(Please write your Exam Roll No.) Exam Roll No. 60225602814

END TERM EXAMINATION

SIXTH SEMESTER [B.TECH] MAY-JUNE 2017

Paper Code: ETEC-304 **Subject: Information Theory and Coding**

Time: 3 Hours **Maximum Marks: 75**

Note: Attempt any five questions including Q no.1 which is compulsory. Select one question from each unit.

Q1 Attempt the following:- **(2.5x10=25)**

(a) Define Uncertainty, Surprise and information with the help of example.

(b) Define random variables and differentiate between discrete and continuous random variables.

(c) State and explain the properties of Mutual Information.

(d) Explain Prefix Coding or Instantaneous Coding with an example.

(e) Differentiate between block codes and convolutional codes.

(f) What is channel capacity? Derive the channel capacity expression of binary symmetric channel.

(g) Explain the need of error detection and correction.

(h) What are the advantages and disadvantages of cyclic codes?

(i) Describe different types of error control techniques

(j) What is discrete memoryless channel (DMC)?

UNIT-I

Q2 (a) State and explain the Lempel-Ziv algorithm with the help of one example. **(6)**

(b) A source generates 9 messages with probabilities of occurrence as shown below. **(6.5)**

$[X] = \{x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8, x_9\}$

$[P] = \{0.14, 0.04, 0.02, 0.02, 0.01, 0.07, 0.07, 0.14, 0.49\}$

Apply Huffman coding algorithm and place the combined message as low as possible when its Probability is equal to that of another message. Calculate codeword and average codeword length for the messages.

Q3 (a) Two BSCs are connected in cascade, as shown in fig. **(6)**

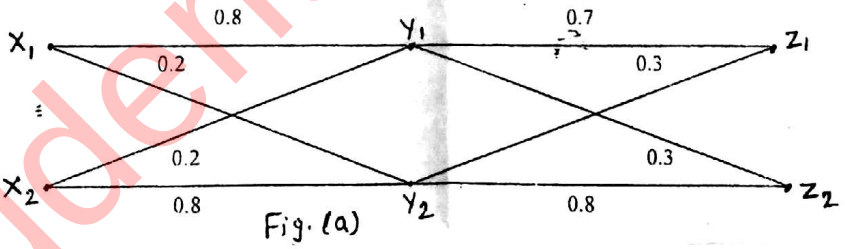

Fig. (a)

(i) Find the channel matrix of the resultant channel.

(ii) Find $P(z_1)$ and $P(z_2)$ if $P(x_1)=0.6$ and $P(x_2)=0.4$

(b) Prove the following relationships. **(6.5)**

$$I(X;Y) = H(X) - H(X/Y)$$

$$I(X;Y) = H(Y) - H(Y/X)$$

UNIT-II

Q4 (a) Explain the significance of Channel Models. Discuss types of channel models in details. **(8.5)**

(b) Write a short note on Channel capacity Theorem and its implications. **(4)**

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Q5 (a) Given below P(Y/X) of the noisy channel. Determine the rate of transmission through this channel.

$$P(Y/X)=\begin{bmatrix}0.5 & 0.5 & 0\\ 0.5 & 0 & 0.5\\ 0 & 0.5 & 0.5\end{bmatrix} p(A_1)=0.6, p(A_2)=0.3, p(A_3)=0.1,$$ where A_1, A_2, A_3 are transmitters. **(9.5)**

(b) Describe necessary and sufficient conditions for noiseless coding. **(3)**

UNIT-III

Q6 (a) For a (6, 3) systematic linear block code, the three parity check bits c_4, c_5, c_6 are formed from the following equation: **(8.5)**

$$c_4 = d_1 \oplus d_3$$

$$c_5 = d_1 \oplus d_2 \oplus d_3$$

$$c_6 = d_1 \oplus d_2$$

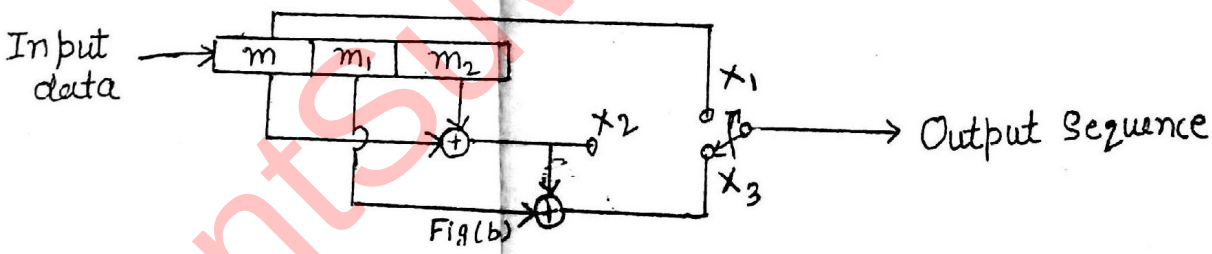
(i) Determine the generator and parity check matrices for the systematic code.

(ii) Comment on error detection and error correction, capabilities of the code.

(iii) If the received sequence is 101101, determine the message word.

(b) Explain the salient features of Reed-soleman codes. **(4)**

Q7 (a) For a convolutional encoder shown in fig.(b), give state diagram and code trellis for the same. Determine the output data sequence for the input data sequence of 11010. **(8.5)**



Fig(b)

(b) A convolution encoder has a single shift register with two stages (i.e. constraint length K = 3), three modulo-2-adder and an output multiplexer. The generator sequence of the encoder are as follows: **(4)**

$G1 = (1\ 0\ 1), G2 = (1\ 1\ 0), G3 = (1\ 1\ 1)$

Draw the block diagram of the encoder.

UNIT-IV

Q8 (a) Explain Viterbi's algorithm and sequential decoding of convolutional codes. **(6.5)**

(b) Compare linear block codes, cyclic codes and convolutional codes. **(6)**

Q9 (a) What is cryptography? Explain various cryptographic techniques and their features. **(6.5)**

(b) Describe turbo encoder and decoder. Also explain puncturing. **(6)**

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