Code No: R193104A **R19** **SET - 1**

III B. Tech I Semester Supplementary Examinations, June/July-2022

INFORMATION THEORY & CODING

(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions **ONE** Question from **Each unit**
All Questions Carry Equal Marks
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UNIT-I

1 a) Define coding efficiency. Derive the relation between coding efficiency and entropy. [8M]

b) A source emits independent sequence of symbols from an alphabet consisting of five symbols from an alphabet with probabilities 1/4, 1/8, 1/8, 3/16, 5/16 respectively. Find the Shannon code using Shannon encoding algorithm and compute the efficiency. [7M]

(OR)

2 a) What is information? Show that amount of information is equal to $-\log p(x_j)$? [8M]

b) A source produces six message with probabilities 1/4, 1/4, 1/8, 1/8, 1/8, 1/8. Obtain the information content of each message and the entropy. [7M]

UNIT-II

3 a) Derive the relation between mutual information and entropy. [8M]

b) A Gaussian channel has bandwidth of 1MHz. [7M]

(i) Calculate the channel capacity if the signal power to noise spectral density ratio is 10^5 Hz.

(ii) Find the maximum information rate.

(OR)

4 a) Prove I(X;Y) = I(Y;X). [8M]

b) What is channel capacity and channel efficiency? Define redundancy. [7M]

UNIT-III

5. a) For a systematic (6, 3) linear block code, the parity matrix 'P' is given by P = [8M]

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

(i) Construct table for code words.

(ii) If the received bit pattern R = [1 0 1 1 0 0], determine the syndrome, correctable error pattern and corrected code vector for a single bit error.

b) Justify [7M]
(i) For a 2 bit error detection $d_{min} = 2$
(ii) For a single bit error correction $d_{min} = 3$

(OR)

6. a) Explain the following terms with necessary equations [8M]
(i) Minimum distance
(ii) Syndrome
(iii) Generator matrix
(iv) Parity check matrix
b) Compare coded systems and un-coded system. [7M]

UNIT-IV

7. a) Design encoder for the (7, 4) binary cyclic code generated by $g(x) = 1 + x + x^3$ and verify the operation using the message vector {1 0 0 1}. [8M]
b) (i) Differentiate systematic and non-systematic cyclic codes. [7M]
(ii) Briefly explain cyclic hamming codes.

(OR)

8. a) Write the decoding procedure for BCH codes. [8M]
b) For the (7, 4) single error correcting cyclic code using generator polynomial $g(x) = 1 + x + x^3$. Find all code vectors in systematic form. [7M]

UNIT-V

9. a) A convolution encoder has three flip flops, three modulo-2 adders and an output multiplexer. The generator sequence of the encoder are as follows: g(1) = (1, 0, 1), g(2) = (1, 1, 0), g (3) = (1, 1, Draw the block diagram of the Convolution encoder. Also find the convolution code for message sequence m ={1 1 0 1 0}. [8M]
b) What are convolutional codes? How are they different from block codes? [7M]

(OR)

10. a) Give the Viterbi Algorithm's procedural steps with an example. [8M]
b) If the input sequence is 1010, draw the code tree and specify the outputs at each state. [7M]

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