

Total No. of Questions :8]

SEAT No. :

P1732

[5058]-366

[Total No. of Pages :3

T.E. (Electronics and Telecommunication Engineering)
INFORMATION THEORY AND CODING TECHNIQUE
(2012 Course) (Semester - II) (304189)

Time : 2½ Hours]

[Max. Marks :70

Instructions to the candidates:

- 1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6 and Q7 or Q8.*
- 2) *Figures to the right side indicate full marks.*
- 3) *Use of calculator is allowed.*
- 4) *Assume suitable data if necessary.*

- Q1)** a) A discrete source emits messages X_1 & X_2 with probabilities $\frac{3}{4}$ & $\frac{1}{4}$ with BSC, Find $H(X)$, $H(Y)$, $H(X,Y)$, $H(X/Y)$, $I(X;Y)$. [7]
- b) Obtain the coding efficiency of a Shannon Fano and Huffman code for a zero memory source that emits six messages (G, N, H, A, E, S) with probabilities of {0.19, 0.15, 0.02, 0.16, 0.4, 0.08} respectively. [8]
- c) Determine Lempel-Ziv code for the following bit stream 0100 1111 1001 10000010101 0110 0110 000. [5]

OR

- Q2)** a) For a systematic Linear Block code, the three parity check digits C_4, C_5, C_6 are given $C_4 = d_1 + d_2 + d_3$, $C_5 = d_1 + d_2$ and $C_6 = d_1 + d_3$ [6]
- i) Construct Generator matrix
 - ii) Determine error correcting capability
 - iii) Prepare a suitable decoding table
- Decode the received words 101100 and 000110.
- b) Construct a systematic (7, 4) cyclic code using generator polynomial $g(X) = X^3 + X + 1$. Construct the decoding table for the received code word 1 1 0 1 1 0 0, determine the transmitted data word. [7]
- c) Explain any two properties of mutual information and show that Shannon's limit for AWGN Channel is -1.6dB. [7]

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Q3) a) Obtain generator polynomials and specifications for BCH code with block length $n=15$ & error correcting capability $t_c = 1,2,3$. [8]

b) Explain the following terms with the help of equations [6]

i) Primitive Polynomial

ii) Minimal Polynomial

iii) Generator Polynomial

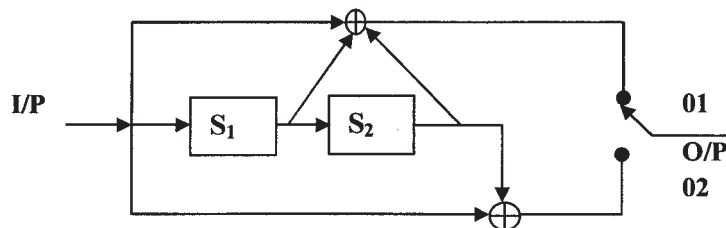
c) Differentiate between BCH and RS codes. [4]

OR

Q4) a) Consider the BCH (15,5) triple error correcting code has the following generator polynomial $g(x) = x^{10} + x^8 + x^5 + x^4 + x^2 + x + 1$ Find the errors using Gorenstein-Zierler algorithm in received polynomial $x^9 + x^6 + x^5 + x^4$. [10]

b) Explain the applications of RS codes and CRC code. [8]

Q5) a) A convolution encoder has code rate $=1/2$ constraint length $K=3$ as shown in Figure below. Draw the trellis diagram. By using Viterbi algorithm decode the sequence 010001000. [8]



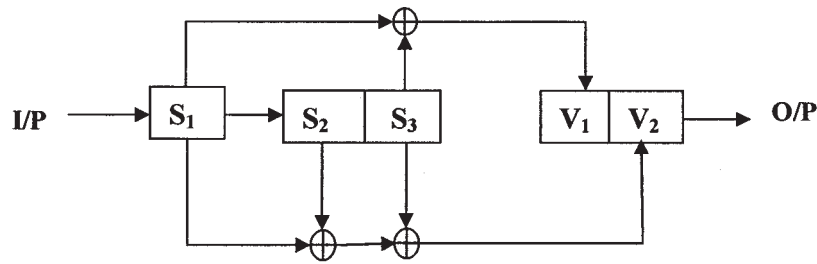
b) A convolutional encoder is rate $1/3$, constraint length $K = 4$
 $g^1 = 1 + D + D^2 + D^3$, $g^2 = 1 + D^2 + D^3$, $g^3 = 1 + D + D^3$.

i) Obtain State Table.

ii) Draw the state diagram. [8]

OR

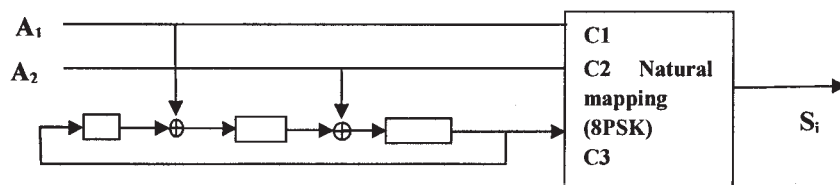
Q6) a) For the convolution encoder shown in figure below. Sketch the state diagrams, Code Tree and trellis diagram. Find the output data sequence 10011. **[10]**



b) Explain FEC and ARQ systems. [6]

Q7) a) What are the Ungerboeck'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) What are turbo codes? Explain necessity of Inter-leaver in turbo codes?[6]

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

c) Discuss the importance of Trellis Coded Modulation with the block diagram of Communication System. [6]

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