

CBCS SCHEME

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17EC54

Fifth Semester B.E. Degree Examination, June/July 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 with block diagram information systems. (10 Marks)
 b. Consider a discrete memoryless source with source alphabet $S = \{S_0, S_1, S_2\}$ with source statistics $\{0.7, 0.15, 0.15\}$
 i) Calculate the entropy of source
 ii) Calculate the entropy of the second order extension of the source. (10 Marks)

OR

- 2 a. Explain the properties of Entropy. (10 Marks)
 b. Write short note on measure of information and information ratio? (10 Marks)

Module-2

- 3 a. Explain Block code, Non singular code Instantaneous code, Optimal code. (10 Marks)
 b. Apply Shannon's encoding binary algorithm the following set of message and obtain code effect and resending

m_1	m_2	m_3	m_4	m_5
$\frac{1}{8}$	$\frac{1}{16}$	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{3}{8}$

(10 Marks)

OR

- 4 a. Write steps of Shannon Fano Encoding Algorithms. (10 Marks)
 b. Given the message S_1, S_2, S_3, S_4 with responding probabilities 0.4, 0.3, 0.2, 0.1 construct binary code by applying Huffman Encoding procedure. Determine efficiency and Redundancy. (10 Marks)

Module-3

- 5 a. Explain with Block diagram of communication channel. (10 Marks)
 b. In a communication system, a transmitter has 3 input symbols $A = \{a_1, a_2, a_3\}$ receiver also has 3 output symbols $B = \{b_1, b_2, b_3\}$. The matrix give below is JPM.

$a_i \backslash b_j$	b_1	b_2	b_3
a_1	$\frac{1}{12}$	*	$\frac{5}{36}$
a_2	$\frac{5}{36}$	$\frac{1}{9}$	$\frac{5}{36}$
a_3	*	$\frac{1}{6}$	*
$P(b_j)$	$\frac{1}{3}$	$\frac{14}{36}$	*

Fig Q5(b)

- i) Find the missing probabilities (*) in the table
 ii) Find $P(b_3/a_1)$ and $P(a_1/b_3)$

(10 Marks)

OR

- 6 a. For JPM given below, compute $H(x)$, $H(y)$, $H(x, y)$, $H(x/y)$, $H(y/x)$ and $I(x, y)$. Verify the relationship among these entropies

$$P(x, y) = \begin{bmatrix} 0.05 & 0 & 0.20 & 0.05 \\ 0 & 0.10 & 0.10 & 0 \\ 0 & 0 & 0.20 & 0.10 \\ 0.05 & 0.05 & 0 & 0.10 \end{bmatrix}$$

(10 Marks)

- b. Explain Binary Symmetric Channel (BSC). And Binary Erasure Channel (BEC) (10 Marks)

Module-4

- 7 a. Explain different types of Error. (10 Marks)
 b. Explain different methods of controlling error. (10 Marks)

OR

- 8 a. Explain in detail Linear block code. (10 Marks)
 b. For systematic (7, 4) linear block code, the parity matrix P is given by

$$[P] = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 1 \end{bmatrix}$$

- i) Find all possible valid code vectors (10 Marks)
 ii) Draw the corresponding encoding circuits.

Module-5

- 9 a. Explain in detail Golay code? (10 Marks)
 b. An Encoder for $(n, k, m) = (3, 1, 3)$ convolution code shown below Fig Q9(b). Explain operation of Encoder and hence. Obtain the output of Encoder.

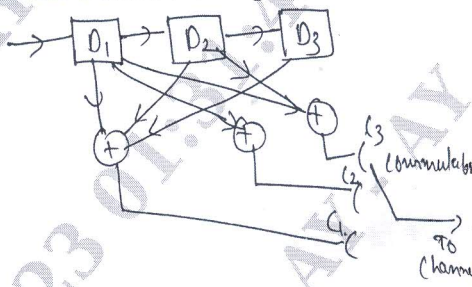


Fig Q9(b) (10 Marks)

OR

- 10 a. Let us consider (n, k, m) as $(2, 1, 3)$ convolution at encoder shown in Fig Q10(b). Find Encoder output using time domain approach for message sequence 10111?

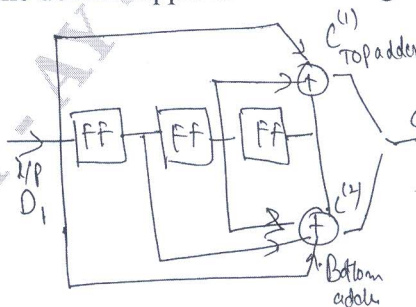


Fig Q10(b) (10 Marks)

- b. Explain Encoding of convolutional at using Transform domain approach with example. (10 Marks)