U.S.N.										

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

Autonomous Institute Affiliated to VTU

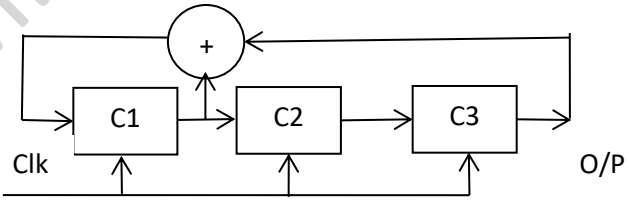
January / February 2025 Semester End Main Examinations

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.
3. Use of error function table allowed.

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)		Derive an expression for the signal to quantization noise power ratio for a PCM System. Assume a midrise type of quantizer.	*CO1*	*PO1*	**08**
	b)		A PCM system uses a uniform quantizer followed by a 7 bit binary encoder .The bit rate of the system 56 Mega bits/sec. i)Determine the Message bandwidth for which system operates satisfactorily ii)Determine the output signal to quantization noise ratio when a sinusoidal wave of 2M Hz frequency is applied to the input.	*CO2*	*PO2*	**06**
	c)		With a neat sketch explain Companding in PCM .Also explain A-law and μ-law Commanding.	*CO1*	*PO1*	**06**
			OR			
2	a)		An Audio signal of bandwidth 20 kHz is to be transmitted using a PCM system. Design a suitable PCM system. Indicate the specifications of each block of the system. Assume a channel used having a bandwidth of 60kHz	*CO3*	*PO3*	**06**
	b)		Analyze the problem in Transmission over baseband channel and ideal solution to overcome this. Indicate the limitations of ideal solution and illustrate how Raised Cosine spectrum would resolve this problem	*CO2*	*PO2*	**08**
	c)		Explain the T1 multiplexing system with block diagrams	*CO1*	*PO1*	**06**
			UNIT - II			
3	a)		A binary sequence 101110 is applied to a DPSK transmitter.Construct the resulting DPSK signal .Sketch the resulting waveform at the DPSK transmitter output and explain modulator and demodulator with a neat block diagram.	*CO2*	*PO2*	**10**
	b)		Derive an expression for the probability of bit error of a binary PSK receiver	*CO1*	*PO1*	**05**

		c)	Briefly explain the QPSK modulation Scheme with a suitable constellation diagram.	*CO1*	*PO1*	**05**
			OR			
	4	a)	Explain the working of the Correlator type receiver	*CO1*	*PO1*	**06**
		b)	With a block diagram explain FSK transmitter and Receiver. Obtain its signal constellation diagram .	*CO1*	*PO1*	**08**
		c)	A coherent Binary FSK system transmits data at a rate of 2 Mbps over and AWGN channel. The noise is zero mean with Power spectral density is (No/2) $=10^{-20}$ watts/Hz . In the absence of noise, the amplitude of the received signal is 1µVolt. Determine the average probability of error	*CO2*	*PO2*	**06**
			UNIT - III			
	5	a)	With a neat diagram explain the generation of PN sequence and state its properties,	*CO1*	*PO1*	**08**
		b)	A spread spectrum communication system has the chip duration Tc =1 µsec and the information bit duration Tb=4.095msec . Find the processing gain and jamming margin of the system. Assume (Eb/N_0) ratio is 10.	*CO1*	*PO1*	**05**
		c)	With the structure of FHSS /MFSK Transmitter and Receiver , Illustrate fast hopping FHSS for following data bk={011000110011} modulated by 4FSK tones f0,f1,f2,f3 =00,01,10,11 respectively. PN sequence = 111001100100110101 Number of hops /symbol=2, Length of PN segment /hop=3.	*CO2*	*PO2*	**07**
			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 	*CO3*	*PO3*	**10**
			UNIT - IV			
	7	a)	Derive an expression for the capacity of a binary symmetric channel.	*CO1*	*PO1*	**05**
		b)	Consider the following source S=(A,B,C,D,E,F), P=(0.4,0.2,0.2,0.1,0.08,0.02). Find the code words using Shannon Fano algorithm. Find the source efficiency, redundancy and comment.	*CO1*	*PO1*	**07**

		c)	An information source produces a sequence of independent symbols having the following probabilities. [A B C D E F G] [1/3, 1/27, 1/3 ,1/9 ,1/9, 1/27, 1/27] Analyze its property and Find the codeword using Huffman encoding procedure and find its efficiency.	*CO2*	*PO2*	**08**
			OR			
	8	a)	Check the following codes given in Table are instantaneous or not with the help of Kraft McMillan Inequality Symbols | Code A | Code B | Code C A | 0 | 0 | 00 B | 10 | 11 | 01 C | 110 | 100 | 10 D | 1110 | 110 | 111 E | 1111 | 1011 | 0110	*CO2*	*PO2*	**06**
		b)	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 are given below. $P(A,B) = \begin{array}{c} \\ a_1 \\ a_2 \\ a_3 \\ a_4 \\ a_5 \end{array} \begin{array}{c} \begin{array}{cccc} b_1 & b_2 & b_3 & b_4 \end{array} \\ \begin{bmatrix} 0.25 & 0 & 0 & 0 \\ 0.10 & 0.30 & 0 & 0 \\ 0 & 0.05 & 0.10 & 0 \\ 0 & 0 & 0.05 & 0.1 \\ 0 & 0 & 0.05 & 0 \end{bmatrix} \end{array}$ Compute the different entropies of this channel	*CO2*	*PO2*	**10**
		c)	List the various properties of entropy	*CO1*	*PO1*	**04**
			UNIT - V			
	9	a)	Given the generator Matrix for a Linear Block Code. $[G] = \begin{bmatrix} 1 & 1 & 1 & 1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 \\ 1 & 1 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}$ i) Find n and k value . ii)Write G in its systematic form, iii))Find all the code word. Iv)Find the error detecting and correcting capability of the code v) Design the encoder circuit.	*CO3*	*PO3*	**10**
		b)	Design the (3,1,2) convolution code with g(1) =(110), g(2) =(101),g(3) =(111). Find the constraint length and rate. Draw the encoder block diagram. Find the generator matrix. Find the codeword for the message (11101) using time domain and transfer domain approach	*CO3*	*PO3*	**10**
			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. If the received code vector is R=[110010]. Detect and correct the single error that has occurred due to noise. Draw the syndrome calculation Circuit	*CO3*	*PO3*	**14**
		b)	Discuss the need for Channel coding in a digital communication system. Mention the chief objectives of Channel code	*CO1*	*PO1*	**06**

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