in details		CO6	U
Q.3	Solve any **two** questions out of three. (10 marks each)	20		
a)	The joint probability matrix is given below. Find all entropies and Mutual Information. $$\begin{bmatrix} 0.3 & 0.05 & 0 \\ 0 & 0.25 & 0 \\ 0 & 0.15 & 0.05 \\ 0 & 0.05 & 0.15 \end{bmatrix}$$		CO1	Ap
b)	Consider a three letter alphbeat $A=\{a1, a2, a3\}$ with $P(a1)=0.7$,		CO2	Ap

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	$P(a2)=0.1$, $P(a3)=0.2$. Encode the sequence a1, a2, a3 using arithmetic coding process and generate tag.			
c)	For the convolution encoder with code rate 1/3 and K=3 generating vectors g1=(1 1 1), g2-(1 0 1), g3=(1 1 0) draw the encoder and find the code word for the input sequence 10101.		CO6	Ap
Q.4	Solve any **two** questions out of three. (10 marks each)	20		
a)	Explain H.261 video compression standard		CO4	U
b)	Consider a Hamming code with n=7 and k=3 consider generator matrix as given below, 10 $$G= \begin{bmatrix} 1 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 \\ 1 & 1 & 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 0 & 0 & 1 \end{bmatrix}$$ i) Find parity check matrix. ii) Find code words for message words 1101, 1010, 1100, 0101. iii) What is the minimum distance for the above codes? iv) What is the error correcting capability?		CO6	Ap
c)	A sequence is encoded using the LZW algorithm and the initial dictionary shown in the table. The output of the LZW encoder is the following sequence, 6,3,4,5,2,3,1,6,2,9,11,16,12,14,4,20,10,8,23,13, Decode this sequence.		CO3	Ap

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