

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.
2. (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.

UNIT-II

3. (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. 8
- (b) Describe ideal Nyquist channel raised cosine spectrum in detail. 7
4. (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. 8

UNIT-III

5. (a) Write note on optimum detection of signals in noise. 8
- (b) An FSK system transmits binary data at the rate of 2.5×10^6 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 sinusoidal wave for digit 1 or 0 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. 7

6. (a) What is the difference between coherent and non-coherent detection technique? Describe non-coherent detection of PSK signal. 8
- (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 ϕ_e is

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

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 likelihood sequence detector. 8
- (b) Describe the performance of optimum receiver for memoryless modulation and calculate the probability of error for M-ary PSK. 7