BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: M.TECH **SEMESTER : II**
BRANCH: ECE **SESSION : SP/2025**

SUBJECT: EC525 INFORMATION THEORY AND ERROR CONTROL CODING

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	i)Show that entropy of a random variable X is zero if and only if X has only one value with non zero probability ii) Show that if the conditional entropy H(X/Y) is zero, then the value of X is completely determined by the value of Y,with probability 1.	[5]	2	3
Q.1(b)	A DMS has three output symbols with probabilities {0.5,0.4,0.1} **(i)** Determine the Huffman code for this source find the efficiency η. **(ii)** Determine the Huffman code for this source taking two symbols at a time and find the efficiency η. iii) Determine the Huffman code for this source taking three symbols at a time and find the efficiency η.	[5]	2,3	4
Q.2(a)	i) List three properties of channel capacity. ii)What is the need for channel coding? iii) Define Gaussian Channel iv) What is the significance of Shannon Limit?	[5]	2,3,4	3,4
Q.2(b)	Consider the channels A,B, and the cascaded channel AB shown in figure. i)Find C_A the capacity of channel A. ii) Find C_B the capacity of channel B. iii)Cascade the two channels and determine the combined capacity C_{AB} iv)Explain the relation between C_A, C_B and C_{AB}	[5]	3	3

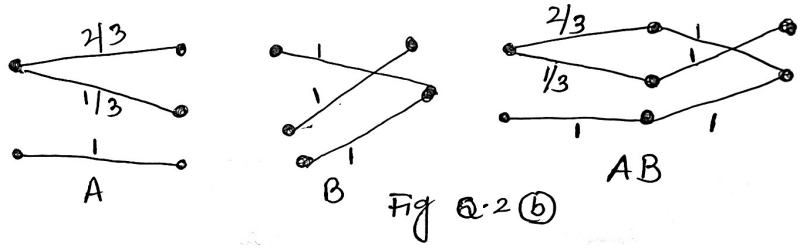

Fig Q.2 (b)

2/3,1/3,1 (A) 1,1,1(B) AB 2/3,1,1 1,1,1

Q.3(a)	i)Show that C={0000,1100,0011,1111} is a linear code. What is minimum distance? ii) Construct , binary (n,k,d*) codes with the following parameters (6,1,6)	[2+3]	3	4
Q.3(b)	i) What is the basic difference between Standard and Syndrome decoding? ii)Let C be a binary perfect code of length n with minimum distance 7. Show that n=7 or n=23	[2+3]	2,3	4
Q.4(a)	i) Design Shift encoder and Meggitt decoder for code generated of the polynomial $g(x)=x^6+3x^5+ x^4+x^3+2x^2+2x+1$. ii)Code with generator polynomial $g(x)=(x^{23}+1)(x^{17}+x^3+1)$ is used for error detection and correction in GSM standard. a) How many random errors can this code correct? b)How many burst errors can this code correct?	[5]	3,4	3,4

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Q.4(b)	If polynomial $g(x)=x^{10}+x^8+x^5+x^4+x^2+x+1$ be the generator polynomial of cyclic code over GF(2) with block length 15. i) Find Generator polynomial GF(2) ,Parity check matrix (H) and Generator matrix. ii)No of error it can detect or correct.	[5]	2,3	3,4
Q.5(a)	Design a rate ½ convolution encoder with constraint length v=4 and d*=6. i) Construct the State diagram for this encoder. ii) Construct the Trellis diagram for this encoder. iii) Give generator matrix	[5]	3,4	3,4
Q.5(b)	i)What are the important decoding techniques for convolutional codes? ii)Explain Polynomial description of convolutional codes.	[5]	3,4	3,4

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