Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER– VI • EXAMINATION – SUMMER-2017

Subject Code:X61101 **Date: 29/04/2017**

Subject Name: Digital Communication

Time: 10.30AM to 01:00PM **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)** Answer the following in one or two sentences. **10**

[1] Define Cumulative Distribution Function for random variables.

[2] An experiment consists of drawing two cards from a deck in succession (without replacing the first card drawn). Assign a value to the probability of obtaining two aces in two draws.

[3] What is Hamming Bound condition for linear block codes?

[4] In (7,4) cyclic code, if generator polynomial is $g(x)= 1+x+x^3$. What is the parity check polynomial for this code?

[5] What is the difference between linear block code and convolution code?

[6] What is Nyquist's first criterion for zero ISI?

[7] How DPCM does improve SNR over PCM?

[8] Why regenerative repeater is used in digital communication systems?

[9] Define expectation of continuous random variable.

[10] The ON-OFF signaling requires twice as much energy per bit to achieve the same error performance as polar signaling. Ture or False?

(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**

Q.2 **(a)** Derive the general expression for PSD of a large class of line codes. **07**

(b) 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 10% 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.

OR

(b) Explain the Delta modulation and demodulation technique. **07**

Q.3 **(a)** Construct a systematic (7, 4) cyclic code using generator polynomial $g(x) = x^3 + x + 1$. **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)** What is BSC? Find the channel capacity of the BSC. **07**

(b) What is perfect code? For a (6,3) code with following generator matrix **07**

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

Construct the code for this G, and show that d_{min}, the minimum distance between code words is 3.

Q.4	**(a)**	Show that entropy is maximum when all messages are equiprobable.	**07**
	(b)	What is scrambling? Explain scrambling and unscrambling process with block diagram and example.	**07**

OR

Q.4	**(a)**	What is the multi-amplitude signaling? Derive the BER for the same using matched-filter receiver.	**07**
	(b)	What is pulse shaping? Why pulse shaping is done? Explain pulse shaping by transversal filter.	**07**
Q.5	**(a)**	Explain briefly QPSK Demodulation with neat sketch.	**07**
	(b)	Derive the formula for signal to quantization noise ratio for PCM.	**07**

OR

Q.5	**(a)**	With necessary diagram and waveforms explain the principle of Binary Phase Shift Keying (BPSK).	**07**
	(b)	Write short note on optimum binary receiver.	**07**

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