Printed Pages: 4 **NEC-408**

(Following Paper ID and Roll No. to be filled in your Answer Books)

Paper ID : 131408 **Roll No.** | | | | | | | | | | |

B.TECH.

Theory Examination (Semester-IV) 2015-16

INFORMATION THEORY AND CODING

Time : 3 Hours ***Max. Marks : 100***

Note: Attempt questions from all Sections as per directions.

Section-A

Q1. Attempt all parts of this section. Answer in brief. **(2×10=20)**

(a) Derive the relation between conditional and joint entropies.

(b) What is DMC? Explain its significance.

(c) Give difference between digital audio and audio compression.

(d) Briefly explain Run Length Encoding (RLE). State its examples.

(e) Compare and contrast Huffman coding and arithmetic coding.

(f) If C is a valid code vector, then prove that $CH^T = 0$ where H^T is transpose of parity check matrix H.

(g) Explain in brief the Golay code.

(h) State the limitations of sequential decoding.

(i) What is ARQ? State its types.

(j) Differentiate among Code rate, Constraint length and Code dimension.

Section-B

Q2. Attempt any five questions from this section. (10×5=50)

(a) Prove that the upper bound on the value of entropy H of a source is $\log_2 M$, where M is the number of symbols.

(b) For a discrete memory less source there are three symbols with probabilities $p_1 = \alpha$ and $p_2 = p_3$. Determine the entropy of the source and sketch its variation for different values of α.

(c) Define and explain the term information rate. State the relation between information rate and entropy.

(d) Design a syndrome calculator for a (7, 4) cyclic Hamming code generated by the polynomial $G(p) = p^3+p+1$. Calculatethe syndrome for Y = (1 0 0 1 1 0 1).

(e) State and explain source coding theorem. What is coding efficiency?

(f) A channel has the following channel matrix.?

$$[P\ (Y/X)] = \begin{pmatrix} 1-p & p & 0 \\ 0 & p & 1-p \end{pmatrix}$$

(i) Draw the channel diagram.

(ii) If the source has equally like outputs. Compute the probabilities associated with the channel output for p=0.2.

(g) Determine For the given code shown in figure 1 obtain the convolution code for the bit sequence 1 1 0 1 1 0 1 1 and decode it by constructing the corresponding code tree.

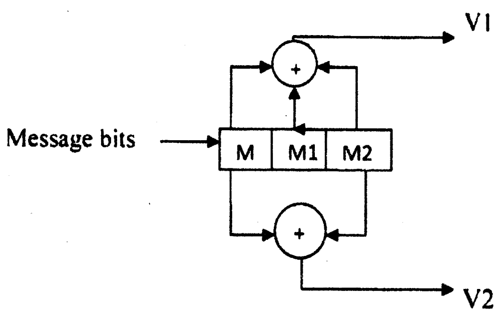

Fig.1

(h) Explain VRC and LRC techniques. Define minimum distance dmm and explain its role in detecting and correcting errors.

Section-C

Attempt any two questions from this section. (15×2=30)

Q3. With the following symbol and their probability of occurrence, encode the message "went#""using arithmetic coding algorithms.

Symbol	e	n	w	t	'#'
Probability	0.3	0.3	0.1	0.1	0.1

Q4. For the joint probability matrix (JPM) shown below, H(X,Y), H(X),H(Y), H(X/Y) and H(Y/X)

$$\begin{pmatrix} 0.2 & 0 & 0.2 & 0 \\ 0.1 & 0.01 & 0.01 & 0.01 \\ 0 & 0.02 & 0.02 & 0 \\ 0.04 & 0.04 & 0.01 & 0.06 \\ 0 & 0.06 & 0.02 & 0.2 \end{pmatrix}$$

Q5. How do you obtain the generator polynomial for the cyclic code? Check if the following codes are cyclic or not

Code X_1 = {0000. 0101, 1010, 1111}

Code X_2 = {0000. 0110, 1001, 1111}