



PRESIDENCY UNIVERSITY

BENGALURU

Roll No.														
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End - Term Examinations - May/June 2026

Date: 14 - 05- 2026

Time: 01:00pm - 04:00pm

School: SOE	Program: B.Tech	
Course Code: ECE3012	Course Name: Information Theory and coding	
Semester: VI	Max Marks: 100	Weightage: 50%

CO - Levels	C01	C02	C03	C04	C05	C06
Marks	12	16	18	12	20	20

Instructions:

- Read all questions carefully and answer accordingly.
- 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	Explain the Extremal Property of Entropy	2 Marks	L2	C01
2	List the properties of different types of codes	2 Marks	L1	C02
3	Explain non-singular and singular code with an example	2 Marks	L2	C02
4	Differentiate between source efficiency and code efficiency	2 Marks	L1	C02
5	Explain the relationship between channel capacity and information rate	2 Marks	L1	C03
6	Express Mutual information in terms of joint entropy	2 Marks	L1	C03
7	Define symmetric/ Uniform channel	2 Marks	L2	C03
8	List different methods available for controlling errors in communication system	2 Marks	L1	C04

9	State Shannon's Hartley law for channel capacity	2 Marks	L1	C03
10	List the properties of standard array	2 Marks	L1	C06

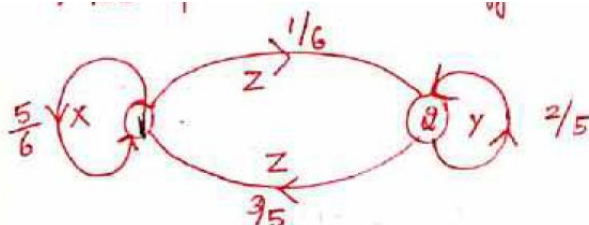
Part B

Answer the Questions.

Total Marks 80

11.	A card is drawn from a deck. (i) You are told it is a spade. How much information did you receive? (ii) How much information did you receive if you are told that the card drawn is an ace? (iii) If you are told that the card drawn is an ace of spades, how much information did you receive? (iv) Is the information obtained in (iii) equal to the sum of the informations obtained in (i) and (ii)?	10M	L3	C01
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or

12.	For the given state diagram, find: a) Entropy of each state & total entropy. b) Find G_1 and G_2. Also verify $G_1 > G_2 > H$ 	10M	L2	C01
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13.	A source emits an independent sequence of symbols from an alphabet consisting of five symbols A,B,C,D,E with probabilities of $\{1/4, 1/8, 1/8, 3/16, 5/16\}$ Find the Shannon fano code for each symbol and the efficiency of the coding scheme.	10Marks	L3	C02
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or

14.	An information source produces a sequence of independent symbols $S=A,B,C,D,E,F$, with probabilities $P=\{1/3, 1/4, 1/8, 1/8, 1/12, 1/12\}$ Construct ternary codes using the Huffman encoding procedure and also find its efficiency	10Marks	L3	C02
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15.	For the given channel matrix $P(B/A)$ of a Noiseless Channel , Prove that it is indeed Noiseless and find its Channel Capacity. $P(B/A) =$ <table><tr><td></td><td>b1</td><td>b2</td><td>b3</td><td>b4</td><td>b5</td><td>b6</td></tr><tr><td>a1</td><td>1/2</td><td>1/2</td><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>a2</td><td>0</td><td>0</td><td>3/5</td><td>3/10</td><td>1/10</td><td>0</td></tr><tr><td>a3</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td></tr></table>		b1	b2	b3	b4	b5	b6	a1	1/2	1/2	0	0	0	0	a2	0	0	3/5	3/10	1/10	0	a3	0	0	0	0	0	1	10Marks	L3	C03
	b1	b2	b3	b4	b5	b6																										
a1	1/2	1/2	0	0	0	0																										
a2	0	0	3/5	3/10	1/10	0																										
a3	0	0	0	0	0	1																										

Or

16.	Alphanumeric data are entered into a computer from a remote terminal through a voice grade telephone channel. The channel has a Bandwidth of 3.4KHz and output signal to Noise Ratio of 20dB. The terminal has a total of 128 symbols. Assume that the symbols are equiprobable and the successive transmission are statistically independent. a) Calculate the channel Capacity b) Find the average information content per character c) Calculate the maximum symbol rate for which Error-Free transmission over the channel is possible.	10Marks	L3	C03
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17.	For a Systematic (6,3) Linear Block Codes, the Parity Matrix P is given by [P]. [P] = <table><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>1</td><td>0</td></tr></table> Find all the Possible Code-Vectors. Find the Hamming Weight of the code-vectors.	1	0	1	0	1	1	1	1	0	10Marks	L3	C04
1	0	1											
0	1	1											
1	1	0											

or

18	For the systematic (6, 3) code the code-vector C for a message input of (d_1, d_2, d_3) is given by $[C] = [d_1, d_2, d_3, (d_1 + d_3), (d_2 + d_3), (d_1 + d_2)]$ Construct the corresponding encoding circuit.	10Marks	L3	C04
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19.	a) For the Systematic (6,3)LBC, The Parity Matrix P and Received vector R are given below as: [P] = <table><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>1</td><td>0</td></tr></table> R= [1 1 0 0 1 0] , Detect and Correct the Single Error that has occurred due to Noise. b) For the Systematic (6,3)LBC, The Parity Matrix P and Received vector R are given below as: [P] = <table><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>1</td><td>0</td></tr></table> R= [r1,r2,r3,r4,r5,r6] , Construct Syndrome Calculation Circuit.	1	0	1	0	1	1	1	1	0	1	0	1	0	1	1	1	1	0	20 Marks	L3	C05
1	0	1																				
0	1	1																				
1	1	0																				
1	0	1																				
0	1	1																				
1	1	0																				
Or																						
20.	For a 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. ii. Draw the corresponding encoding circuit. A single error has occurred in each of these received vectors. Detect and correct those errors. (a) $R_A = [0111110]$ (b) $R_B = [1011100]$ (c) $R_C = [1010000]$ iii. Draw the syndrome calculation circuit.	20 Marks	L3	C05																		

21.	a) Describe the Block diagram of communication system employing error control coding. What are the various methods available for controlling errors in communication systems. b) For a Systematic (6,3) Linear Block Codes, the Parity Matrix P is given by [P]. $[P] = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 0 \end{bmatrix}$ i. Find all the Possible Code-Vectors. Find the Hamming Weight of the code-vectors. ii. Draw the encoding Circuit for the given (6,3)LBC.	20 Marks	L3	C06
Or				
22.	a) List the different types of errors caused by Noise and mention the types of Codes used for Error Control in communication systems. b) For the Systematic (6,3)LBC, The Parity Matrix P and Received vector R are given below as: [P] = $\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 0 \end{bmatrix}$ Construct the Standard Array Using Table-LookUp Decoding (Syndrome Decoding) , Find the Corrected code- vector for given R=100100	20 Marks	L3	C06

******* BEST WISHES *******