Roll No. ....

Total Pages : 3

## BT-4/M-21

# 44157

## DIGITAL COMMUNICATION Paper–EC-202A

Time : Three Hours]

[Maximum Marks: 75

**Note :** There is total *eight* questions. Each question carries equal marks. The candidate is required to attempt *five* questions in all, selecting *one* question from each unit.

## UNIT-I

- 1. (a) State and prove Sampling Theorem.
  - (b) A PCM system has a uniform quantizer followed by a v bit encoder. Show that the rms signal to noise ratio is approximately given by (1.8 + 6v) dB, assuming a sinusoidal input.
  - (c) Show that the signal to noise ratio of a uniform quantizer is PCM system increases significantly with increase in number of bits per sample. Also determine the signal to quantization noise ratio of an audio signal s(t) = 4 sin  $(2\pi 500t)$  which is quantized using a 10 bit PCM.
- (a) Explain the construction features and working of Adaptive Delta Modulation. Derive the expression for output signal to quantization noise ratio in delta modulation.
  - (b) Elucidate a DPCM system. Derive the expression for slope overload noise of a system.

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## UNIT-II

- (a) What is ISI and what are the various methods to remove ISI in communication system ? Also state and prove Nyquist first criterion for Zero ISI.
  - (b) Describe ideal Nyquist channel raised cosine spectrum in detail. 7
- (a) Binary data at 9600 bits/sec are transmitted using 8-ary PAM modulation with a system using a raised cosine roll-off characteristics. The system has a frequency response out to 2.4 kHz.
  - (i) What is symbol rate?
  - (ii) What is roll off factor of filter characteristics? 7
  - (b) Discuss Duo-binary signalling.

## UNIT-III

5. (a) Write note on optimum detection of signals in noise.

8

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- (b) An FSK system transmits binary data at the rate of  $2.5 \times 10^6$  bits per second. During the course of transmission, white Gaussian noise of zero mean and power spectral density  $10^{-20}$  W/Hz is added to the signal. In the absence of noise, the amplitude of the received sinusoidalnwave for digit 1 or 0 is 1 is 1 mV. Determine the average probability of symbol error for the following system configurations :
  - (i) Coherent binary FSK.
  - (ii) Coherent MSK.
  - (iii) Non-coherent binary FSK.

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- 6. (a) What is the difference between coherent and non-coherent detection technique? Describe non-coherent detection of PSK signal.
  - (b) Explain the PSD of QAM and derive its BER. State the advantages of QAM. 7

#### UNIT-IV

7. (a) The probability of error for binary PSK demodulation and detection when there is a carrier phase error  $\phi_{\rho}$  is

$$P_2(\phi_e) = Q\left(\sqrt{\frac{2\xi_b \cos^2}{N_0}} \phi_e\right)$$

Suppose that the phase error from the PLL is modelled as a zero mean Gaussian random variable with variance  $\sigma_{\phi}^2 \ll \pi$ . Determine the expression for the average probability of error(in integral form). 8

- (b) Determine the ML phase estimate for offset QPSK. 7
- 8. (a) Explain Maximum likehood sequence detector. 8
  - (b) Describe the performance of optimum receiver for memoryless modulation and calculate the probability of error for M-ary PSK.

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