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

(An Autonomous Institution affiliated to VTU, Belagavi)

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

Semester End Examination; May / June - 2019

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. With the help of a neat block diagram, describe a typical data transmission system. 6

b. Consider the (3, 1, 2) convolution code with $g^{(1)} = (1 1 0)$, $g^{(2)} = (1 0 1)$ and $g^{(3)} = (1 1 1)$

i) Draw the encoder block diagram

ii) Find the code word produced using the above encoder, if the input to the encoder is (1 1 1 0 1) 8

c. Define Field and describe the properties of field with an example. 6

2 a. Show that an irreducible polynomial over GF(2) of degree *m* divides $X^{2^\wedge m-1}+1$. 6

b. Using binary field arithmetic, solve the following simultaneous equations :
X + Y + W = 1, X + Z + W = 0, X + Y + Z + W = 1, Y + Z + W = 0 6

c. Construct a table of code words for Galois field GF (2^3) using primitive polynomial P(x) = 1 + X + X^3. Display the power, polynomial and vector representation of each element. 8

UNIT - II

3 a. Construct a rate R = 1/3 turbo encoder using two identical (2, 1, 3) RSC encoder whose generator matrix is given by $g^{(1)}$ = [1 0 1], $g^{(2)}$ = [1 1 1] and separated by an inter-leaver and determine the code word produced by the encoder for an input of u = [1 0 1 1 0 1 0 0]. 12

b. Show that for any (*n*, l, *v*) systematic feed forward encoder $A_W^{(W)}(Z) = [A_1^{(1)}(Z)]^w$ and that for any (*n*, l, *v*) systematic feedback encoder $A_{2W}^{(W)}(Z) = [A_2^{(1)}(Z)]^W$. 8

4 a. With a neat block diagram, explain the basic structure of an iterative turbo decoder. 8

b. Consider a parallel concatenated block code with two different constituent codes: the (7, 4, 3) Hamming code and (8, 4, 4) extended Hamming code. Find the CWEFs, IRWEFs and WEFs of this code assuming a uniform inter-leaver. 12

UNIT - III

5 a. Define LDPC Code and check whether the matrix H satisfy the condition of Parity-Check matrix of an LDPC code. Determine the rank of the matrix and show the tanner graph representation of the same. 10

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

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b.	Explain different finite geometry LDPC codes family with example.	10
6 a.	Explain different types of decoding which can be used in LDPC codes.	10
b.	Briefly explain; i) Tanner graph for linear block codes ii) Bipartite graph	10

UNIT - IV

7 a.	Explain the steps involved in TCM code construction.	10
b.	With a neat block diagram, explain General TCM encoder and signal mapper.	10
8 a.	Explain multi dimensional TCM system with an example. List the advantages of multi dimensional TCM system.	12
b.	Realize a rotationally invariant 8-state rate R = ½ QPSK encoder with separate differential encoding and embedded differential encoding.	8

UNIT - V

9 a.	Explain the error trapping decoder for l-burst-error-correcting cyclic codes with neat block diagram.	10
b.	The polynomial $P(x) = 1+X+X^4$ is a primitive polynomial over GF(2). Find the generator polynomial or a fire code that is capable of correcting any single error burst of length 4 or less. What is the length of this code? Devise a simple error trapping decoder for this code.	10
10 a.	Define ARQ and explain different ARQ schemes.	6
b.	Explain selective repeat ARQ with finite receiver buffer size of N = 7.	8
c.	Explain how hybrid ARQ can be an advantage by comparing its throughput traditional ARQ schemes.	6

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