Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – MAY 2025

Date: 24-05-2025 **Time:** 09:30 am – 12:30 pm

School: SOE	**Program**: B. Tech(Electronics and Communication Eng**g)**	
Course Code : ECE3012	**Course Name:** Information Theory and Coding	
Semester: VI	**Max Marks**:100	**Weightage**: 50%

CO - Levels	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Marks	**22**	**22**	**28**	**28**	**NA**

Instructions:

(i) Read all questions carefully and answer accordingly.

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

Part A

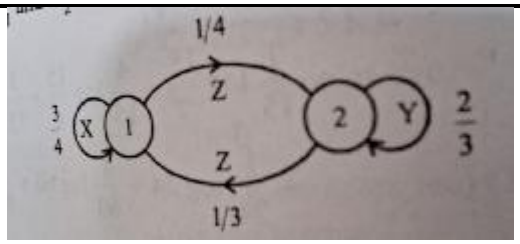
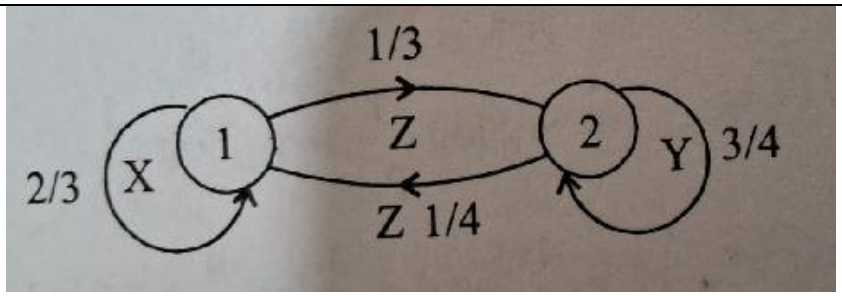
Answer ALL the Questions. Each question carries 2marks. **10Q x 2M=20M**

1.	Differentiate between source encoder and channel encoder	2 Marks	L1	CO1
2.	Draw the code diagram for the following codes S1={00}, S2={01}, S3={101}, S4={ 1100}, S5={1110}	2 Marks	L1	CO2
3.	For a coding technique of ternary code, seven symbols are available. Is it possible to code using Huffman coding without adding dummy symbols	2 Marks	L1	CO3
4.	Brief about different types of classification of codes	2 Marks	L1	CO4
5.	List different properties of Mutual Information	2 Marks	L1	CO3
6.	A JPM is given by P(X,Y) = 0.05 0 0.2 0.05 0 0.1 0.1 0 0 0 0.2 0.1 0.05 0.05 0 0.1	2 Marks	L1	CO3

	Find all input probabilities and output probabilities			
7.	Write the mathematical equation for channel efficiency and channel redundancy	2 Marks	L1	CO3
8.	List different special channels available.	2 Marks	L1	CO4
9.	What is the importance of parity bits or check bits in block codes	2 Marks	L1	CO4
10.	A continuous channel is having the band width of 5khz and S/N ratio of 10 db, Calculate the channel capacity	2 Marks	L1	CO4

Part B

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

11.	**a.**	 For the state diagram of the Maokoff source shown above, find (i) entropy H of the source **(ii) Find G1 and G2 and hence show that G1>G2>H**	**20 Marks**	**L2**	**CO 1**
		Or			
12.	**a.**	 **For the state diagram of the Markoff source shown above, find** **(i) Entropy H of the source** **(ii) G1, G2 and G3 and verify G1>G2>G3>H**	**20 Marks**	**L2**	**CO 1**

13.	**a.**	A source emits an independent sequence of symbols from an alphabet consisting of five symbols A, B, C, D and E with probabilities of ¼, 1/8, 1/8, 3/16 and 5/16 respectively. Find the Schannon code for each symbol and efficiency of the coding scheme.	**10 Marks**	**L2**	**CO 2**

	b.	A discrete memoryless source has an alphabet of seven symbols with probabilities for its output, as described below **symbols** | **S0** | **S1** | **S2** | **S3** | **S4** | **S5** | **S6** **Probability** | 0.25 | 0.25 | 0.125 | 0.125 | 0.125 | 0.0625 | 0.0625 Construct Schannon Fano code for this source and calculate code efficiency and redundancy.	10 Marks	**L2**	**CO 2**
		Or			
14.	**a.**	Design a binary and quaternary source code for the source shown below using Huffman coding procedure. Calculate the code efficiency in both cases and comment on the result **S={S1, S2, S3, S4, S5, S6, S7}** **P={ 9/32, 3/32, 3/32, 2/32, 9/32, 3/32, 3/32}** **X={0, 1, 2, 3} and X={0, 1}**	**20 Marks**	**L2**	**CO 2**

15.	**a.**	For the JPM given below, Calculate different entropies H(X), H(Y), H(X,Y), H(X/Y), H(Y/X) and I(X,Y). Verify the relationship among these entropies **P(A,B)=** **0.25 0 0 0** **0.10 0.30 0 0** **0 0.05 0.10 0** **0 0 0.05 0.1** **0 0 0.05 0**	**20 Marks**	**L3**	**CO 3**
		Or			
16.	**a.**	A binary symmetric channel has the following noise matrix with source probabilities of P(x1) = 2/3 and P(x2) = 1/3. P(Y/X) = ¾ ¼ ¼ ¾ (i) Determine H(X), H(Y), H(X,Y), H(Y/X), H(X/Y) and I(X,Y) **(ii)** Find channel capacity, efficiency and redundancy	**15 Marks**	**L3**	**CO 3**
	b.	A CRT terminal is used to enter alphanumeric data into a computer. The CRT is connected through voice grade telephone line having usable bandwidth of 3KHz and an output (S/N) of 10 dB. Assume that the terminal has 128 characters and data is sent in an independent manner with equal probability. Find	**5 Marks**	**L3**	**CO 3**

		(i) The average information per character (ii) Capacity of the channel **(iii)** Find the max rate at which data can be sent from terminal to the computer without error			

17.	**a.**	For a systematic (7,4) Linear Block Code, the parity matrix P is given by **P= 1 1 1** **1 1 0** **1 0 1** **0 1 1** Find all possible valid code vectors. Draw the corresponding encoding circuit	**10 Marks**	**L3**	**CO4**
	b.	**For a systematic (6,3)Linear Block Code, the received code vector is R=[110010]and the parity matrix is given by** **P= 1 0 1** **0 1 1** 1 1 0 Detect and correct the single error that has occurred due to noise.	10 Marks	**L3**	**CO4**
		Or			
18.	**a.**	For a systematic (7,4) Linear Block Code, the parity matrix P is given by **P= 1 1 1** **1 1 0** **1 0 1** **0 1 1** (i) Find all possible valid code-vectors. (ii) Draw the corresponding encoding circuit (iii) A single error has occurred in each of these received vectors. Detect and correct those errors. (a)R_A =[0111110] (b) R_B=[1010000] **(iv)** Draw the syndrome calculation circuit	**15 Marks**	**L3**	**CO4**
	b.	Discuss different types of errors that may affect the signal during transmission in the channel	**5 Marks**	**L3**	**CO4**