Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI • EXAMINATION – WINTER • 2014

Subject Code: 161001 Date: 26-11-2014

Subject Name: Digital Communication

Time: 02:30 pm - 05:00 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)** Explain briefly Nyquist's sampling theorem. What is Interpolation process? Derive Interpolation formula. **07**

(b) What is probability density function? State and prove its properties. **07**

Q.2 **(a)** A television signal has a bandwidth of 4.5 MHz. This signal is sampled, quantized and binary coded to obtain a PCM signal. **07**
(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.

(b) Draw and explain block diagram of ADPCM system. Compare PCM and ADPCM. **07**

OR

(b) Why pulse shaping is required? What is Inter Symbol Interference? Explain Nyquist's first criterion for zero ISI. **07**

Q.3 **(a)** Derive the general expression for PSD of a large class of line codes. **07**

(b) Define mean, variance and standard deviation of the random variable. Find mean square and variance of the uniform quantization error whose pdf is **07**

$$p_q(q) = L/2m_p \quad \text{for } -m_p/L \le q \le m_p/L$$
$$= 0 \quad \text{otherwise}$$

where L is quantization level and $(-m_p, m_p)$ is signal amplitudes range.

OR

Q.3 **(a)** 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**

(b) What is scrambling? Explain scrambling and descrambling process with block diagram and suitable example. **07**

Q.4 **(a)** Derive the equation for channel capacity of discrete memoryless channel. **07**

(b) Find the generator matrix G for a (15,11) single error correcting systematic linear block code. Find the code word for the data vector 10111010101. **07**

OR

Q.4 **(a)** Define entropy. Prove that entropy is maximum when all the messages are equiprobable. **07**

(b) A generator matrix $G = \begin{bmatrix} 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 \end{bmatrix}$ generates a (4,2) code.(a) Is this a systematic code? (b) What is the parity check matrix of this code? (c) Find the codewords for all possible input bits. (d) Determine the minimum distance of the code and the number of bit errors this code can correct. **07**

Q.5 **(a)** Explain Quadrature Phase Shift Keying (QPSK) technique with neat sketch. Draw constellation diagram for QPSK. **07**

	(b)	Derive expressions for impulse response and probability of error of Matched filter.	**07**

OR

Q.5	**(a)**	What are the different types of spread spectrum systems? Draw and explain block diagram of frequency hopping spread spectrum (FHSS) system.	**07**
	(b)	Explain convolution coding in brief.	**07**

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