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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Eighth Semester, B.E. - Electronics and Communication Engineering

Semester End Examination; June - 2017

Error Control Coding

Time: 3 hrs *Max. Marks: 100*

***Note**: Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

UNIT - I

1 a. Define the following :

(i) (n, k) Systematic code (ii) Perfect code

(iii) Minimum Distance (iv) Minimum Weight. 4

b. Consider a systematic (8, 4) code whose parity check equations are :

$C_4 = d_1 + d_2 + d_3$; $C_5 = d_0 + d_1 + d_2$; $C_6 = d_0 + d_1 + d_3$; $C_7 = d_0 + d_2 + d_3$, where d_0, d_1, d_2 and d_3 are message bits. 10

(i) Find the generator matrix (ii) Construct all the possible code words.

c. Consider a (6, 3) linear code whose generator matrix is :

$$G = \begin{pmatrix} 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 \end{pmatrix}$$ 6

(i) Find all code vectors (ii) Find all the hamming weights and distances.

2 a. Design single error correcting Hamming code for a message length of 4 bits. Obtain G and H matrices and all valid code words. 10

b. For a systematic (6, 3) linear block code, the parity matrix '*P*' is given by :

$$[P] = \begin{pmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 0 \end{pmatrix}$$

(i) Construct standard array table for the code words

(ii) Decode the received code word r = [101100]. 10

UNIT - II

3 a. Design an encoder for the (7, 4) binary cyclic code generated by $g(x) = 1 + x + x^3$ and verify its operation using the message vector (1001). 10

b. With the help of meggitt decoder diagram, explain the general decoder operation for (n, k) cyclic code. 10

4 a. Explain the following codes :

(i) Quasi cyclic codes (ii) Shortened cyclic code (iii) Burst error correction code 10

(iv) Fire code (v) Golay code.

Contd…2

b. A linear hamming code is described by a generating polynomial $g(D) = 1 + D + D^3$. Determine the generator matrix G and parity check matrix H. 5

c. Explain the matrix description of cyclic codes. 5

UNIT - III

5 a. Explain the matrix description of convolution encoder. 10

b. Design a rate ½ convolution encoder with a constraint length $v = 2$ and block length of 61.
(i) Construct the state diagram for this encoder
(ii) Construct the trellis diagram
(iii) Write incoming and outgoing bits of encoder. 10

6 a. Explain the Viterbi decoding algorithm with example. 10

b. Calculate the free distance d_{free} of convolutional encoder given in a below Fig. Q6(b), by using generating functions.

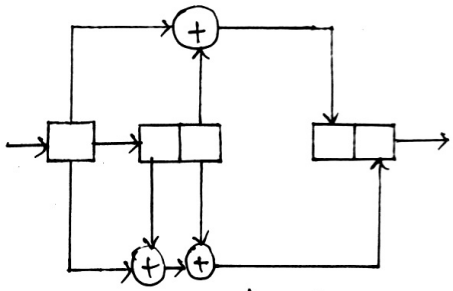

fig. Q6(b) 10

UNIT - IV

7 a. Explain performance and distance bounds for convolutional codes. 10

b. Explain iterative MAP decoding for turbo codes. 10

8 a. Write short notes on turbo codes. 10

b. Explain modified BCJR algorithm. 10

UNIT - V

9 a. With a neat diagram, explain the general structure of TCM encoder and also TCM decoder. 10

b. Explain space time trellis codes. 10

10 a. Explain performance evaluation for AWGN channels. 10

b. Explain the concept of coded modulation. 10

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