USN | | | | | | | | | |

17EC54

Fifth Semester B.E. Degree Examination, Jan./Feb. 2023
Information Theory and Coding

Time: 3 hrs.

Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Explain the terms:
   i)   Self Information
   ii) Average Information
   iii) Mutual Information
   iv) Efficiency
   v)   Redundancy. **(10 Marks)**
   b. Write the block diagram of digital communication system and explain. **(10 Marks)**

OR

2 a. What is Entropy? Explain properties of entropy. **(10 Marks)**
   b. Ina binary PCM, if '0' occur with probability 1/4 and '1' occur with probability 3/4, then calculate amount of information conveyed by each bit. **(10 Marks)**

Module-2

3 a. Explain KRAFT INEQUALITY theorem. **(10 Marks)**
   b. Explain Shannon's encoding algorithm. **(10 Marks)**

OR

4 a. Apply Shannon's encoding algorithm to the following messages $\{S_1, S_2, S_3\}$ with probabilities $\{0.5, 0.3, 0.2\}$ to find code-words and also find code-efficiency and redundancy. **(10 Marks)**
   b. Explain properties of codes. **(10 Marks)**

Module-3

5 a. Consider a binary channel shown in Fig.Q.5(a) given below.

Fig.Q.5(a)
   i)   Find the 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 joint probabilities $P(x_1, y_2)$ and $P(x_2, y_1)$ when $P(x_1) = P(x_2) = 0.5$. **(10 Marks)**
   b. For a noiseless channel with an input symbols and m output symbols. Prove that $H(X) = H(Y)$ and $H(Y/X) = 0$. **(10 Marks)**

OR

6 a. State and discuss Shannon's theorem on channel capacity.   (10 Marks)
   b. A binary channel has the following characteristics:

$$P(Y/X) = \begin{bmatrix} 2/3 & 1/3 \\ 1/3 & 2/3 \end{bmatrix}$$

   If input symbols an transmitted with probabilities 3/4 and 1/4 respectively, find entropies
   $H(X)$, $H(X, Y)$ and $H(Y/X)$.   (10 Marks)

Module-4

7 a. With a neat block diagram and a suitable example, explain the error-control based
       communication system.   (10 Marks)
   b. Distinguish between "block codes" and "convolutional codes".   (10 Marks)

OR

8 Consider a (6, 3) linear code whose generator matrix is

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

   i)   Find all code vectors.
   ii)   Find all Hamming weights and distances.
   iii) Find minimum weight parity check matrix.
   iv)   Draw the encoder circuit for the above codes.   (20 Marks)

Module-5

9 a. Write a note on: i) Golay codes   ii) BCH codes.   (10 Marks)
   b. Discuss the various properties of cyclic codes.   (10 Marks)

OR

10 Explain encoding of convolution codes using transform-domain approach, with an examples.
                                                                              (20 Marks)

* * * * *