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

(An Autonomous Institution affiliated to VTU, Belgaum)

Eighth Semester, B.E. – Electronics and Communication Engineering Semester End Examination; June -2016

Error Control Coding

Time: 3 hrs

Max. Marks: 100

Note: Answer any **FIVE** full questions, selecting at least **TWO** full questions from each part.

PART - A

1 a. Describe (n, k) hamming code with a minimum distance of $d_{min} = 3$ and message length of 4 bits.

i) Construct G and H matrix.

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ii) List all the code vectors.

iii) What is the error correcting capability?

b. In a (7, 4) linear block code the parity check matrix H is given by,

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

i) Find the Generator matrix G.

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ii) Find the code word for all the messages.

iii) Find the minimum distance between the codes.

iv) Write the encoder and decoder circuit.

v) If the received data is 1011011 is it a valid code. If code is not valid, assuming single error, write the valid code.

2 a. Explain the LDPC codes for a graph with 6 vertices and 10 edges.

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b. Explain different ways for decoding the LDPC codes.

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3 a. A (15, 5) cyclic code has a generator polynomial.

$$G(x) = 1 + x + x^2 + x^4 + x^5 + x^8 + x^{10}$$

i) Draw the block diagram of the encoder.

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ii) Find the code polynomial for the message polynomial $D(x) = 1 + x^2 + x^4$ in the systematic form.

iii) Is $V(x) = 1 + x^4 + x^6 + x^8 + x^{11}$ code polynomial?

b. Find H and G matrix for a (7, 4) cyclic code generated by $g(x) = 1 + x + x^3$.

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4 a. Explain with a neat diagram encoding circuit for a (9, 3) quasi cyclic – code.

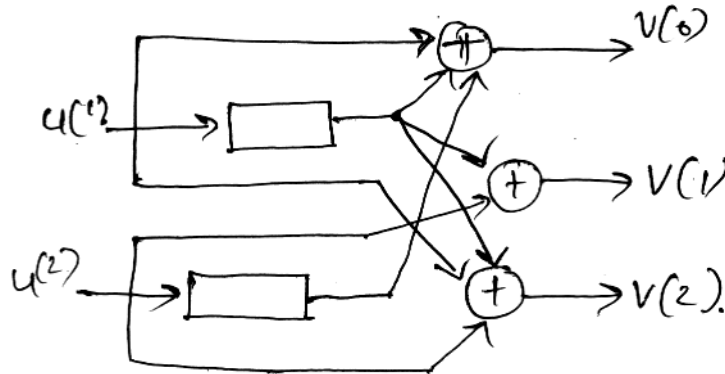
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b. Write a decoding circuit for the (31, 26) cyclic hamming code generated by $g(x) = 1 + x^2 + x^5$.

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PART - B

5 a. A rate of $R = 2/3$ non systematic feed forward convolutional encoder (3, 2, 1) shown in Fig. below. Find the code word C for I/P sequence using convolution and matrix approach.



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b. Consider (3, 1, 5) systematic feed forward encoder with $g^{(0)} = (1\ 0\ 1\ 1\ 0\ 1)$ $g^{(1)} = (1\ 1\ 0\ 0\ 1\ 1)$

i) find time domain G.

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ii) Find the sequence $V^{(1)}$ and $V^{(2)}$ for the I/P sequence $u = 1101$.

6 a. Explain the two state turbo encoder with the diagram.

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b. Write a short note on:

i) construction of good convolutional code

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ii) Design of turbo codes.

7 a. Assuming that the transmitted symbols drawn from M – ary signal constellation in either one – two Euclidean space derive the expression for constellation expression factor and distance gain factor.

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b. Write basic steps in designing a TCM system.

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8 a. Explain encoder for STTC.

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b. Derive an expression for upper bounds on error event probability.

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