

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 $X(t) = M \cos(\omega_0 t) + N \sin(\omega_0 t)$ 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 $E[M^2] = E[N^2] = \sigma^2$.

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.

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- 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 $S_1(t) = A \cdot \cos(\omega_0 t)$ and $S_2(t) = -A \cdot \cos(\omega_0 t)$. The received signals are coherently detected using a matched filter. If $A = 10\text{mV}$ and single sided noise power spectral density is $N_0 = 10^{-11} \text{ W/Hz}$. Assume that the signal power and energy per bit are normalized. Assume if necessary $\text{erfc}[2.24] = 41 \times 10^{-5}$ and $\text{erf}[3.1] = 0.9999$. [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 $T_c = 1 \mu\text{S}$. Calculate the processing gain and jamming margin if $(E_b / N_0) = 10$ 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]

