CBCS SCHEME

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BEC503

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.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.	Explain Hilbert transform and its properties.	6	L2	CO1
	b.	Describe the canonical representation of bandpass signal.	7	L2	CO1
	c.	Describe the correlation receiver with neat diagram.	7	L2	CO1
		OR			
Q.2	a.	Apply gram Schmidt orthogonalizaiton procedure find the set of orthonormal basis function to represent the signals $S_1(t)$, $S_2(t)$ and $S_3(t)$ as shown in Fig.Q2(a). Also express each of these figures interms of set of basis function.	10	L3	CO1

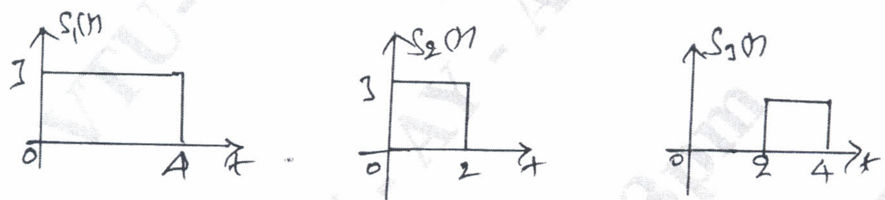
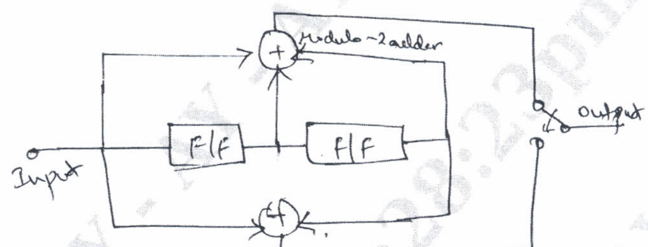
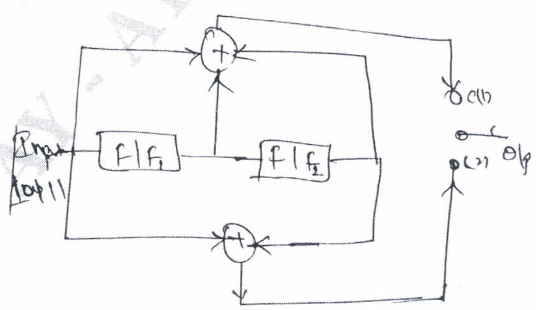


Fig.Q2(a)

	b.	Derive the equation for converting continuous AWGN channel into a vector channel.	10	L2	CO1
		Module – 2			
Q.3	a.	Describe with a neat diagram, the generation and detection of BPSK signal.	8	L2	CO2
	b.	Define bandwidth efficiency. Tabulate the comment on the bandwidth efficiency of M-ary PSK signal.	8	L2	CO2
	c.	Encode the binary sequence using DPSK 11011011. Assume reference bit as 1.	4	L2	CO2
		OR			
Q.4	a.	Derive the expression for probability of error of QPSK signal.	8	L2	CO2
	b.	Discuss the non-coherent detection of BFSK signal.	8	L2	CO2
	c.	Calculate the average power required for a DPSK signal operation gat a data rate of 1000 bit/sec, over a band-pass channel having a bandwidth of 3000 Hz, $\frac{N_0}{2} = 10^{-10}\,\mathrm{w/H_z}$ probability of error $P_e = 10^{-5}$.	4	L3	CO2
		Module – 3			
Q.5	a.	Define entropy and summaries its properties.	6	L2	CO3
	b.	A source has five symbols S = {S_1. S_2, S_3, S_4, S_5} with probabilities P = {0.4, 0.2, 0.2, 0.1, 0.1} respectively. compute the source code using Huffman binary coding. Also find the average length and entropy.	8	L3	CO3
	c.	Briefly discuss instantaneous code with an example.	6	L2	CO3
		OR			
Q.6	a.	Derive the expression for mutual information and summarize its properties.	10	L2	CO3
	b.	Derive the expression for the channel capacity of binary symmetric channel.	10	L3	CO3

		Module – 4			
Q.7	**a.**	Indicate the advantages and disadvantages of error control coding. Also differentiate between block code and convolution code.	8	L2	CO4
	b.	If 'C' is a valid code vector then show that $CH^T = 0$ where H is parity check matrix of code.	5	L2	CO4
	c.	Design an encoder for the (7, 4) binary cyclic code generated by : $g(x) = 1 + x + x^3$ for the message vector [1001].	7	L3	CO4
		OR			
Q.8	**a.**	Describe the block diagram of generator and parity check matrix with equation. Also write the syndrome equation and list its properties.	10	L2	CO4
	b.	A (7, 4) Linear block code has : $P = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 0 & 1 \end{bmatrix}$ i) All possible code vector ii) Determine the Hamming weight of each code word iii) If the received vector is [1100010]. Determine its syndrome correct the codeword.	10	L3	CO4
		Module – 5			
Q.9	**a.**	For a given convolutional encoder shown in Fig.Q9(a), with D = 10011. Compute output sequence using transform domain approach. Also draw the code free diagram.  Fig.Q9(a)	10	L3	CO5
	b.	Describe the recursive systematic convolutional code encoder with an example.	10	L3	CO5
		OR			
Q.10	**a.**	A convolution encoder has two flip-flop with two states, three modulo – 2 adders and an output multiplexer. The generator sequences of the encoder. $g^{(1)} = (1, 0, 1)$, $g^{(2)} = (1, 1, 0)$, $g^{(3)} = (1, 1, 1)$. i) Generator matrix [G] ii) Draw the encoder block diagram iii) Calculate the codeword for the message input vector 11101.	10	L3	CO5
	b.	For a given convolution encoder shown in Fig.Q10(b). Build state table, state transaction table, sketch diagram and describe the Trellis diagram for the input message vector (10111).  Fig.Q10(b)	10	L3	CO5

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