Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E –Ist SEMESTER–EXAMINATION – JULY- 2012

Subject code: 710402N Date: 07/07/2012

Subject Name: Information Theory and Coding

Time: 2:30 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)** Find the generator matrix G' for a non-systematic (23,12) Golay code described by polynomial $g(x) = x^{11}+x^9+x^7+x^6+x^5+x+1$. Determine the code words for the data vectors 000011110000 and 101010101010. **07**

(b) Give differences between public key and private key encryption. Discuss the Knapsack problem. **07**

Q.2 **(a)** A binary channel matrix is given by **07**

$$\begin{array}{c} \\ \text{Input} \end{array} \begin{array}{c} \begin{array}{cc} y1 & y2 \end{array} \text{ Output} \\ \begin{array}{c} x1 \\ x2 \end{array} \begin{bmatrix} 2/3 & 1/3 \\ 1/10 & 9/10 \end{bmatrix} \end{array}$$

It is also given $P_X(x1) = 1/3$, $P_X(x2) = 2/3$. Determine $H(x)$, $H(x/y)$, $H(y)$, $H(y/x)$ and $I(x,y)$.

(b) Consider a telegraph source having two symbols dot and dash. The dot duration is 0.2 sec and the dash duration is 3 times of the dot duration. The probability of the dot's occurring is twice that of dash and time between symbols is 0.2 seconds. Calculate information rate of telegraph source. **07**

OR

(b) Construct the Shannon–Fano code for the probability distribution (0.5, 0.25, 0.125, and 0.125). Given distribution is dyadic. If Distribution is non dyadic, What is the difference to construct Shannon–Fano code for dyadic distribution and non dyadic distribution? **07**

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) Explain the Viterbi Convolution Decoding Algorithm. **07**

OR

Q.3 **(a)** Use the generator polynomial for the (7,3) R-S code to encode the message 010110111 in systematic form. Use polynomial division to find the parity polynomial. **07**

(b) Describe the data encryption standard (DES) encryption procedure. **07**

Q.4 **(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) Find the channel capacity of a channel of infinite bandwidth. Why does it not become infinite? **07**

OR

Q.4 **(a)** A source emits three equiprobable messages randomly and independently. **07**
(a) Find the source entropy.
(b) Find the compact ternary code, the average length of the codeword, the code efficiency and the redundancy.

(b) Explain why R-S codes perform so well in a bursty-noise environment. **07**

Q.5 **(a)** Explain JPEG standard for image compression. **07**

(b) Write a note on cyclic codes also mention advantages and disadvantages. **07**

OR

Q.5 **(a)** An often –heard saying is that "A picture is worth a thousand words" Is a picture really worth a thousand words? Explain in the context of image compression. **07**

(b) Why are cyclic codes effective in detecting error burst? The message 1001001010 is to be transmitted in a cyclic code with a generator polynomial $g(x) = x^2+1$. **07**
(i) How many check bits does the encoded message contain?
(ii) Obtain the transmitted code word?
(iii) Draw encoding arrangement to obtain remainder bits.

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