Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. IST Semester–Remedial Examination – July- 2011

Sub code: 710402

Sub Name: Information Theory and Coding

Date:08/07/2011 **Time: 10:30 am – 01:00 pm**

Total Marks: 60

Instructions:

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

Q.1 **(a)** Explain in detail Reed-Solomon encoding **06**

(b) Find a generator polynomial g(x) for a (7,4) cyclic code and find code vectors for the following data vectors: 0010,1110,1001,1011 **06**

Q.2 **(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 $g(x) = x^2+1$. **06**
(i) How many check bits does the encoded message contain?
(ii) Obtain the transmitted code word?
(iii) Draw encoding arrangement to obtain remainder bits.

(b) Describe any one decoding techniques for the binary double error correcting BCH codes. **06**

OR

(b) A source emits three equiprobable messages randomly and independently. **06**
(a) Find the source entropy.
(b) Find the compact ternary code, the average length of the codeword, the code efficiency and the redundancy.

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. **06**

(b) Define entropy of a source. Explain Huffman code with the help of an example. **06**

OR

Q.3 **(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. **06**

(b) State and explain theorem of extensions of source with proof. **06**

Q.4 **(a)** Give differences between public key and private key encryption. Discuss the Knapsack problem. **06**

(b) Variable length coding is preferred over fixed length codes for better coding efficiency. Justify the statement with a suitable example. **06**

OR

Q.4 **(a)** Describe Data Encryption Standard scheme. **06**

(b) Explain construction of instantaneous code and state the theorem of kraft inequality. **06**

Q.5 **(a)** Construct a code table for the (6, 3) code generated by the matrix G. Prepare a suitable decoding table. **06**

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

(b) An analog signal is band limited to B Hz and sampled at Nyquist rate. The samples are quantized into 4 levels. Each level represents one message. Thus there are 4 messages. In one case, The probabilities of occurrence of these 4 levels (messages) are p1=p4=1/8 and p2=p3=3/8.On other case All messages are equally likely. Find out information rate of source. Give comments on it. **06**

OR

Q.5 **(a)** Can we have a channel with infinite channel capacity? Justify your answer with mathematical equations. **06**

(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. **06**

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