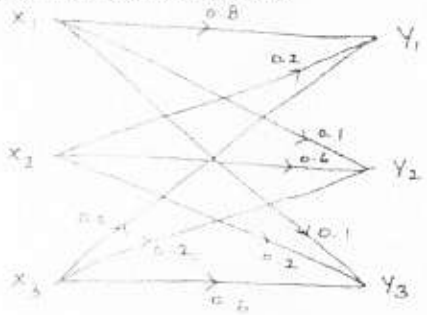
CONTINUOUS INTERNAL EVALUATION-2

Dept: EC	Sem / Div: V	Sub: Information Theory & Coding	S Code: 18EC54
Date: 02/12/2020	Time: 2:30-4:00PM	Max Marks: 50	Elective: N

Note: Answer any 2 full questions, choosing one full question from each part.

Q N	Questions	Marks	RBT	COs
	PART A			
1 a	A discrete memory less source has an alphabet of five symbols with their probabilities as given below: Symbol: S_0 S_1 S_2 S_3 S_4 Probabilities: 0.55 0.15 0.15 0.1 0.05 Compute the huffman code by placing composite symbol as high as possible. Also find i) The average code word length ii) Find Code efficiency.	8	L3	CO2
b	Define Mutual Information. List the properties of mutual information.	3	L2	CO3
c	For a systematic (7,4) linear block code the Parity matrix P is given by: i) Find all code vectors. ii) A single error has occurred in the received vector R = [0 1 1 1 1 0 0] Detect and correct the error. iii) Draw the syndrome calculation circuit. $[P] = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 1 \end{bmatrix}$	8	L3	CO4
d	The noise characteristics of a channel is as shown in Fig. Find the channel capacity (Using Muroga's method). 	6	L3	CO3
	OR			
2 a	A source produces 5 symbols S_1, S_2, S_3, S_4 and S_5 with respective probabilities of 0.1,0.3,0.4,0.12,0.08. i) Construct Huffman binary code ii) Determine efficiency and redundancy of the code	8	L3	CO2
b	For a systematic (6, 3) linear block code the parity matrix[P], i) Find all possible code vectors. ii) Find the minimum weight of the code. iii) Find the parity check matrix. iv) For a received code vector R=[1 1 0 0 1 0] detect and correct error that has occurred due to noise. $P = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$	8	L3	CO4
c	For a channel whose matrix is given below, Find I(X;Y) and channel capacity, Where the input symbol occur with equal probabilities. $P\left(\frac{Y}{X}\right) = \begin{bmatrix} 0.6 & 0.2 & 0.2 \\ 0.2 & 0.6 & 0.2 \\ 0.2 & 0.2 & 0.6 \end{bmatrix}$	5	L3	CO3

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d	Consider the BSC, whose channel matrix is given, find the channel capacity using Muroga's method. $P(Y/X)=\begin{matrix}3/4 & 1/4\\ 1/4 & 3/4\end{matrix}$	4	L3	CO3

PART B

3 a	For a Binary symmetric channel, find H(x), H(y), H(x,y), I(x, y) and capacity of the channel. The Noise matrix of the given Binary symmetric channel is as follows. The input symbol probabilities $P(x=0)=P(x=1)=1/2$; $P(y/x)=\begin{matrix}\frac{3}{4} & \frac{1}{4}\\ \frac{1}{4} & \frac{3}{4}\end{matrix}$	7	L3	CO3
b	Derive an expression for channel capacity of a Binary Erasure channel.	7	L3	CO3
c	Define the following: i)Block Code, ii)Hamming weight, iii)Minimum Hamming distance.	3	L2	CO4
d	The parity check bits of a (7,4) Hamming codes are generated by $c_5 = d_1+d_3+d_4$ $c_6 = d_1+d_2+d_3$ $c_7 = d_2+d_3+d_4$ Where d_1, d_2, d_3 and d_4 are message bits. i) Find generator matrix [G] and parity check matrix [H] for this code. ii) Prove that $GH^T=0$. iii) Find the minimum weight of this code. iv) Draw syndrome circuit.	8	L3	CO4

OR

4 a	A transmitter has an alphabet consisting of 5 letters $\{a_1, a_2, a_3, a_4, a_5\}$ and the receiver has an alphabet of four letters $\{b_1, b_2, b_3, b_4\}$. The joint probabilities of the system is given below. Calculate (i) H(A), (ii) H(B), (iii) H(A,B), (iv) I(A;B).		7	L3	CO3

	b_1	b_2	b_3	b_4
a_1	0.25	0	0	0
a_2	0.1	0.3	0	0
a_3	0	0.05	0.1	0
a_4	0	0	0.05	0.1
a_5	0	0	0.05	0

b	Derive the expression for channel capacity of a binary symmetric channel.	8	L3	CO3
c	Prove that $CH^T=0$ where H^T is transpose of parity check matrix H.	5	L3	CO4
d	What are the methods of controlling errors? Mention types of errors and explain.	5	L2	CO4

Note: Write internals in A4 sheets and in every page write your name, USN, subject name with your signture. After exam arrange all pages of answer script in single PDF file and Send the answer script to the mail id: **nc.vcet@gmail.com**

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