Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE – SEMESTER – VI (OLD).EXAMINATION – WINTER 2016

Subject Code: 161001 Date: 26/10/2016

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)** The Rayleigh density is characterized by the PDF **07**

$$p_r(r) = \begin{cases} \frac{r}{\sigma^2} e^{-r^2} / 2\sigma^2 & r \geq 0 \\ 0 & r < 0 \end{cases}$$

Show that Rayleigh random variable can be derived from two independent Gaussian random variables.

(b) Answer the following questions: (4+3 Marks) **07**

1 Explain Bernoulli Trials and find the probability of k successes in n (Bernoulli) trials.

2 We have two boxes. Box-1 contains 2000 components of which 5% are defective. Box-2 contains 500 components of which 20% are defective. We select at random one of the boxes and we remove at random a single component then, what is the probability that the selected component is defective?

Q.2 **(a)** Derive expression for signal-to-noise ratio for Pulse-Code Modulation. **07**

(b) Answer the following questions: (4+3 Marks) **07**

1 Discuss the need of Adaptive Delta Modulation.

2 For a PCM signal, determine L if the compression parameter μ=100 and the minimum SNR required is 45 dB.

OR

(b) Answer the following questions: (4+3 Marks) **07**

1 Find the message probability distributions that yield the maximum entropy of a source.

2 In a random experiment, a trial consists of four successive tosses of a coin. If we define an RV x as the number of heads appearing in a trial, determine probabilities $P_X(x)$ and CDF $F_X(x)$.

Q.3 **(a)** Discuss channel capacity of a continuous channel. Also explain ideal law for the exchange between the SNR and the transmission bandwidth using channel capacity equation. **07**

(b) A zero-memory source emits messages m1 and m2 with probabilities 0.9 and 0.1, respectively. Find the optimum (Huffman) binary code for this source as well as for its third- order extensions (that is, for N=3). Determine the code efficiency in each case. **07**

OR

Q.3 **(a)** What is pulse shaping? Describe any one criterion proposed by Nyquist for pulse shaping to eliminate ISI. **07**

(b) For a (7,4) linear block code, the generator matrix G is **07**

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

1. Construct the code table generated by this matrix.
2. Prepare a suitable decoding table.

Q.4 **(a)** Explain Viterbi's algorithm for decoding of Convolutional codes. **07**

(b) Answer the following questions: (5+2 Marks) **07**

1 Using general expression for finding Power Spectral Density (PSD), find PSD of a polar signaling.

2 Define mean and variance of random variable.

OR

Q.4 **(a)** Answer the following questions: (4+3 Marks) **07**

1 Explain Binary Frequency-Shift Keying (BFSK) in brief.

2 Explain the concept of scrambling.

(b) Answer the following questions: (5+2 Marks) **07**

1 Explain an MSK digital modulation technique in brief.

2 What is Noise figure?

Q.5 **(a)** Explain Quadrature Phase-Shift Keying (QPSK) technique including QPSK transmitter and receiver. **07**

(b) Discuss optimum binary receiver in brief and derive the general expression of bit error rate for it. **07**

OR

Q.5 **(a)** Describe non-coherent detection of Amplitude-Shift Keying (ASK) signal. **07**

(b) Describe Direct sequence spread spectrum system in detail. **07**

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