

2020

## Information Theory and Coding

Full marks-70

Answer all

Time: 3 Hours

The figures in the right hand margin indicate marks

1. State Shannon's channel coding theorem for a discrete memoryless channel and discuss its utility in communication systems. 14

**OR**

Define entropy and amount of information. Write an expression for H. Suppose, one of four possible messages Q1, Q2, Q3 and Q4 having probabilities 1/8, 3/8, 3/8 and 1/8 respectively, is transmitted. Calculate the average information per message.

2. Define Shannon Hartley theorem and derive the channel capacity in terms of rate of transmission of information. Discuss about the bandwidth and SNR trade-off in this. 14

**OR**

(i) Discuss about the parity check bit for error detection. 6

(ii) Define a block code and find out the code rate for a (7,4) systematic code. 8

3. Using block coding and decoding principle, show how a ROM can be used for encoding process with a block diagram and necessary derivation to decode it using error syndrome. Transmitted message is [1 0 0 0 1 1 1], received message is [1 0 0 0 0 1 1], and H is given as:

$$H = \begin{bmatrix} 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 1 & 1 & 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 1 & 0 & 0 & 1 \end{bmatrix} \quad 14$$

**OR**

Comprehensively discuss about the Algebraic codes with suitable examples. 14

4. What is Convolutional code? Describe the methods of decoding the convolutional code. 14

**OR**

- (i) Discuss about Reed-Solomon code with example. Explain for a (255,223) RS code, how many symbols and consecutive bit errors can be corrected? What about error free regions? Also, can it be an efficient code for random errors, discuss? 7
- (ii) What is Huffman Coding? Draw the Huffman Tree with step by step procedure for the following example. 7

character	Frequency
a	5
b	9
c	12
d	13
e	16
f	45

5. What is channel coding? Discuss about the properties of LDPC codes in detail. Draw a Tanner graph for (7,4) Hamming code. 14

**OR**

Discuss about the principles and applications of Turbo code. Draw the structure of a rate 1/3 Turbo encoder and discuss its operation. 14

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