[4658] – 82

Seat No.	

T.E. (E&TC) (Semester – I) Examination, 2014
DIGITAL COMMUNICATION
(2008 Course)

Time : 3 Hours Max. Marks : 100

Instructions : *1) Answer* ***any three*** *questions from* ***each*** *Section.*
2) Answer to the ***two*** *Sections should be written in* ***separate*** *books.*
3) ***Neat*** *diagrams must be drawn* ***wherever*** *necessary.*
4) Figures to the ***right*** *indicate* ***full*** *marks.*
5) Assume ***suitable*** *data,* ***if necessary****.*

SECTION – I

1. a) Identify and compare the distinctive feature and relative advantage of PCM (with and without companding), delta modulation and differential PCM. **8**

b) We wish to transmit a 100 character alphanumeric message in 2s using 7-bit ASCII coding, followed by an eighth bit for error detection per character. A multilevel PAM waveform with M = 32 levels is used. **8**

A) Calculate the effective transmitted bit rate and symbol rate.

B) Repeat part (a) for 16 level PAM, 8 level PAM, 4 level PAM, PCM (Binary).

OR

2. a) Derive an expression for signal-to-quantisation noise ratio in a Delta modulation (DM) system with no slope overload. **8**

b) Consider an audio signal with spectral components limited to the frequency band 300 to 3300 Hz. Assume that the sampling rate of 8000 samples/s will be used to generate a PCM signal. Assume that the ratio of peak signal power to average quantization noise power at the output needs to be 30dB. **8**

a) What is the minimum number of uniform quantization level needed and what is minimum number of bits per sample needed ?

b) Calculate the system bandwidth (as specified by the main spectral lobe of signal) required for detection of such a PCM signal.

3. a) Explain need of Line coding. State its properties. Draw and give mathematical expression of Power Spectral density for unipolar NRZ, Polar RZ, AMI, and Manchester. **10**

b) A computer gives a binary data at the rate of 56 kbps and its transmitted using base band PAM system that is designed to have a raised cosine spectrum. Determine transmission band width required for roll off rates i) α = 0.25 ii) α = 0.75. **8**

OR

P.T.O.

4. a) Explain Inter Symbol Interference (ISI) with help of block diagram of a binary base band transmission system. Also explain Nyquist solution used for curing ISI. **10**

   b) Write short note on with respect to PCM **8**
      a) Decoding noise
      b) Error threshold.

5. a) Classify and explain different types of random processes. **8**

   b) Two random processes z(t) and y(t) are given by

   $z(t) = A \cos(\omega ct + \phi)$

   $y(t) = A \sin(\omega ct + \phi)$

   Where A and ωc are constants and ϕ is a uniform random variable over (0, 2π). Find the auto correlation and cross correlation of z(t) and y(t). **8**

OR

6. a) Explain ergodic process. If X(t) = A cos ($2\pi f\ ct$ + $\varnothing$) is random process with $\varnothing$ as a random variable uniformly distributed over (0, 2π). Prove that x(t) is ergodic in mean. **8**

   b) A wide sense stationary random process X(t) is applied to the input of LTI system with impulse response h(t) = 3e – 2t u(t). Find the mean value of output Y(t) of the system if E[X(t)] = 2. **8**

SECTION – II

7. a) With a neat diagram, explain how a coherent binary FSK wave can be generated and detected. And compare its performance with BPSK. **10**

   b) The bit rate of NRZ data stream is 10Mbps and average energy per bit is 0.02 units. Find the Euclidean Distance ‘d’ and Bandwidth for the following Schemes. 1. BPSK 2. 8-PSK, 3. QPSK, 4. BFSK. **8**

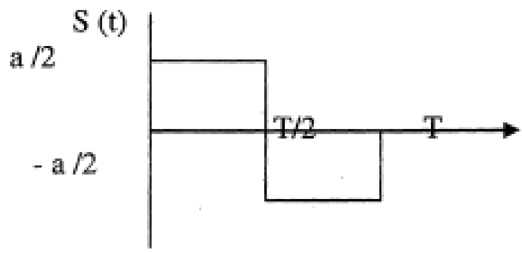
OR

8. a) Compare the Euclidian distance ‘d’ and Bandwidth of M-Ary PSK, M-Ary FSK and QAM with M = 2n for n = 3, 4. **10**

   b) The following bit streams are to be transmitted using DPSK scheme **8**
      i) 1011100011
      ii) 0101000111.

   Determine and sketch the encoded sequence and transmitted phase sequence.

9. a) Consider the signal S(t) shown in fig. **8**



   Determine the impulse response of a filter matched to this signal and sketch it as a function of time, Plot the matched filter output as a function of time.

   b) Derive the expression for the probability of error of a BFSK system. **8**

OR

10. a) Derive the expressions for signal to noise ratio and error probability of a matched filter in presence of white Gaussian noise. **8**

b) Binary data is transmitted using M-ary PSK at a rate 2 Mbps over RF link having bandwidth 2 MHz. Find signal power required at receiver input so that bit error probability is less than or equal to 10^5. The channel noise PSD is 10^{-8} Watt/Hz. **8**

Calculate for M = 16 and M = 32

Given erf (0.99996) = 3.1

erf (0.99995) = 3.2

11. a) With a neat block diagram, explain the working of a working of a frequency hopped transmitter – receiver combination. **8**

b) A PN sequence is generated using a feedback shift register of length 4. Find the generated output sequence if the initial contents of shift register are 1000. If the chip rate is 10^7 Chip/sec calculate the chip and PN sequence duration and period of output sequence. Draw its Scheme arrangement. **8**

OR

12. a) Represent variation of the frequency of an slow hop spread spectrum system with binary FSK, having following parameters. **8**

Number of bits per MFSK symbol K = 2.

Number of MFSK tones $M = 2^K = 4$

Length of PN segment per hop k = 3

Total number of frequency hops $2^k = 8$

for the binary message of 011111110001001111010

Generate the PN sequence for the message to be transmitted. The period of the PN sequence is $2^4 - 1 = 15$ with initial shift register content of 1100.

b) What is multi-user communication ? Describe different multiple access techniques on the basis of channel sharing and applications. **8**

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