

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

Subject Code: AIC504

Subject Name: Information Theory and Coding

Date: 09/12/2022

Nov – Dec 2022 Program: B.Tech AI - DS Examination: TY Semester: V Course Code: AIC504 and Course Name: Information Theory and Coding Duration: 2.5 Hours Max. Marks: 60				
Instructions: (1) All questions are compulsory. (2) Draw neat diagrams wherever applicable. (3) Assume suitable data, if necessary.				
		Max. Marks	CO	BT level
Q 1	Solve any six questions out of eight:	12		
i)	What is conditional probability?	2	CO1	U
ii)	Calculate amount of information if probability of occurrence of event is 1/4.	2	CO1	A
iii)	Compare Static Dictionary and Dynamic Dictionary	2	CO3	A
iv)	What is the principle of image compression?	2	CO4	U
v)	Calculate amount of information if two binary digits 0 and 1 occur equally likely.	2	CO1	A
vi)	Compare Huffman code and Arithmetic code.	2	CO2	U
vii)	Explain properties of human auditory system.	2	CO5	U
viii)	What are the advantages and Disadvantages of Convolutional codes.	2	CO6	U
Q.2	Solve any four questions out of six.	16		
i)	Show that the entropy is maximum when all the messages are equiprobable. Assume that M=3	4	CO1	A
ii)	Consider three alphabets $A=\{a_1, a_2, a_3\}$ with $P(a_1)=0.7$, $P(a_2)=0.1$, $P(a_3)=0.2$. Encode the sequence "a1,a2,a3" using arithmetic coding process.	4	CO2	U
iii)	Encode the following sequence using LZ78 approach 'wabba#wabba#wabba#wabba#woo#woo'	4	CO3	U
iv)	Explain with example how RLE used for image compression.	4	CO6	U
v)	What is JPEG? What are different goals and different modes of operation of JPEG?	4	CO4	U
vi)	Explain in details A law and μ law companding	4	CO5	U
Q.3	Solve any two questions out of three.	16		

i)	Consider four messages Q1 to Q4 have probabilities $\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{8}$ a) Calculate self- information of the symbol b) Find the entropy of the message. c) Find the IR if r=1 message. d) What is the rate, when the messages are coded as {00,01,10,11} e) Find the rate if the code is {0,10,110,111}	8	CO1	A												
ii)	Explain H.261 Encoder and Decoder block diagram	8	CO4	U												
iii)	Explain MPEG layers frame formats in details	8	CO5	U												
Q.4	Solve any two questions out of three.	16														
i)	Given an initial dictionary consisting of letters a,b,r,y,# Encode using LZW algorithm 'a#bar#array#by#arrayar#bay'. Also decode the encoding sequence to get back the string. <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Index</th> <th>Entry</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>a</td> </tr> <tr> <td>2</td> <td>b</td> </tr> <tr> <td>3</td> <td>r</td> </tr> <tr> <td>4</td> <td>y</td> </tr> <tr> <td>5</td> <td>#</td> </tr> </tbody> </table>	Index	Entry	1	a	2	b	3	r	4	y	5	#	8	CO3	A
Index	Entry															
1	a															
2	b															
3	r															
4	y															
5	#															
ii)	Design the encoder for the (7,4) cyclic code generated by $G(p) = p^3 + p + 1$ and verify its operation for any message vector.	8	CO6	A												
iii)	A source and its letters from an alphabet $A = \{a_1, a_2, a_3, a_4, a_5\}$ with probabilities $P = \{0.4, 0.2, 0.2, 0.1, 0.1\}$ respectively. Calculate Huffman code, average code word length, entropy, variance of code and code efficiency	8	CO2	A												
