## B-TECH (SEM VII) THEORY EXAMINATION 2022-23 INFORMATION THEORY & CODING

Roll No.

Time: 3 Hours

Note: Attempt all Sections. If require any missing data; then choose suitably.

## SECTION A

## 1. Attempt *all* questions in brief.

- (a) What is conditional entropy?
- (b) "Sun rises in the south". This statement contain what amount of information
- (c) What is Kraft's Inequality?
- (d) What is optimal solution for a source coding?
- (e) On which parameters does channel capacity depend?
- (f) What is Noisy Channel? Determine its matrix representation
- (g) What is Hamming Distance? Give Example
- (h) What are prefix code? State
- (i) What are parity bits and its importance?
- (j) What does k determine in convolution coding?

## SECTION B

## 2. Attempt any *three* of the following:

- (a) A discrete source emits one of five symbols once every seconds with probabilities 1/2, 1/4, 1/8, 1/16 and 1/16. Find the source entropy and information rate
- (b) A Memory less source emits six messages with probabilities X  $\{0.3, 0.2, 0.2, 0.1, 0.1, 0.05, 0.05\}$ 
  - Find the Shannon Fano code and determine its efficiency
- (c) Give the relation between channel capacity C, bandwidth W and signal to noise ratio S/N of a AWGN channel. Explain the trade-off between them
- (d) A generator matrix for a (6, 3) block code is given below

11	0	U	U	1	11
0	1	0	1	0	1
Lo	0	1	1	1	L٥

- (i) List all the code vectors
- (ii) How may errors can be corrected and detected
- (e) Explain the working of (2,1,3) convolutional encoder using transform domain approach.

SECTION C



- (a) Show that I(X;Y):H(X)+H(Y)-H(X,Y). List out the properties of Mutual information prove any two properties?
- (b) Explain what is log sum inequality and list it applications?

# Total Marks: 100

Sub Code:KEC-075

 $2 \ge 10 = 20$ 

 $10 \times 1 = 10$ 

 $10 \ge 1 = 10$ 

#### 4. Attempt any one part of the following:

- (a) What is meant by stop-and-wait ARQ? Explain.
- (b) Construct the Huffman code with minimum code variance for the following probabilities and also determine the code variance and code efficiency:  $\{0.25, 0.25, 0.125, 0.125, 0.125, 0.0625, 0.0625\}$

#### 5. Attempt any one part of the following:

- (a) A BSC has the error probability p = 0.2 and the input to the channel consists of 4 equiprobable messages
  - $x_1 = 000; x_2 = 001; x_3 = 011; x_4 = 111.$  Calculate
    - i) p(0) and p(1) at the input
    - ii) Efficiency of the code
    - iii) Channel capacity
- (b) Two binary symmetric channel with error probability 0.1, are cascaded as shown below and P (0) = 0.25.Calculate I (X,Y)and I (X,Z).



### 6. Attempt any *one* part of the following:

(a) The Generator matrix(G) for a (7, 4) block code is given below

Find code vectors (ii)

(b) Draw and explain the block diagram of ARQ system in detail

#### 7. Attempt any one part of the following:

(a) Consider the convolutional encoder shown in Figure 1. The message bits are shifted into the encoder two bits at a time. Assume the initial content of the registers to be zero and find the code block for the input message block 11010



(b) Design a convolutional coder of constraint length 6 and rate efficiency ½.Draw its tree diagram and trellis diagram

## $10 \ge 1 = 10$

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 $10 \ge 1 = 10$