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Roll No. .....

328655(28)

BE (6th Semester)
Examination, Nov.-Dec., 2017

(New Scheme)

Information Theory and Coding

Time Allowed : 3 hours *Maximum Marks* : 80
Minimum Pass Marks : 28

Note : Part (*a*) of each unit is compulsory and carries 2 marks. Attempt any **two** parts from (*b*), (*c*) and (*d*) and carry 7-7 marks from each unit.

Unit-I

1. (*a*) Define entropy. [2]

   (*b*) Describe JPEG standard for lossless and lossy compression with neat block diagram. [7]

   (*c*) Apply Huffman coding procedure for the following message and also calculate coding efficiency : [7]

   $[X] = [x_1, x_2, x_3, x_4, x_5, x_6, x_7]$

   $[P] = [0.05, 0.15, 0.2, 0.05, 0.15, 0.3, 0.1]$

(*d*) Show that the channel capacity of an ideal AWGN channel with infinite bandwidth is

$$C_\infty = \frac{1s}{\ln 2n} \approx 1.44\frac{s}{n} \text{ b/s}$$

where s is the average signal power and $n/2$ is the power spectral density of white Gaussian noise. [7]

Unit-II

2. (*a*) Define weight of code word. [2]

   (*b*) Consider a generator matrix

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

   Find parity check matrix and check whether the following code words are valid or not : (*i*) 1000110 (*ii*) 0101011 [7]

   (*c*) Construct a systematic (7, 4) cyclic code using generator polynomial

   $g(x) = x^3 + x^2 + 1$

   for the message (*i*) 1010 and (*ii*) 1000. [7]

(*d*) Obtain all possible code vectors for a (7, 4) linear block code in its systematic form for the generator matrix

$$G = \begin{bmatrix} 1 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 \end{bmatrix}$$ [7]

Unit-III

3. (*a*) Define primitive BCH codes over GF(q). [2]

(*b*) Find generator polynomials for BCH over GF(16) using primitive polynomial $p(x) = x^2 + x + 2$ over GF(4) code word. The code should correct $t = 1, 2, 3$ errors. [7]

(*c*) Explain RS codes and enlist its applications. [7]

(*d*) A (7, 4) single error correcting systematic BCH code generated using

$$g(x) = x^3 + x + 1$$

If received code words are 1011100 and 1010000, find the corresponding corrected code words. [7]

Unit-IV

4. (*a*) Define code rate. [2]

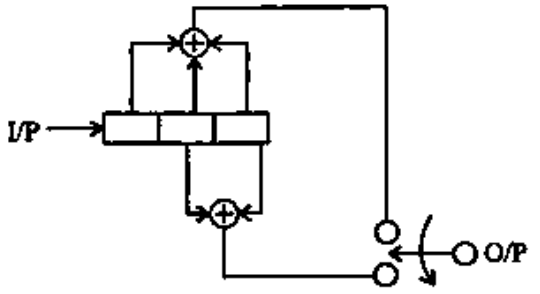
(*b*) Draw the state diagram, tree diagram and trellis diagram for K=3 rate 1/3 code generated by

$g_1(x) = x + x^2$

$g_2(x) = 1 + x$

$g_3(x) = 1 + x + x^2$ [7]

(*c*) Draw the state diagram and tree diagram for the convolutional encoder characterized by the block diagram in given below figure : [7]



(*d*) Explain Viterbi decoding. [7]

Unit-V

5. (*a*) Define coding gain of TCM. [2]

(*b*) Explain concept of TCM. [7]

(*c*) Explain Ungerboeck's TCM design rules. [7]

(*d*) Explain TCM decoding. [7]

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