Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – May/June 2026

Date: 18-05-2026 **Time:** 01:00pm – 04:00pm

School: SOIS	**Program:** information Science and engineering	
Course Code: ISE2503	**Course Name:** Information Theory and Coding	
Semester: VI	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	CO1	CO2	CO3	CO4	CO5
Marks	20	20	20	20	20

Instructions:

(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks. 10Q x 2M=20M

1.	Define information and self-information.	**2 Marks**	**L1**	**CO1**
2.	What is the difference between independent and dependent symbol sequences?	**2 Marks**	**L1**	**CO1**
3.	State any two properties of entropy.	**2 Marks**	**L1**	**CO2**
4.	What is information rate?	**2 Marks**	**L1**	**CO2**
5.	define source coding.	**2 Marks**	**L1**	**CO3**
6.	What is a uniquely decodable code?	**2 Marks**	**L1**	**CO3**
7.	Define a discrete communication channel.	**2 Marks**	**L1**	**CO4**
8.	What is mutual information?	**2 Marks**	**L1**	**CO4**
9.	What is error detection?	**2 Marks**	**L1**	**CO5**
10.	What is error correction?	**2 Marks**	**L1**	**CO5**

Part B

Answer the Questions. **Total Marks 80M**

11.	**a.**	A source emits symbols with probabilities {0.5, 0.25, 0.15, 0.10}. Calculate the entropy of the source.	**20 Marks**	**L3**	**CO1**
	b.	Explain the properties of entropy with suitable examples.		**L2**	**CO1**
	c.	Describe Markov source and compute entropy for a simple two-state Markov model.		**L3**	**CO1**
		Or			
12.	**a.**	Define entropy and derive its expression. Explain its significance in communication systems.	**20 Marks**	**L2**	**CO1**
	b.	Distinguish between independent and dependent information sources with examples.		**L2**	**CO1**
	c.	A source produces symbols at a rate of 2000 symbols/sec with entropy 2 bits/symbol. Find the information rate.		**L3**	**CO1**

13.	**a.**	Construct a Huffman code for symbols with probabilities {0.4, 0.3, 0.2, 0.1}. Find average code length and efficiency.	**20 Marks**	**L3**	**CO2**
	b.	Explain Shannon–Fano coding with an example.		**L2**	**CO2**
	c.	State and prove Kraft-McMillan inequality.		**L4**	**CO2**
		Or			
14.	**a.**	Explain Shannon's noiseless coding theorem and its implications.	**20 Marks**	**L2**	**CO2**
	b.	Describe the Extended Huffman Coding algorithm. (b) Construct an extended Huffman code for a source with symbol probabilities {0.4, 0.3, 0.2, 0.1} considering pairs of symbols		**L4**	**CO2**
	c.	Explain Lempel-Ziv (LZ77) algorithm.		**L3**	**CO2**

15.	**a.**	Define mutual information and derive its properties.	**20 Marks**	**L2**	**CO3**
	b.	A Binary Symmetric Channel has crossover probability p = 0.1. Calculate channel capacity.		**L3**	**CO3**
	c.	Explain Shannon's second theorem and its significance.		**L2**	**CO3**
		Or			

16.	**a.**	Find the capacity of the Gaussian channel with a bandwidth of 10 MHz and the SNR is 10 dB.	**20 Marks**	**L2**	**CO3**
	b.	Explain different types of communication channels: BSC, BEC, noiseless channel.		**L3**	**CO3**
	c.	Consider a discrete communication channel with 3 inputs and 4 outputs. The incomplete channel matrix of that channel is as given below. Complete the channel matrix and also draw its channel diagram. $$P\begin{pmatrix}Y\\X\end{pmatrix}=\begin{bmatrix}0.5 & 0.2 & * & 0.1\\0.4 & 0.1 & 0.5 & *\\0.3 & * & 0.2 & 0.4\end{bmatrix}$$		**L2**	**CO3**

17.	**a.**	Define linear block codes and explain generator matrix.	**20 Marks**	**L2**	**CO4**
	b.	For a given parity-check matrix, determine syndrome and detect error.		**L3**	**CO4**
	c.	Explain Hamming codes and their error correction capability.		**L2**	**CO4**
		Or			
18.	**a.**	Explain syndrome decoding with an example.	**20 Marks**	**L3**	**CO5**
	b.	Construct a (7,4) Hamming code and encode a message.		**L3**	**CO5**
	c.	Discuss real-world applications of error control coding.		**L2**	**CO5**