Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER–VI • EXAMINATION – SUMMER 2015

Subject Code: X61101 **Date: 08/05/2015**

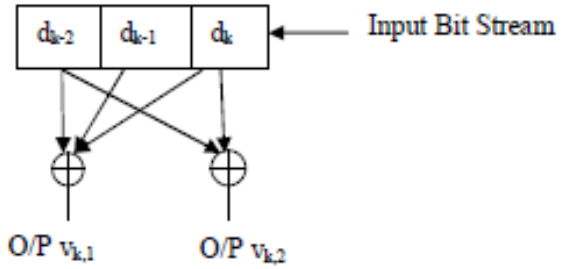
Subject Name: Digital Communication

Time: 10:30 am - 01:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Define (1) Conditional Probability (2) Marginal Probability (3) Covariance of random variables (4) Cumulative Distribution Function	**04**
	(b)	What is line coding? What are the ideal requirements from line coding?	**03**
	(c)	Derive the formula of Signal to quantization noise ratio for PCM.	**07**
Q.2	**(a)**	For a PCM signal, determine L if the compression parameter μ = 100 and the minimum SNR required is 45 dB. Determine the output SQNR with this value of L.	**07**
	(b)	Find the PSD of On-OFF signaling and discuss the advantages and disadvantages of it.	**07**
		OR	
	(b)	Explain the working principal of Delta modulation with necessary waveforms. What is slope overloading and granular noise in delta modulation?	**07**
Q.3	**(a)**	(a) Use the generator polynomial $g(x)= x^3+x+1$ to construct a systematic (7,4) cyclic code. (b) What are the error correcting capabilities of this code?	**07**
	(b)	Find the mean and variance of Gaussian random variable with the PDF $p_x(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-(x-m)^2/2\sigma^2}$	**07**
		OR	
Q.3	**(a)**	Consider a generator matrix G for a systematic (6,3) code: $G = \begin{bmatrix} 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 \end{bmatrix}$ Construct the code and find d_{min}, error correction and detection capability of the code.	**07**
	(b)	Two dice are thrown. One die is regular and the other is biased with the following probabilities. P(1)= P(6) =1/6, P(2)=P(4)=0, P(3)= p(5)= 1/3 Determine the probabilities of obtaining a sum: (a) 4; (b) 5.	**04**
	(c)	Why timing extraction is required in digital communication system? List three general methods of synchronization. Which method is efficient among three?	**03**
Q.4	**(a)**	Find the channel capacity of a binary symmetric channel.	**07**
	(b)	Derive Hamming Bound for (n,k) binary t-error correcting block code. Define perfect code and Hamming code.	**07**
		OR	
Q.4	**(a)**	For the following convolution encoder, draw the state diagram and trellis diagram.	**07**



	(b)	A source emits seven messages with probabilities1/3, 1/3, 1/9, 1/9, 1/27, 1/27, 1/27, respectively. Find the entropy of the source. Obtain the compact 3-ary code and find the average length of the codeword. Determine the efficiency and the redundancy of the code.	**07**
Q.5	**(a)**	With necessary diagram and waveforms explain the principle of Binary Phase Shift Keying (BPSK).	**07**
	(b)	Derive the general expression of Bit Error Rate (BER) for Optimum Binary Receiver.	**07**

OR

Q.5	**(a)**	What is Inter-symbol interference? Explain the Nyquist's first and second criteria for zero ISI.	**07**
	(b)	Explain QPSK with waveforms, constellation diagram and mathematical representations.	**07**

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