CBCS SCHEME

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BEC503

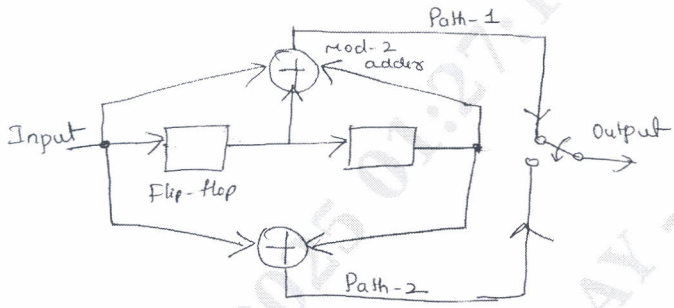
Fifth Semester B.E./B.Tech. Degree Examination, June/July 2025
Digital Communication

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	List the properties of Hilbert transform.	6	L2	CO1
	b.	Describe preenvelope of low pass signal.	4	L2	CO1
	c.	Outline the steps for deriving and reconstructing the band pass signal from in-phase and quadrature components.	10	L2	CO1
		OR			
Q.2	a.	Discuss correlation receiver of AWGN channel.	7	L2	CO1
	b.	Describe the matched filter with a necessary diagram.	8	L2	CO1
	c.	Relate signal representation of 2 BIQ code.	5	L2	CO1
		Module – 2			
Q.3	a.	Illustrate BPSK using coherent detection with transmitter and receiver and deriving expression for error probability function.	10	L2	CO2
	b.	Interpret the working of coherent generation and detection of QPSK. Draw QPSK w/fm for I/P binary sequence 01101000.	10	L2	CO2
		OR			
Q.4	a.	Demonstrate M-ary QAM M = 4 with signal space diagram.	10	L2	CO2
	b.	Discuss the working of FSK coherent receiver and transmitter with block diagram.	10	L2	CO2
		Module – 3			
Q.5	a.	International Morse code uses a sequence of dots and dashes to transmit letters of English alphabet. The dash is represented by a current pulse that has a duration of 3 units and the dot has a duration of 1 unit. The probability of occurrence of a dash is 1/3 of probability of occurrence of a dot. i) Calculate information content of dot and dash. ii) Calculate average information in the dot-dash-code. iii) Assume that dot last 1m sec, which is the same-time interval as the pause between symbols. Find average rate of information transmission.	8	L3	CO3

	b.	A binary source is emitting an independent sequence of 0's and 1's with probabilities P and 1-P outline the entropy of source, with a diagram.	5	L2	CO3
	c.	Show that entropy of 2 MS is given by $H(s^2)=2H(s)$ considering $P_0=\frac{1}{2}$, $P_1=\frac{1}{4}$, $P_2=\frac{1}{4}$.	7	L2	CO3
		OR			
Q.6	a.	Summarize properties of mutual information.	6	L2	CO3
	b.	Construct Huffman tree with symbols $\{S_0, S_1, S_2, S_3, S_4\}$ having probabilities {0.4, 0.2, 0.2, 0.1, 0.1}.	7	L3	CO3
	c.	A binary symmetric channel has matrix $P(Y/X)=\begin{bmatrix}0.8 & 0.2\\ 0.2 & 0.8\end{bmatrix}$ Also $P(X_1)=0.6$ $P(X_2)=0.4$. Calculate I(X, Y) C_S, η_{ch}.	7	L3	CO3
		Module – 4			
Q.7	a.	Illustrate different error correcting codes.	5	L2	CO4
	b.	Outline the procedure of syndrome decoding.	6	L2	CO4
	c.	Illustrate encoding procedure (n, k) cyclic code steps considering linear feedback shift register with (n-k) stages.	9	L2	CO4
		OR			
Q.8	a.	Define G and H matrix show that $C.H^T=0$.	5	L2	CO4
	b.	For (6, 3) linear block code the parity matrix is $P=\begin{bmatrix}1 & 0 & 1\\ 0 & 1 & 1\\ 1 & 1 & 0\end{bmatrix}$ i) Calculate the generator matrix ii) Compute all possible code words.	10	L3	CO4
	c.	A (15, 5) cyclic code has the generator polynomial given by $g(x) = 1 + x + x^2 + x^4 + x^5 + x^8 + x^{10}$. Construct the block diagram of encoder and syndrome calculator.	5	L3	CO4
		Module – 5			
Q.9	a.	Consider a (3, 1, 2) convolutions encoder with $g^{(1)} = 110$, $g^{(2)} = 101$, $g^{(3)} = 111$ i) Build the encoder diagram. ii) Compute the code word for message sequence (11101).	14	L3	CO5

	b.	Consider convolutional encoder shown in Fig.Q.9(b). Compute the generator polynomial, output polynomial for path1 and path2. Also compute encoded sequence.  Fig.Q.9(b)	**6**	**L3**	**CO5**
		OR			
Q.10	**a.**	Interpret optimum decoding of convolutional codes.	**6**	**L3**	**CO5**
	b.	Apply viter bi decoder algorithm steps considering all-zero sequence (0100010000).	**14**	**L3**	**CO5**

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