Total No. of Questions :8]   [Total No. of Printed Pages :3

Roll No ....

MEDC-301(A)

M.E./M.Tech. III Semester

Examination, June 2016

Information Theory and Coding (Elective-I)

Time : Three Hours

Maximum Marks: 70

Note : i) Attempt any five questions out of eight.

ii) All questions carry equal marks.

1. a) Write down the comparison between binary memory less channel and discrete memory less channel.

   b) A discrete source emits one of five symbols once every millisecond with probabilities $\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}$ and $\frac{1}{32}$ respectively. Determine the source entropy and information rate.

2. a) State and explain Shannon's capacity theorem.

   b) Given a binary channel shown in figure.
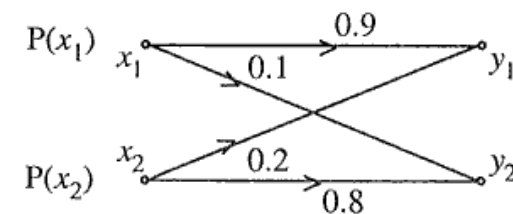
   i) Find the channel matrix of the channel.

   ii) Find $P(y_1)$ and $P(y_2)$ when $P(x_1) = P(x_2) = 0.5$

   iii) Find the joint probability $P(x_1, y_2)$ and $P(x_2, y_1)$ when $P(x_1) = P(x_2) = 0.5$

3. a) Define following terms :
Code word, Block length, Code rate, Channel data rate, Code vector.

   b) State and explain channel coding theorem in detail.

4. a) Describe syndrome decoding method to correct errors with suitable diagram and description.

   b) For a (7, 4) block code generated by [G] below, explain how the error syndrome helps in correcting single error.

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

5. a) Draw the block diagram of encoder for systematic (n, k) cyclic codes and explain briefly.

   b) For the (7, 4) Hamming code, the parity check matrix H is given by

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

   i) Construct the generator matrix.
   ii) The code word that begins with 1010.
   iii) If the received code word Y is 0111100, then decode this received code word.

6. a) What do you mean by Cyclic codes? Write down the basic properties of cyclic codes.

   b) Describe Viterbi algorithm for decoding convolutional codes.

7. a) What are BCH codes? Discuss its encoding and decoding procedures.

   b) Explain code tree, Trellis and state diagram for a convolutional encoder with suitable example.

8. Write short notes (any two) :
   a) Hamming code and their applications
   b) Fading channel
   c) Huffman coding
   d) Advantages and disadvantages of convolutional codes.

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