Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**PDDC - SEMESTER– VI • EXAMINATION – WINTER 2016**

**Subject Code:X61101** **Date:25.10.2016**

**Subject Name: Digital Communication**

**Time:10.30 AM TO 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)** | What is line coding? State and explain the properties of line codes. | **07** |
| | **(b)** | Explain principal of non-uniform quantization and companding in PCM. State laws for the same. | **07** |
| **Q.2** | **(a)** | Find the PSD of Bipolar signaling. Discuss the advantages and disadvantages of bipolar signaling. | **07** |
| | **(b)** | In a binary data transmission using duobinary pulses, sample values were read as follows: 1 2 0 -2 -2 0 0 -2 0 2 0 0 2 0 0 0 -2<br>(a) Explain if there is any error in detection.<br>(b) If there is no detection error, determine the received bit sequence. | **07** |
| | | **OR** | |
| | **(b)** | A television signal has a bandwidth of 4.5 MHz. This signal is sampled, quantized and binary coded to obtain a PCM signal.<br>(a)Determine the sampling rate if the signal is to be sampled at a rate 20% above the Nyquist rate. (b) If the samples are quantized into 1024 levels, determine the number of binary pulses required to encode each sample. (c) Determine the binary pulse rate (bits per second) of the binary-coded signal, and the minimum bandwidth required to transmit this signal. | **07** |
| **Q.3** | **(a)** | For a (6,3) systematic linear block code, the three parity-check digits $c_4$, $c_5$, and $c_6$ are<br>$c_4 = d_1 + d_2 + d_3$<br>$c_5 = d_1 + d_2$<br>$c_6 = d_1 + d_3$<br>(a) Construct the appropriate generator matrix for this code.<br>(b) Construct the code generated by this matrix.<br>(c) Determine the error correcting capabilities of this code. | **07** |
| | **(b)** | A source emits seven massages with probabilities 1/2, 1/4, 1/8, 1/16, 1/32, 1/64, and 1/64, respectively. Find the entropy of the source. Obtain the compact binary code and find the average length of the code word. Determine the efficiency and the redundancy of the code. | **07** |
| | | **OR** | |
| **Q.3** | **(a)** | Construct a systematic (7, 4) cyclic code using generator polynomial $g(x) = x^3 + x^2 + 1$. | **07** |
| | **(b)** | Derive the equation of channel capacity of a discrete memoryless channel. | **07** |
| **Q.4** | **(a)** | What is cumulative distribution function? State and prove its properties. | **07** |
| | **(b)** | Derive the general expression of Bit Error Rate (BER) for Optimum Binary Receiver. | **07** |
| | | **OR** | |
| **Q.4** | **(a)** | Define: Mean, variance and $n^{th}$ central moment of random variable. | **03** |

| | | | |
|---|---|---|---|
| | **(b)** | If X and Y are independent random variables and Z= X+Y. Prove that the variance of a sum of independent RVs is equal to the sum of their variances, $\sigma_Z^2 = \sigma_X^2 + \sigma_Y^2$. | **04** |
| | **(c)** | Explain DPCM system with transmitter and receiver block diagram. Compare DPCM and PCM system. | **07** |
| **Q.5** | **(a)** | With necessary diagram and waveforms explain the principle of Binary Phase Shift Keying (BPSK). | **07** |
| | **(b)** | Compare coded and uncoded digital transmission system under the similar constrain of signal power, transmission rate and modulation scheme. | **07** |

**OR**

| | | | |
|---|---|---|---|
| **Q.5** | **(a)** | Explain convolution coding in brief. | **07** |
| | **(b)** | Explain QPSK modulation and demodulation with necessary diagram and waveforms. | **07** |

**********