[5560]-156

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: 00000111110000111111. **[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]**

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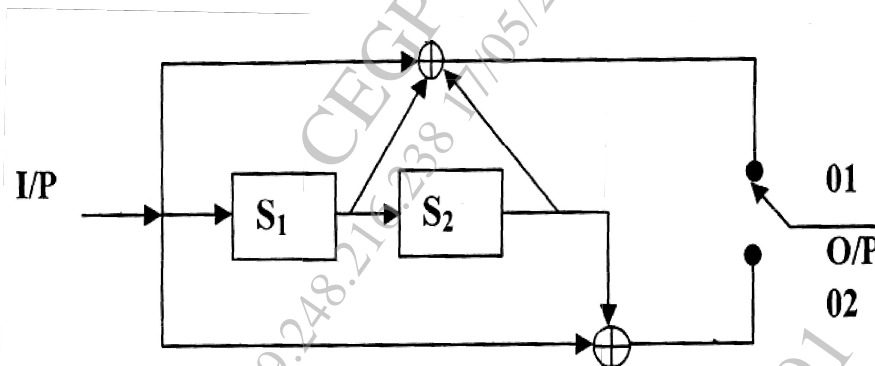
b) Explain Viterbi Decoding mechanism for convolutional codes with suitable example. **[8]**

OR

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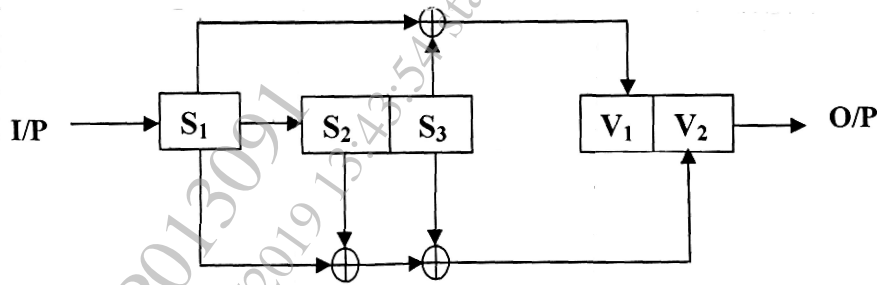
b) Explain FEC and ARQ systems. **[6]**

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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