Total No. of Questions : 8]

SEAT No. :

P3506

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

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) ***Figures to the right side indicate full marks.***
3) ***Use of Calculator is allowed.***
4) ***Assume suitable data if necessary.***

Q1) a) Obtain the coding efficiency of a Shannon Fano and Huffman code for a zero memory source that emits six messages (R, N, E, R, A, O, G) with probabilities of {0.19, 0.15, 0.02, 0.16, 0.4, 0.08} respectively. **[8]**

b) What is Run Length Encoding? Use RLE method of compression to compress the following data: 0000011110000111111. **[6]**

c) What is Mutual Information? State and prove any two properties of Mutual Information. **[6]**

OR

Q2) a) Write short notes on Hamming Code. **[4]**

b) The generator matrix for the (7, 4) linear block code is given below: **[8]**

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

i) Find all the codewords and its minimum distance.

ii) If the received codeword is 0101011, check for the error and correct if any.

c) Construct a generator matrix for a systematic (7, 4) cyclic code using generator polynomial $g(X) = X^3 + X + 1$. Find syndrome for the received code word 1101100. **[8]**

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Q3) a) Find the generator polynomial for BCH code over GF (2^3) using primitive polynomial $p(x) = x^3 + x + 1$. The code should correct $t_c = 1, 2$ error. **[10]**

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

i) Primitive polynomial

ii) Minimal Polynomial

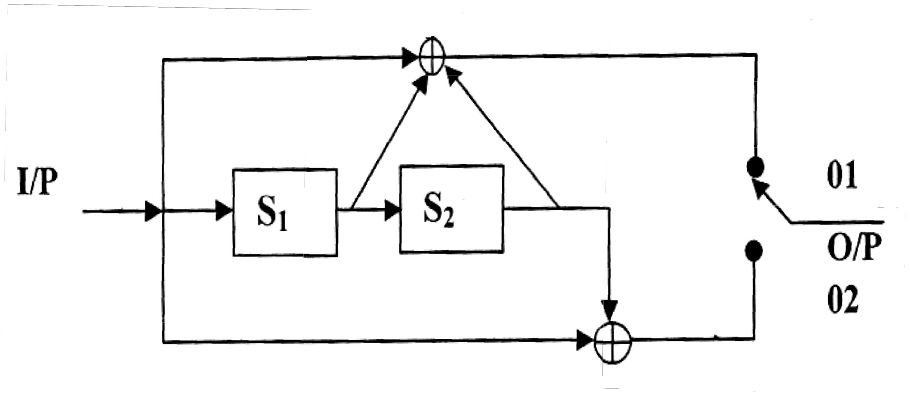
iii) Generator Polynomial

OR

Q4) a) Explain the encoding and decoding procedure for BCH codes. **[10]**

b) Differentiate between BCH and RS codes. **[6]**

Q5) a) A convolution encoder has code rate = ½ constraint length K = 3 as shown in Figure below. Draw the state diagram and trellis diagram. Encode the sequence 10110. **[10]**



b) Explain Viterbi Decoding mechanism for convolutional codes with suitable example. **[8]**

OR

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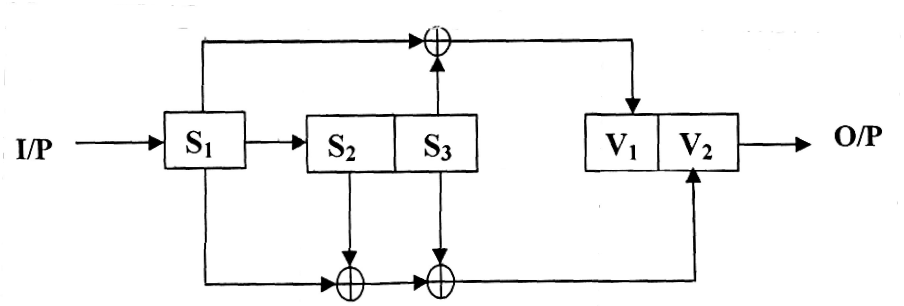
Q6) a) For the convolution encoder shown in figure below. Sketch the state diagrams, Code Tree and trellis diagram. Find the output data sequence 10101. **[12]**



b) Explain FEC and ARQ systems. **[6]**

Q7) a) What are the Ungerboek's TCM design rules. Explain asymptotic coding gain. **[8]**

b) Explain set partitioning for 8-PSK and 16-PSK system. **[8]**

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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