Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER I (OLD) – • EXAMINATION – SUMMER 2016

Subject Code: 710402N **Date:17/05/2016**

Subject Name: INFORMATION THEORY AND CODING

Time:02:30 pm to 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)** Define instantaneous code and derive Krafts inequality for code binary alphabet. **07**

(b) Briefly discuss on: **07**

(1) Binary Symmetric Channel.

(2) Source Entropy and Information rate.

(3) Hamming Distance

Q.2 **(a)** Define entropy and derive the conditions for maximum and minimum entropy. **07**

(b) 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**

OR

(b) Source Symbol A, B , C , D and E has probabilities 0.25, 0.25, 0.20 , 0.15 and 0.15 respectively. Construct arithmetic code for message BCAE. **07**

Q.3 **(a)** State and prove Shannon's Noiseless coding Theorem. **07**

(b) A binary symmetric channel has the following noise matrix with source probabilities of p(x1)=1/3 and p(x2)=2/3 **07**

	Y1	**Y2**
X1	**2/3**	**1/3**
X2	**1/10**	**9/10**

Determine H(X), H(Y), H(X, Y), H(Y/X), H(X/Y) AND I(X,Y).

OR

Q.3 **(a)** Explain Shannon-fano Code With Example. **07**

(b) Derive the equation for average mutual information (I(**x; y**)) and channel capacity of a discrete memory less channel. **07**

Q.4 **(a)** Draw the diagram of an encoder for systematic cyclic code and explain cyclic code generation in detail. **07**

(b) For a (6,3) systematic linear block code, the three parity-check digits c4,c5 and c6 are **07**

c4 = d1+d2+d3, c5 = d1+d2, c6 = d1+d3

(a) Construct the appropriate generator matrix for this code.

(b) Construct the code generated by this matrix.

(c) Determine the error correcting capabilities of this code.

(d) Prepare a suitable decoding table.

(e) Decode the following received words : 101100 , 000110 , 101010

OR

Q.4	**(a)**	Describe the procedure for encoding and decoding of linear block code.	**07**
	(b)	A three-error correcting (23, 12) Golay code is a cyclic code with a generator polynomial. $g(x) = x^{11} + x^9 + x^7 + x^6 + x^5 + x + 1$ Determine the code word for the data vectors 000011110000, 101010101010, and 11000101011110	**07**
Q.5	**(a)**	Give differences between public key and private key encryption. Discuss the Knapsack problem.	**07**
	(b)	Draw Rate ½ Convolution encoder for constraint length of 3. Explain various methods of representing this encoder.	**07**
		OR	
Q.5	**(a)**	Explain JPEG standard for image compression.	**07**
	(b)	Write short note on Hamming Codes.	**07**

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