Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI- EXAMINATION – SUMMER 2016

Subject Code:161001 **Date:19/05/2016**

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)** Define the terms mean, variance and standard deviation for random variable X. let random variable X have a uniform distribution given by **07**

$f_x(x) = 1/2\pi$ for $0 \leq x \leq 2\pi$

$= 0$ elsewhere

Calculate mean, mean square value, variance and standard deviation

(b) State and prove central limit theorem **07**

Q.2 **(a)** State and prove sampling theorem. What is Aliasing? **07**

(b) Find the Nyquist rate and Nyquist interval for the following signals **07**

i) $x(t) = (1/2\pi) \cos(4000\pi t)\cos(1000\pi t)$

ii) $x(t) = (\sin 500\pi t) / \pi t$

OR

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

Q.3 **(a)** A television signal with bandwidth of 4.2 MHz is transmitted using binary PCM. The number of quantization levels are 512. Calculate **07**

i. Code word length
ii. Transmission bandwidth
iii. Final bit rate
iv. Output signal to quantization noise ratio

(b) With the help of block diagram and waveform explain the operation of DPSK transmitter and receiver. **07**

OR

Q.3 **(a)** What is line coding? Explain the desirable properties of line codes. **07**
For the data stream 1011100101 draw the following formats.
(i)Polar RZ (ii) Split phase manchester (iii) AMI NRZ (iv) ON-OFF RZ.

(b) Explain the use of Scrambler and unscrambler in digital communication. Draw the circuits and explain the operation with suitable example. **07**

Q.4 **(a)** What is Inter Symbol Interference? Explain Nyquist's first criterion for zero ISI? **07**

(b) What is the difference between coherent and non-coherent detection techniques? Discuss coherent and non-coherent detection of FSK signal. **07**

OR

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

(b) A continuous signal is band limited to 5 kHz. The signal is quantized to 8 levels with probabilities 0.25, 0.2, 0.2, 0.1, 0.1, 0.05, 0.05, 0.05. Calculate entropy and rate of information **07**

Q.5 **(a)** State & explain Shannon's theorem of channel capacity. What is its importance? What are its limitations **07**

(b) A generator matrix of (6,3) linear block code is given as **07**

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

Determine 'd_{min}' for the above code. Comment on error detection and correction capabilities. If the received sequence is 1 0 1 1 0 1, determine the message bit sequence.

OR

Q.5 **(a)** What are systematic codes. Find generator polynomial for (7,4) systematic cyclic code. Find the code words for 1010 and 1000. **07**

(b) Explain code tree, code trellis and state diagram for convolution encoders **07**

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