

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

April – May 2023 (B.Tech ) Program: Scheme II Examination: TY Semester: V Course Code: AIC504 and Course Name: Information Theory and Coding		
Date of Exam: 02/06/2023	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
<b>Q 1</b>	<b>Solve any six questions out of eight:</b>	<b>12</b>		
i)	Justify “If there are M equally likely and independent messages then prove that amount of information carried by each message will be N bits where $M=2^N$ and N is an integer”	2	CO1	Ap
ii)	Compare Huffman coding and Arithmetic coding	2	CO2	U
iii)	Compare Static Dictionary and Dynamic Dictionary	2	CO3	U
iv)	Explain different types of images?	2	CO4	U
v)	What are different steps involved in JPEG Compression process?	2	CO4	U
vi)	Write a note on human-auditory system	2	CO5	U
vii)	What are the advantages and Disadvantages of Convolutional codes	2	CO6	U
viii)	Explain Frequency masking and Temporal masking in detail	2	CO5	U
<b>Q.2</b>	<b>Solve any four questions out of six.</b>	<b>16</b>		
i)	An event has 4 possible outcomes with probabilities of occurrence $p_1=p_2=0.125$ and $p_3=p_4=0.375$ respectively. Determine the entropy of the system and obtain the rate of	04	CO1	Ap

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	information if there are 8 outcomes per second.			
ii)	For an alphabet $A=\{a_1,a_2,a_3,a_4\}$ with probabilities $P=\{0.5, 0.25,0.125,0.125\}$ . Find Shannon Fano Code, Determine average codeword length, entropy, redundancy and efficiency of code.	04	CO2	Ap
iii)	Encode the sequence using LZ77 algorithm "cabracadabrarrarrad". Length of the window is 13. The size of the lookahead buffer is 6.	04	CO3	Ap
iv)	Explain different frames used in video compression.	04	CO4	U
v)	Explain ADPCM encoder in details	04	CO5	U
vi)	Consider a (7,4) Hamming code, given matrix $H = \begin{bmatrix} 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 1 & 1 & 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 1 & 0 & 0 & 1 \end{bmatrix}$ <ol style="list-style-type: none"> <li>1. Find the generator matrix G</li> <li>2. List all code vectors</li> <li>3. What is minimum distance between code vectors?</li> <li>4. How many errors can be detected? How many errors can be corrected?</li> </ol>	04	CO6	Ap
<b>Q.3</b>	<b>Solve any two questions out of three.</b>	<b>16</b>		
i)	The generator polynomial of (7,4) cyclic code is $G(p)=p^3+p+1$ . Find all code vectors for the code in systematic and nonsystematic form.	08	CO6	Ap
ii)	For a BSC it is given that $P_{y/x}(0/1)=0.1$ and $P_{y/x}(1/0)=0.2$ where x is the transmitted digit and y is received digit, if $P_x(0)=0.4$ determine $P_y(0)$ and $P_y(1)$ .	08	CO1	Ap

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iii)	A sequence is encoded using the LZW algorithm and the initial dictionary shown below, <table border="1" style="margin: 10px auto; border-collapse: collapse;"> <thead> <tr> <th style="padding: 2px;">Inde x</th> <th style="padding: 2px;">Entr y</th> </tr> </thead> <tbody> <tr> <td style="padding: 2px;">1</td> <td style="padding: 2px;">a</td> </tr> <tr> <td style="padding: 2px;">2</td> <td style="padding: 2px;">#</td> </tr> <tr> <td style="padding: 2px;">3</td> <td style="padding: 2px;">h</td> </tr> <tr> <td style="padding: 2px;">4</td> <td style="padding: 2px;">i</td> </tr> <tr> <td style="padding: 2px;">5</td> <td style="padding: 2px;">s</td> </tr> <tr> <td style="padding: 2px;">6</td> <td style="padding: 2px;">t</td> </tr> </tbody> </table> <p>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 the sequence.</p>	Inde x	Entr y	1	a	2	#	3	h	4	i	5	s	6	t	08	CO3	Ap
Inde x	Entr y																	
1	a																	
2	#																	
3	h																	
4	i																	
5	s																	
6	t																	
<b>Q.4</b>	<b>Solve any two questions out of three.</b>	<b>16</b>																
i)	Explain H.261 Encoder and Decoder block diagram	08	CO4	U														
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 "a <sub>1</sub> a <sub>2</sub> a <sub>3</sub> " using arithmetic coding tabular process.	08	CO2	Ap														
iii)	Explain in details A law compression and $\mu$ law companding	08	CO5	U														