6E6095

Roll No. :

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B. Tech. (Sem. VI) (Main / Back) Examination, April-May - 2018
Information Technology
6IT5A Information Theory & Coding

Time : 3 Hours] **[Maximum Marks : 80**
[Min. Passing Marks : 26

*Attempt any **five questions**, selecting **one question** from **each unit**. All Questions carry **equal** marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used calculated must be stated clearly.*

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL 2. NIL

UNIT - I

1 (a) If there are M equally likely and independent symbols then prove that amount of information carried by each symbol will be

$I(X_i) = N$ *bits*

where $M = 2^N$ [N is integer]

(b) Verify the following expression : 6

$0 \leq H(X) \leq \log_2 M$

where M is size of alphabet of X. 10

OR

1 (a) Given a Binary channel in Fig. 1.

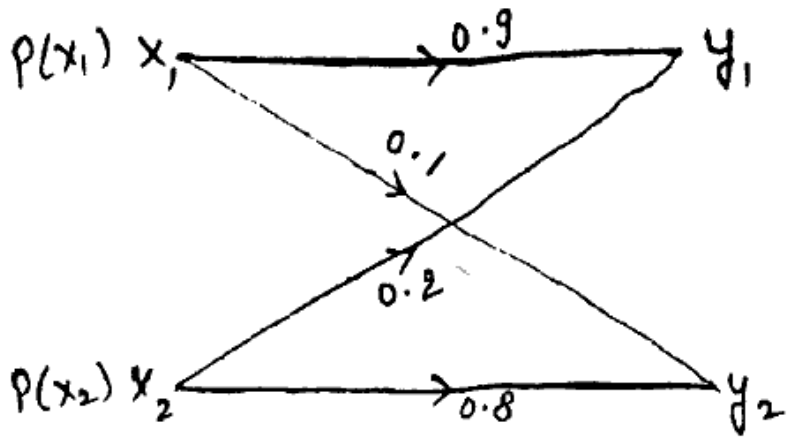

Fig. 1

(i) Find channel matrix of the channel.

(ii) Find $P(y_1)$ and $P(y_2)$ when $P(x_1) = P(x_2) = 0.5$

(iii) Find the point probability $P(x_1 y_2)$ and $P(x_2 y_1)$ when $P(x_1) = P(x_2) = 0.5$.

10

(b) Define entropy and derive the expression of it.

6

UNIT - II

2 (a) Prove that the channel capacity of additive white Gaussian Noise channel is given by :

$$C = B \log_2 \left(1 + \frac{S}{N}\right)$$

where B = Bandwidth of channel
N = Noise power
S = Signal power.

10

(b) Explain Lempel Ziv coding.

6

OR

2 (a) A DMS X has four symbols x_1, x_2, x_3, x_4, x_5 with probability $P(x_1) = \frac{1}{2}$, $P(x_2) = \frac{1}{4}$ and $P(x_3) = P(x_4) = \frac{1}{8}$. Construct a Shannon fano code and calculate the code efficiency. **8**

(b) What is the meaning of implications of Shannon Hartley theorem ? **8**

UNIT - III

3 (a) Explain working of syndrome decoder for (n, k) block code. **8**

(b) Prove that $GH^T = HG^T = 0$ for a systematic linear block code. **8**

OR

3 The parity check matrix of a (7, 4) LBC is given by

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

(i) Find the Generator Matrix (G).
(ii) List all the code vectors.
(iii) What is minimum distance between the code vector ?
(iv) How many errors can be detected ? And how many can be corrected ? **16**

UNIT - IV

4 (a) Design an Encoder for (7, 4) cyclic code generated by generator polynomial $G(P) = P^3 + P + 1$. Also verify its operation for any one message words **8**

(b) How error correction in systematic cyclic code is done ? Explain in detail. **8**

OR

4 (a) Compare cyclic code and linear block code. **8**

(b) The generator polynomial of a (7, 4) cyclic code is given by $G(P) = P^2 + P + 1$. Then find the code vector in non-systematic form by assuming M = {0 1 0 1}. **8**

UNIT - V

5 (a) What are advantages of Viterbi decoding algorithm ? Explain in detail. **8**

(b) Consider the convolution encoder shown in Fig. 2.

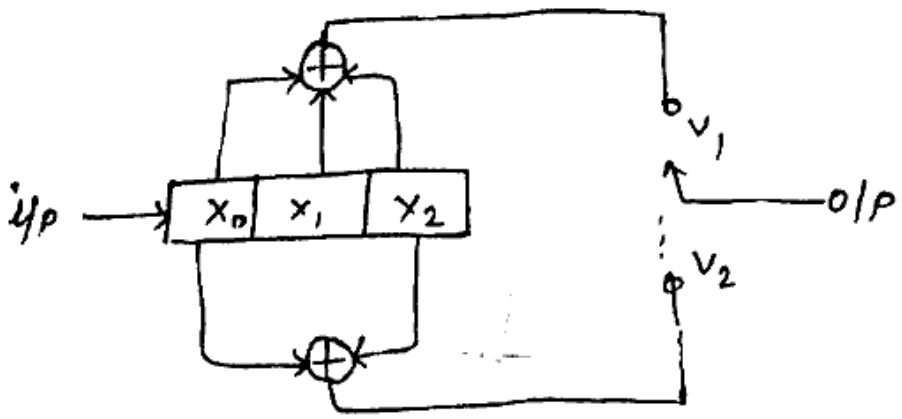

Fig. 2

(1) Find the impulse response of encoder.

(2) Find the output code word if the i/p sequences is all 1's. (111111....). **8**

OR

5 (a) Describe maximum likelihood of decoding of convolutional code. **8**

(b) Explain following with examples

(i) Code tree

(ii) Code trellis

(iii) Free distance

(iv) State diagram. **8**