Total No. of Questions :8]

SEAT No. :

P1729

[Total No. of Pages :3

[5058] - 362

T.E. (E & TC)

DIGITAL COMMUNICATION

(2012 Pattern) (End Semester) (Semester - I)

Time : 2½ Hours] *[Max. Marks :70*

Instructions to the candidates:

1) ***Answer Q.1 OR Q.2, Q.3 OR Q.4, Q.5 OR Q.6, Q.7 OR Q.8.***
2) ***Neat diagrams must be drawn whenever necessary.***
3) ***Figures to the right side indicate full marks.***

Q1) a) Draw block diagram of Adaptive Delta modulator and explain the same. What are the advantages of Adaptive delta modulator over Delta Modulator. **[8]**

b) Explain Inter symbol interference. Explain its causes and remedies to avoid it. **[6]**

c) A random process X (t) is expressed as X (t) = M. Cos (ω_0 t) + N. Sin (ω_0 t) where ω_0 is constant while M and N are random variables. **[6]**

i) Prove that the necessary condition for X (t) to be stationary is, E [M] = E [N] = 0.

ii) Prove that X (t) is wide sense stationary if M and N only if and are uncorrelated and have equal variance. i.e. E [MN] = 0 and E [M^2] = E [N^2] = σ^2 .

OR

Q2) a) Draw and explain CCIT hierarchy of multiplexing. **[6]**

b) An audio signal with highest frequency component 3300 Hz is pulse code modulated with a sampling rate of 8000 samples/sec. The required signal-to-quantization noise ratio is 40dB. **[8]**

i) What is the minimum number of uniform quantising levels needed?

ii) What is the minimum number of bits per sample needed?

iii) Calculate the minimum number of bits per sample needed.

P.T.O.

c) Define mean, correlation and covariance function for random process. Write down mathematical expression for the same. **[6]**

Q3) a) Derive expression for signal to noise ratio of Integrate and Dump filter. **[8]**

b) Explain Geometrical representation of signal and Gram-Schmidt procedure. **[8]**

OR

Q4) a) Derive the expression for signal to noise ratio and error probability of a matched filter in the presence of white gaussian noise. **[8]**

b) Explain the principle of Maximum Likelihood receiver with the help of various methods of detection of signal. **[8]**

Q5) a) Find the bit error probability for a BPSK system having a bit rate of 1 Mbits/s. The receiver receives the waveforms S_1 (t) = A. Cos (ω_0 t) and S_2 (t) = - A. Cos (ω_0 t). The received signals are co-herently detected using a matched filter. If A = 10mV and single sided noise power spectral density is No = 10^{-11} W/Hz. Assume that the signal power and energy per bit are normalized. Assume if necessary erfc [2.24] = 41×10^{-5} and erf [3.1] = 0.9999. **[8]**

b) Give mathematical representation of QPSK signal. Draw signal space diagram of QPSK signal. Write the expression of all message points in the diagram. **[8]**

OR

Q6) a) Explain M-ary PSK transmitter with suitable block diagram. What are the advantages of M-ary PSK over M-ary FSK. **[8]**

b) Draw signal space of 16 - QAM system and comment on Euclidean distance and probability of error for 16 - QAM signals. **[8]**

Q7) a) What is PN sequence? Verify the three properties of PN sequence with the help of shift register. **[6]**

b) A spread spectrum communication system is characterised by the following parameters. Duration of each information bit $T_b = 4.095$ ms, Chip duration of a PN sequence $T_c = 1\ \mu S$. Calculate the processing gain and jamming margin if $(E_b / N_o) = 10$ and the average probability of error $P_e = 0.5 \times 10^{-5}$. **[6]**

c) Explain in brief frequency reuse schemes and cell splitting in mobile communication system. **[6]**

OR

Q8) a) Draw the block diagram of FH-SS systems transmitter and receiver. Write the functional names inside the blocks and input output signals of each block. **[6]**

b) What are multiple access techniques? Explain WCDMA in detail. **[6]**

c) Write a short note on Cellular Telephone system. **[6]**