**20ECD11**

**Hall Ticket Number:**

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| **III/IV B.Tech (Regular) DEGREE EXAMINATION** | | | |
| **February, 2023** | **Electronics & Communication Engineering** | | |
| **Fifth Semester** | **Information Theory & Coding** | | |
| **Time:** Three Hours | | **Maximum: 7**0 Marks | |
| *Answer Question No. 1 Compulsorily.* | | | (14X1 = 14 Marks) |
| *Answer* ***ANY ONE*** *question from each Unit.* | | | (4X14=56 Marks) |
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| 1. | a) | What is mutual information? | CO1 | L1 | 1M |
|  | b) | What is the information rate? | CO1 | L1 | 1M |
|  | c) | Define source efficiency. | CO1 | L1 | 1M |
|  | d) | Write the formula for Huffman coding efficiency . | CO1 | L2 | 1M |
|  | e) | What is meant by the error detecting and error correcting capability of a code? | CO2 | L2 | 1M |
|  | f) | What is the minimum distance of linear block codes? | CO2 | L2 | 1M |
|  | g) | What it signifies if the received code word has a syndrome equal to zero? | CO2 | L2 | 1M |
|  | h) | What is the minimum hamming distance of the coding scheme d(000, 011)? | CO2 | L2 | 1M |
|  | i) | What is BCH code? | CO3 | L1 | 1M |
|  | j) | Define Hamming distance. | CO3 | L1 | 1M |
|  | k) | Explain properties of cyclic codes. | CO3 | L3 | 1M |
|  | l) | Define state diagram. | CO4 | L1 | 1M |
|  | m) | Distinguish between linear block codes and convolution codes. | CO4 | L4 | 1M |
|  | n) | What is the Trellis diagram? | CO4 | L1 | 1M |
| **Unit -I** | | | | | |
| 2. | a) | Explain the Huffman code with an example. | CO1 | L1 | 7M |
|  | b) | For the given message signal S = {s1, s2, s3, s4, s5, s6, s7} with probabilities P = {0.45, 0.15, 0.12, 0.08, 0.08, 0.08, 0.04} construct a binary code and determine its efficiency using Shannon – Fano coding procedure. | CO1 | L3 | 7M |
|  |  | **(OR)** |  |  |  |
| 3. | a) | Explain Run Length code with an example. | CO1 | L2 | 7M |
|  | b) | If X and Y are discrete random sources and *P(X,Y)* is their joint probability  distribution and is given as  Solve *H(X), H(Y), H(X/Y), H(Y/X), H(X, Y) and I(X,Y)*. | CO1 | L3 | 7M |
|  |  | **Unit -II** |  |  |  |
| 4. | a) | Discuss about systematic linear block codes. | CO2 | L1 | 7M |
|  | b) | The parity matrix of a (6, 3) linear systematic block code is given below  i) Find all the possible code vectors.  ii) Find out the minimum distance of the code.  iii) How many errors can be detected and corrected by this code? | CO2 | L3 | 7M |
|  |  | **(OR)**  **P.T.O**  **20ECD11** | | | |
| 5. | a) | Discuss the encoder implementation of Linear Block codes. | CO2 | L2 | 7M |
|  | b) | Construct the standard array for a (6, 3) linear block code whose generator matrix is given below:  Decode the received vector 1 1 1 1 0 0. | CO2 | L3 | 7M |
|  |  | **Unit -III** | |  |  |
| 6. | a) | Define the minimum distance of a code. How is it important in error detection and correction? | CO3 | L1 | 7M |
|  | b) | A channel encoder uses a (7, 4) linear systematic cyclic code in the systematic form, the generator polynomial being *x3 + x + 1*. Determine the correct codeword transmitted if the received word is  (i) 1011011 (ii) 1101111 | CO3 | L3 | 7M |
|  |  | **(OR)** |  |  |  |
| 7. | a) | Explain Decoding procedure for BCH codes | CO3 | L2 | 7M |
|  | b) | For (7,4) cyclic code, the received vector *r(x) =* 1 1 1 0 1 01 1, and the generator polynomial is *g(x) =* *1 + x + x2*. Draw the syndrome calculation circuit and correct the single error in the received vector. | CO3 | L3 | 7M |
|  |  | **Unit -IV** |  |  |  |
| 8. | a) | Explain decoder for cyclic code with the help of a block diagram | CO4 | L2 | 7M |
|  | b) | Draw a (2,1,2) convolutional encoder with the feedback polynomials as  *g1(x)=1+x+x2* and *g2(x)= 1+x2*. Draw the code tree and trace output for input  sequence 10011. | CO4 | L3 | 7M |
|  |  | **(OR)** |  |  |  |
| 9. | a) | Explain Viterbi Algorithm. | CO4 | L2 | 7M |
|  | b) | Consider a convolution encoder with g(1) = (1 1 1), g(2) = (1 0 1) .  (i) Draw a state transition table and state diagram.  (ii) Find the encoder output by traversing through the state diagram for the input message sequence of ( 1 1 1 0 1) | CO4 | L3 | 7M |

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