Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – I • EXAMINATION – SUMMER • 2014

Subject code: 710402N **Date: 17-06-2014**

Subject Name: Information Theory and Coding

Time: 02:30 pm - 05:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Why are cyclic codes effective in detecting error burst? The message 1011001011 is to be transmitted in a cyclic code with a generator polynomial $g(x) = x^2+1$. (i) How many check bits does the encoded message contain? (ii) Obtain the transmitted code word? (iii) Draw encoding arrangement to obtain remainder bits.	**07**
	(b)	State and prove Macmillanôs theorem	**07**
Q.2	**(a)**	A zero memory source emits six messages with probabilities 0.32, 0.23, 0.15, 0.14, 0.1 and 0.06. Find the Huffman code. Determine its average word length, the efficiency and the redundancy.	**07**
	(b)	Define entropy and discuss the conditions for maximum and minimum entropy	**07**
		OR	
	(b)	Explain Reed-Solomon encoding	**07**
Q.3	**(a)**	A source emits seven messages with probabilities 1/2, 1/4, 1/8, 1/16, 1/32, 1/64 and 1/64.respectively. Find the entropy of the source. Obtain the compact binary code and find the average length of the codeword. Determine the efficiency and redundancy of the code	**07**
	(b)	State and prove Shannonôs Noiseless coding Theorem.	**07**
		OR	
Q.3	**(a)**	Find a generator matrix G for a (15,11) single error correcting linear block code. Find the codeword for the data vector 10111010101.	**07**
	(b)	Describe the data encryption standard (DES) encryption procedure	**07**
Q.4	**(a)**	Can we have a channel with infinite channel capacity? Justify your answer with mathematical equations	**07**
	(b)	Give differences between public key and private key encryption. Discuss the Knapsack problem	**07**
		OR	
Q.4	**(a)**	Draw the diagram of an encoder for systematic cyclic code and explain cyclic code generation in detail. Also explain the decoding procedure.	**07**
	(b)	What are the consequences of the Viterbi decoding algorithm not yielding a posteriori probabilities?	**07**
Q.5	**(a)**	Explain JPEG standard for image compression	**07**
	(b)	For convolution code describe sequential decoding briefly. What are its disadvantages?	**07**
		OR	
Q.5	**(a)**	For a binary symmetric channel (BSC), find H(X), H (Y), H (X|Y), H (Y|X) and I (X|Y). Let P (y1|x1) = 2/3, P (y2|x1) = 1/3, P (y1|x2) = 1/10, P (y2|x2) = 9/10, P (x1) = 1/3 and P (x2) = 2/3.	**07**

(b) Construct a code table for the (6, 3) code generated by the matrix G. Prepare a suitable decoding table. **07**

$$G = \begin{bmatrix} 0 & 1 & 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 0 & 0 & 1 \end{bmatrix}$$

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