U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

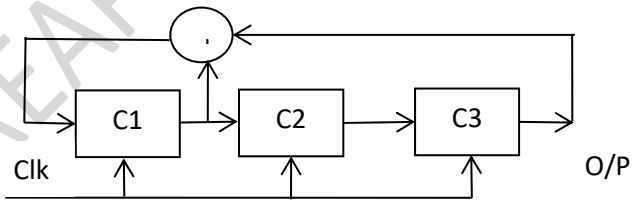
June / July 2025 Semester End Main Examinations

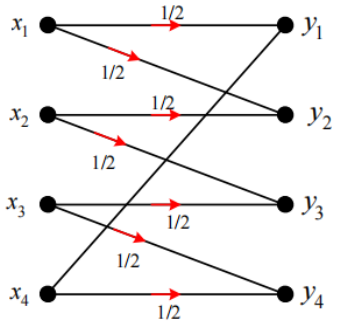
Programme: B.E. **Semester: V**
Branch: Electronics and Communication Engineering **Duration: 3 hrs.**
Course Code: 22EC5PCDCT **Max Marks: 100**
Course: Digital Communication Theory

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			UNIT - I	*CO*	*PO*	Marks
1	a)		Using relevant diagrams and equations, explain the functioning of the 1-step version of Differential Pulse code Modulation. Analyze and discuss the advantages and disadvantages of employing this technique.	*CO2*	*PO2*	**08**
	b)		Illustrate a schematic of a Digital Communication System (DCS) describing the signal processing stages, and elucidate the function of each component.	*CO1*	*PO1*	**08**
	c)		Discuss the key design considerations for implementing practical raised cosine filters in digital communication systems to minimize Inter-Symbol Interference (ISI).	*CO1*	*PO1*	**04**
			OR			
2	a)		With relevant block diagram, interpret the operation of regenerative repeaters towards improving the performance of PCM system.	*CO1*	*PO1*	**06**
	b)		With a neat sketch explain Companding in PCM .Also explain A-law and μ-law Commanding.	-	-	**08**
	c)		Discuss the fundamental features and applications of the E1 carrier system with relevant diagram.	*CO1*	*PO1*	**06**
			UNIT – II			
3	a)		Arrive at the equations for BPSK and derive the probability of error when symbol zero is transmitted.	*CO1*	*PO1*	**10**
	b)		Sketch the in-phase and quadrature-phase components of a QPSK signal for the binary sequence 110010111 choose appropriate carrier signal.	*CO1*	*PO1*	**06**
	c)		Draw the signal space constellation for BPSK modulation.	*CO1*	*PO1*	**04**
			OR			

	4	a)	Show how a message 101101 can be transmitted over a communication channel using DPSK, with the help of a logical block diagram also arrive at the DPSK waveform.	*CO1*	*PO1*	**08**
		b)	Binary data is transmitted using ASK over a AWGN channel at a rate of 2.4 MBPS. The carrier amplitude at the receiver is 1mV. Noise power spectral density , No/2 = 10^{-15} W/Hz. Find the average probability of error if the detection is coherent, take erfc(5)= 3 x 10^{-6}.	*CO1*	*PO1*	**06**
		c)	Compare the digital modulation techniques: BASK,BPSK and BFSK in terms of probability of bit error, BW and power.	*CO2*	*PO2*	**06**
			UNIT – III			
	5	a)	Emphasize the significance of Pseudo-Noise sequences and verify properties with an example.	*CO2*	*PO2*	**08**
		b)	Illustrate the slow frequency hopping with hopping diagram for the message sequence 100011010001111111001. Use PN sequence 000100110101111. No. of bits/ MFSK symbol = 2, No. of MFSK TONES M=4, Length of PN segment/ hop = 3, Total No. of frequency hops = 8.	*CO1*	*PO1*	**10**
		c)	A communication system employs fast frequency hopping spread spectrum technique with 80 available frequencies. If the system hops through all frequencies in 0.05 seconds, determine the hop rate.	*CO1*	*PO1*	**02**
			OR			
	6	a)	Describe the operation of a Direct Sequence Spread Spectrum (DSSS) transmitter and receiver, including detailed block diagrams, relevant equations, and representative waveforms to support your explanation.	*CO1*	*PO1*	**10**
		b)	Obtain the PN sequence from the generator shown assume the initial state to be 100 	*CO2*	*PO2*	**10**
			UNIT - IV			
	7	a)	Discuss the need for channel coding.	*CO1*	*PO1*	**04**
		b)	Given the message x1,x2,x3,x4,x5 and x6 with respective probabilities 0.4, 0.2, 0.2, 0.1, 0.07 and 0.03, construct a binary code by applying Shannon-Fano encoding procedure. Determine code efficiency and redundancy of the code. Comment on the result.	*CO1*	*PO1*	**08**
		c)	Give the detailed Huffman encoding procedure for obtaining a compact code with least redundancy.	*CO1*	*PO1*	**08**

			OR			
	8	a)	Discuss the dependence of entropy on the probability of the message for a discrete memoryless source	*CO1*	*PO1*	**06**
		b)	Consider a discrete memoryless source (DMS) with source alphabet S = S_0, S_1, S_2, whose three distinct symbols have the following probabilities. Find H(s),$H(s)_{max}$ and Information Rate if r_s=3 S_0 | S_1 | S_2 1/4 | 1/4 | 1/2	*CO2*	*PO2*	**04**
		c)	Determine the capacity of the channel shown in Figure  	*CO3*	*PO3*	**10**
			UNIT - V			
	9	a)	Write a note on: Error detecting and correcting capability of block codes.	*CO1*	*PO1*	**06**
		b)	Consider a binary convolutional encoder with a constraint length of K=3. The encoder has two generator polynomials: *G*1=(1,1,1) and *G*2=(1,0,1). Construct the state transition diagram for this encoder.	*CO3*	*PO3*	**10**
		c)	Differentiate between Block code and Convolutional code.	*CO2*	*PO2*	**04**
			OR			
	10	a)	For the systematic (6,3) linear block code the parity matrix P is given by [P]= 1 0 1 0 1 1 1 1 0 Find all possible code vectors. Construct the corresponding encoding circuit.	*CO3*	*PO3*	**10**
		b)	Using the generator polynomials g_1= 1+x+x^2 and g_2= 1+x^2. Write the convolutional code for the data sequence 101011.	*CO3*	*PO3*	**10**

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