

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VI • EXAMINATION – SUMMER • 2014****Subject Code: 161001****Date: 19-05-2014****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 cumulative Distribution Function (CDF). What are the important properties of CDF? State and prove them. **07**

(b) What is Probability Density function? State and prove its properties. **07**

Q.2 (a) A certain random variable has CDF given by: **07**

$$F_x(x) = \begin{cases} 0 & \text{for } x \leq 0 \\ kx^2 & \text{for } 0 < x \leq 10 \\ 100k & \text{for } x > 10 \end{cases}$$

- (1) Calculate the value of k
- (2) Find the values of $p(x \leq 5)$ and $p(5 < x \leq 7)$
- (3) Plot the corresponding PDF.

(b) Define: (1) n^{th} moment of random variable. **07**
 (2) The central moment of random variable.
 (3) Variance of random variable.
 (4) Standard deviation.

OR

(b) The PDF of a random variable x is given by

$$F_x(x) = \begin{cases} 1/2\pi & \text{for } 0 \leq x \leq 2\pi \\ 0 & \text{otherwise.} \end{cases}$$

Calculate the mean value, mean square value, variance and standard deviation.

Q.3 (a) An analog signal is band limited to 4 kHz. If it is sampled at the Nyquist rate and the samples are quantized into 4 levels. The quantization levels Q1, Q2, Q3 and Q4 are independent messages and have the probabilities $p_1=p_2=1/8$ and $p_3=p_4=3/8$. Find the information rate of the source. **07**

(b) (1) State and explain Shannon's theorem of channel capacity. What is its importance? What are its limitations? **07**
 (2) What is the maximum capacity of a perfectly noiseless channel whose width is 120 Hz? In which the values of the data transmitted may be indicated by any one of 10 different amplitudes.

OR

Q.3 (a) (1) A Gaussian channel has 2 MHz band width. Calculate the channel capacity if the signal power to noise spectral density ratio is 10^5 . Also find the maximum information rate. **07**

(2) Explain the concept of trade-off between bandwidth and SNR.

(b) State and prove Sampling theorem for low pass signals in time domain. **07**

Q.4 (a) What is PCM? Draw the block diagram of a PCM Transmitter(encoder). Explain its operation with waveforms. **07**

(b) What is Delta Modulation? Draw the block diagram of Delta modulator transmitter and explain its working with waveforms. **07**

OR

- Q.4 (a)** The generator polynomial of a (7, 4) cyclic code is $G(D) = D^3 + D + 1$. Obtain any one code vector for the code in non systematic form. **07**
- (b)** With diagram explain the principle of Binary Phase Shift Keying (BPSK). **07**
- Q.5 (a)** With diagram and waveforms explain the principle of DPSK generator. **07**
- (b)** Write a short note on CDMA. **07**
- OR**
- Q.5 (a)** Explain the principle of Quadrature Amplitude Shift Keying (QASK) transmitter. **07**
- (b)** With diagram explain the generation of BFSK signals. **07**
