

Total No. of Questions : 12]

SEAT No. : **P2422****[5153]-56**

[Total No. of Pages : 4]

T.E. (Electronics & Telecommunication)
SIGNAL CODING & ESTIMATION THEORY
(2008 Course) (304187) (Semester - II)

Time : 3 Hours]

[Max. Marks : 100

Instructions to the candidates:

- 1) Answer three questions from section - I and three questions from Section - II.
- 2) Answers to the two sections should be written in separate answer books.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Assume suitable data, if necessary.
- 5) Use electronics pocket calculator is allowed.
- 6) Figures to the right indicate full marks.

SECTION - I

- Q1) a)** Consider a DMS 'X' with two symbols x_1 and x_2 with probabilities $p(x_1) = 0.9$ and $p(x_2) = 0.1$. Find the efficiency and redundancy of this code and its second order extension (Use Huffman code) **[8]**
- b)** Show that mutual information is always positive. Also calculate $H(X)$, $H(X,Y)$, $H(X/Y)$, $H(Y/X)$ and $I(X,Y)$ for a channel with three inputs x_1, x_2 and x_3 and three output y_1, y_2, y_3 . **[10]**

$$P(Y / X) = \begin{bmatrix} 0.8 & 0.2 & 0 \\ 0.1 & 0.3 & 0.6 \\ 0 & 0.3 & 0.7 \end{bmatrix}$$

$$p(x_1) = 1/3, p(x_2) = 1/3, p(x_3) = 1/3.$$

OR

- Q2) a)** Determine the Lempel ziv code for the following bit stream. **[8]**
 0100011111001101011011110000
 Recover the original sequence from the encoded stream.
- b)** Calculate variation in codevector of Huffman code and Shannon fano code of following DMS. **[10]**

$$p(x_1) = 0.4, p(x_2) = 0.2, p(x_3) = 0.2, p(x_4) = 0.1, p(x_5) = 0.1$$

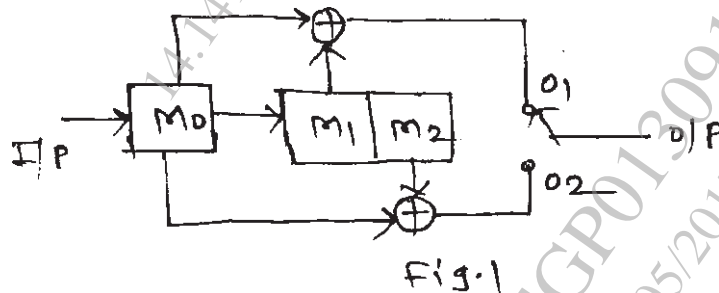
P.T.O.

Q4) a) Show that the Shannon's limit for an AWGN channel is equal to - 1.6Db, in the information capacity theorem. **[8]**

b) Write short notes on any two of the following: **[8]**

- i) Fire code
- ii) Wavelet error control coding.
- iii) Sphere packing problem.

Q5) a) Determine the code tree and trellis diagram for the convolutional encoder as shown in figure given below (Fig.1) **[8]**



OR

- Q6)** a) A rate $1/3$ convolution encoder has generating vectors as $g_1 = (001)$, $g_2 = (011)$, $g_3 = (110)$ [12]
- Sketch encoder
 - Draw state diagram
 - If input message sequence is 101101 determine the output sequence of the encoder
- b) Explain Asymptotic coding gain. [4]

SECTION - II

- Q7)** a) For the (255,225) Reed-Soloman code [8]
- How many bits are there in a symbol of the code?
 - What is block length in bits.
 - What is minimum distance of the code?
 - How many symbols in error can the code correct
- b) Consider the BCH (15,5) triple error correcting code with the generator polynomial $g(x) = x^{10} + x^8 + x^5 + x^4 + x^2 + x + 1$. Find the error using Gorenstein Zierler algorithm in received Polynomial $x^6 + x^4$. [10]

OR

- Q8)** a) Find Minimal polynomial of GF (16) whose transfield is GF (2) with primitive polynomial $x^4 + x + 1$. [10]
- b) Explain RSA algorithm and substitution ciphers. [8]
- Q9)** a) What is Bayesian Estimation? Find the Bayesian estimation with squared error as cost function. [8]
- b) Consider the problem where the observed samples are $Y_k = M + N_k$ $k = 1, 2, 3, \dots, k$, M and N_k are statistical independent Gaussian random variables with zero mean and variance σ^2 . Find \hat{m}_{ms} , \hat{m}_{map} and \hat{m}_{mave} . [8]

OR

- Q10)** a) Explain Kalman filter in context of estimation theory. [8]
 b) State and explain cramer-Rao inequality for a random parameter. [8]

- Q11)** a) Give MAP criteria and explain multiple hypothesis for three regions H_0 , H_1 , H_2 . Hence give the criterion to select the hypothesis. [8]
 b) In on-off keying system, the source transmits signal of amplitude 1 volt or 0 volt. Noise $n(t)$ is added which has zero mean and variance = 1 and it is Gaussian set up the LRT (Likelihood Ratio Test) for this problem. [8]

OR

- Q12)** a) Explain Generalized likelihood ratio tests (GLRTs) and its one application in detail. [8]
 b) Derive the expression for minimax cost. [8]

x

x

x

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