Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

Mid - Term Examinations – MARCH 2026

Date: 10- 03- 2026 **Time:** 09:30am – 11:00am

School: SOE	**Program:** B.TECH/ECE	
Course Code :ECE3012	**Course Name:** INFORMATION THEORY AND CODING	
Semester: VI	**Max Marks**:50	**Weightage**:25%

CO - Levels	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Marks	**14+7**	**6+15+8**			

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. **5Q x 2M=10M**

1	Explain the Extremal Property of Entropy	**2 Marks**	**L2**	**CO1**
2	List the properties of different types of codes	**2 Marks**	**L1**	**CO2**
3	Explain non-singular and singular code with an example	**2 Marks**	**L2**	**CO2**
4	Differentiate between source efficiency and code efficiency	**2 Marks**	**L1**	**CO2**
5	Define information rate	**2 Marks**	**L1**	**CO1**

Part B

Answer the Questions. **Total Marks 40M**

6.	**a.**	The output of an information source contains 160 symbols. 128 of them occur with probability of 1/256 and the remaining with probability of 1/64 each. Find the average information content and average information rate of the source if the source emits 10,000 symbols/sec.	**5 Marks**	**L2**	**CO1**
	b.	A discrete memoryless source emits 5 symbols in 2 ms. The symbol probabilities are {0.5,0.25,0.125,0.0625,0.0625} Find the entropy and the average information rate of the source.	**5 Marks**	**L2**	**CO1**
		Or			
7.	**a.**	Consider a zero memory source emitting 3 symbols X, Y & Z with respective probabilities **0.6, 0.3 & 0.1.** Calculate: i. Entropy of the source ii. All the symbols & their corresponding probabilities for second extension, also find the entropy. iii. Prove that **$H(S^2) = 2\ H(S)$**	**5 Marks**	**L2**	**CO1**
	b.	An analog signal is bandlimited to 500 Hz & is sampled at the Nyquist rate. The samples are quantized into 4 levels. The quantization levels are assumed to be independent & occur with probability **$P_1=P_4=1/8$,$P_2=P_3=3/8$**.Find the information rate.	**5 Marks**	**L2**	**CO1**

8.	**a.**	Consider a source S={s1,s2} with probabilities **P=3/4,1/4** respectively. Obtain the **Shannon Fano code** for the source S, its 2nd extension. Calculate the efficiency for each case.	**10 Marks**	**L3**	**CO2**
	b.	Determine the given code is instantaneous or not A={00,01,10,11} using Kraft-McMillan Equality and Prefix Property and draw the tree	**5 Marks**	**L3**	**CO2**
		Or			
9.	**a.**	An information source produces a sequence of independent symbols S={A,B,C,D,E,F,G} with probabilities **P={1/3, 1/27, 1/3, 1/9, 1/9, 1/27, 1/27}** Construct binary using the Huffman encoding procedure and also find its efficiency**.**	**15 Marks**	**L3**	**CO2**

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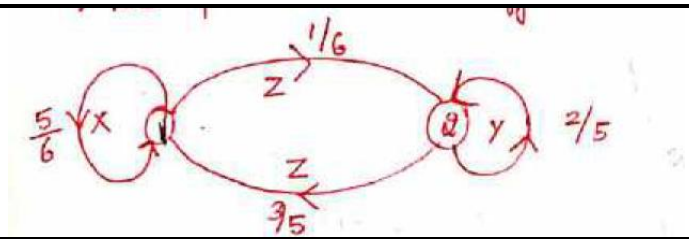
10.	**a.**	A source emits an independent sequence of symbols from an alphabet consisting of five symbols A,B,C,D,E with probabilities of **{1/4, 1/8, 1/8, 3/16, 5/16}** use the **Shannon first encoding algorithm** to binary code for each symbol and the efficiency of the coding scheme**.**	**8 Marks**	**L3**	**CO2**
	b.	For the markov source shown below find i) State entropies ii)Source entropy iii) G1 G2 and show that $G1 \geq G2 \geq H(s)$. where initial Probabilities are given as **P(1)=18/23 and P(2)=5/23**	**7 Marks**	**L2**	**CO1**

					
Or					
11.	**a.**	An information source produces a sequence of independent symbols S=A,B,C,D,E,F, Gwith probabilities probabilities **P={1/3, 1/27, 1/3, 1/9, 1/9, 1/27, 1/27}** Construct ternary codes using the Huffman encoding procedure and also find its efficiency.	**8 Marks**	**L3**	**CO2**
	b.	A code is composed of dots and dashes. Assume that a dash is 3 times as long as a dot and has one-third the probability of occurrence. Calculate: (i) The information in a dot and a dash. (ii) The entropy of the dot–dash code. (iii) The average rate of information if a dot lasts for 10 ms and this time is allowed between symbols.	**7 Marks**	**L2**	**CO1**