

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VI (NEW) EXAMINATION – SUMMER 2024****Subject Code:2161001****Date:15-05-2024****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.
4. Simple and non-programmable scientific calculators are allowed.

		MARKS
Q.1	(a) What do you mean by Sampling? List out the applications of Sampling.	03
	(b) Derive the expression of Quantization noise for PCM modulation technique.	04
	(c) Explain DPCM modulator & demodulator with block diagram and necessary equation.	07
Q.2	(a) What do you mean by line coding? Bipolar coding is having error detection and correction capability. Justify the statement.	03
	(b) Compare BPSK, QPSK and QAM technique in detail.	04
	(c) Derive the expression of Power Spectral Density (PSD) of Polar Signaling technique. Sketch the PSD of Polar signaling technique.	07
	OR	
	(c) Derive the expression of Power Spectral Density (PSD) of On-Off signaling technique. Sketch the PSD of On-Off signaling technique.	07
Q.3	(a) Differentiate Coherent and Non coherent detection technique in detail with example.	03
	(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: (i) 4 and (ii) 5.	04
	(c) Explain Minimum Shift Keying (MSK) modulation and demodulation block diagram in detail with mathematical equation.	07
	OR	
Q.3	(a) Draw the waveform for the given sequence 1 1 0 1 0 0 1 with following modulation technique: (i) ASK, (ii) FSK, (iii) PSK.	03
	(b) Define the following terms: (i) Noise Figure, (ii) Bit Error Rate (BER) (iii) Noise temperature.	04
	(c) In an experiment, a trial consists of four successive tosses of a coin. If we define a Random Variable (RV) X as the number of heads appearing in a trial, determine PDF $P_X(x)$ and CDF $F_X(x)$ with its sketch.	07
Q.4	(a) Write the expression of Probability Density Function (PDF) of Gaussian Random Variable. Also sketch the PDF of Gaussian Random Variable.	03
	(b) Entropy is maximum for equiprobable messages. Justify the statement.	04
	(c) State and Prove Central limit theorem with necessary equation and waveform.	07

OR

- Q.4** (a) Explain the different types of correlation with example. **03**
(b) Compute mean and variance value of uniform random variable. **04**
(c) Derive the expression of Bit Error Rate (BER) or Detection Error Probability for Quadrature Phase Shift Keying (QPSK) technique. Sketch the BER v/s SNR plot of QPSK technique. **07**
- Q.5** (a) Explain the difference between Block code and Convolutional code. **03**
(b) For a (6, 2) linear block code, the generator matrix G is **04**

$$G = \begin{bmatrix} 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 & 1 \end{bmatrix}$$

Construct the code table for this code and determine the minimum distance between code-words.

- (c) A memoryless source emits messages m_1 and m_2 with probabilities 0.8 and 0.2 respectively. Find the Huffman binary code for this source as well as for its second order extensions. Determine the code efficiencies in each case. **07**

OR

- Q.5** (a) Define the following terms: (i) Code rate, (ii) Hamming Bound, (iii) Systematic code. **03**
(b) Find a generator polynomial $g(x)$ for a (7, 4) cyclic code and find code vectors for data vectors: (i) 1010, (ii) 1111. **04**
(c) For a (7,4) cyclic code using the generator polynomial $g(x) = x^3 + x + 1$, (i) Construct the decoding table, (ii) If the received word is **1101100**, determine the transmitted data word. **07**
