Total No. of Questions :8]

SEAT No. :

P2580

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T.E. (Electronics & Telecommunication Engineering)

INFORMATION THEORY AND CODING TECHNIQUES

(2012 Course) (Semester - II) (304189) (End Sem.)

Time : 2½ Hours] *[Max. Marks :70*

Instructions to the candidates:

1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Figure to the right side indicate full marks.***
3) ***Use of calculator is allowed.***
4) ***Assume suitable data if necessary.***

Q1) a) The joint probability matrix representing transmitter and receiver is given below. Find all entropies and mutual information of the communication system **[6]**

$$P(X,Y) = \begin{bmatrix} 0.3 & 0.05 & 0 \\ 0 & 0.25 & 0 \\ 0 & 0.15 & 0.05 \\ 0 & 0.05 & 0.15 \end{bmatrix}$$

b) Obtain the coding efficiency of a Shannon Fano for a zero memory sources that emits eight messages with respective probabilities as given below. Use 3 letters for encoding such as -1, 0, 1. **[6]**

$$P = [0.3 \quad 0.12 \quad 0.12 \quad 0.12 \quad 0.12 \quad 0.08 \quad 0.07 \quad 0.07]$$

$$X = [x_1 \quad x_2 \quad x_3 \quad x_4 \quad x_5 \quad x_6 \quad x_7 \quad x_8]$$

c) Explain the case study related to application of Huffman's coding and JPEG in image compression. **[8]**

OR

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Q2) a) The Party check matrix of a (7, 4) Hamming Code is given as below: **[7]**

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

i) Find Generator Matrix.

ii) Find out all possible codewords.

iii) Determine error correcting capability of the code.

b) Consider (7, 4) cyclic code: with $g(x) = x^3 + x + 1$. **[7]**

i) Draw the hardware arrangement of cyclic encoder and verify the encoder by considering one message.

ii) If received code vector is 1001101, find out transmitted or corrected codeword.

c) Explain any two properties of mutual information and show that Shannon's limit for AWGN Channel is -1.6dB. **[6]**

Q3) a) Find generator polynomial for BCH code over GF(16) using primitive polynomial $P(x) = x^2 + x + 2$ over GF(4) codeword. The code should correct t_c=1, 2 errors. The addition and multiplication tables are as given below: **[8]**

+	0	1	2	3
0	0	1	2	3
1	1	0	3	2
2	2	3	0	1
3	3	2	1	0

•	0	1	2	3
0	0	0	0	0
1	0	1	2	3
2	0	2	3	1
3	0	3	1	2

b) Write short notes on **[6]**

i) CRC codes

ii) Golay Codes

c) Explain FEC technique for Error Control. **[4]**

OR

Q4) a) Explain the steps of BCH decoding with Goreinsein Zierler Algorithm. **[6]**

b) Explain the applications of RS codes and CRC code. **[6]**

c) Distinguish between BCH and RS codes. **[6]**

Q5) a) Explain the following: **[12]**

i) Code Rate

ii) Constraint Length

iii) Word Length

iv) Block Length

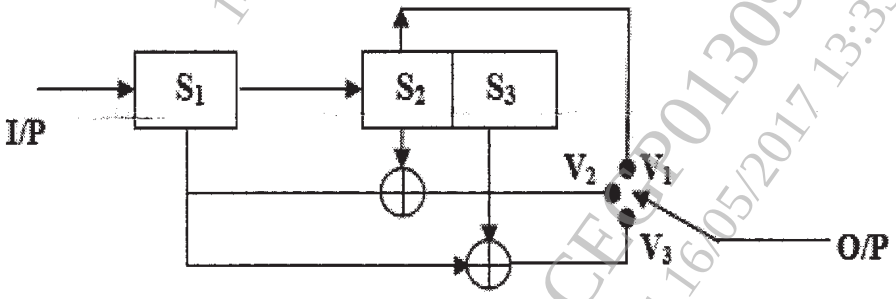
v) Free Distance

vi) Hamming Distance

b) What are Turbo Codes? Explain the coding and decoding of Turbo codes. **[4]**

OR

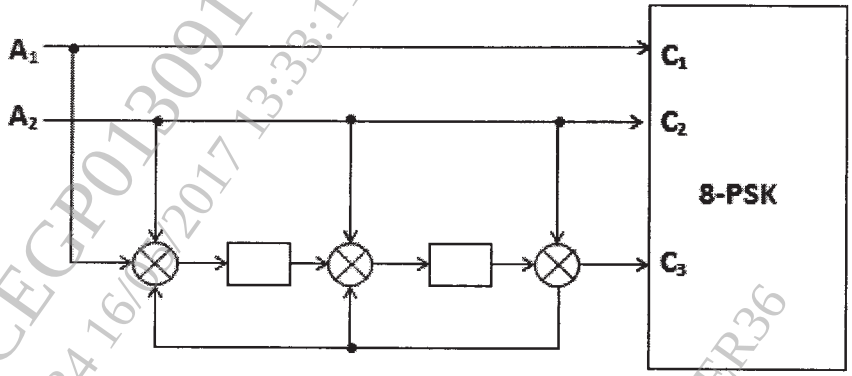
Q6) a) For the convolution encoder shown in fig below, construct the Code tree and trellis diagram, find out the out of the encoder corresponding to message sequence 10110 using trellis. **[10]**



b) Explain Sequential decoding and Viterbi decoding. **[6]**

Q7) a) What are the Ungerboek's TCM design rules. Explain asymptotic coding gain. **[6]**

b) Consider the 8 state, 8 PSK TCM scheme as shown below. **[10]**



i) Draw trellis diagram

ii) Find d_{free} and Asymptotic coding gain and comment on it.

OR

Q8) a) Discuss Mapping by Set partitioning. **[6]**

b) Explain Euclidean distance, Asymptotic coding gain of trellis coded Modulation. **[4]**

c) Draw and explain the band limited and power limited coding system. **[6]**

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