Question Bank for MID TEST-1

Chapter-1

Q – 1: Illustrate the problems of delta modulation with necessary waveforms. Explain how adaptive delta modulation corrects these problems.

Q – 2: A signal \( m(t) \) of bandwidth \( B=4\text{kHz} \) is transmitted using a binary companded PCM with \( \mu=100 \). Compare the cases of \( L=16 \) & \( L=128 \) from the point of view of transmission bandwidth and the output SNR.

Q – 3: Describe quantization noise in a PCM.


Q – 5: Define mean, variance and standard deviation of the random variable. Find mean square and variance of the uniform quantization error whose pdf is \( pq(q) = L/2mp \) for \(-mp/L \leq q \leq mp/L \) = 0 otherwise where \( L \) is quantization level and \((-mp,mp)\) is signal amplitudes range.

Q – 6: State and prove Sampling theorem for low pass signals in time domain.


Q – 8: What is Delta Modulation? Draw the block diagram of Delta modulator transmitter and explain its working with waveforms.

Q – 9: Derive the formula for signal to quantization noise ratio for PCM.

Q – 10: Compare PCM and Delta Modulation in terms of their figure of merits.

Q – 11: What is companding process in PCM? State laws for the same.

Q – 12: Describe the effect of slope overloading and hunting in delta modulation.

Q – 13: Draw the block diagram of digital communication system and explain the three major signal processing tasks.

Q – 14: Draw and explain the block diagram of PCM transmitter and receiver. Explain the quantization process.

Q – 15: Explain delta modulation in detail. Also discuss advantages and disadvantages of delta modulation.

Q – 16: Draw and explain block diagram of ADPCM system. Compare PCM and ADPCM.

Q – 27: Discuss uniform and non-uniform quantization techniques. What is the advantage of non-uniform quantization?
Chapter-2

Q – 1: Using general expression for finding Power Spectral Density (PSD), find PSD of an on-off signaling.
Q – 2: Draw the schematic of a regenerative repeater.
Q – 3: Explain the method proposed by Nyquist to resolve the difficulty of ISI using duobinary pulse.
Q – 4: Discuss briefly power spectral density of NRZ and bi-phase code.
Q – 6: What is scrambling? Explain scrambling and descrambling process with block diagram and suitable example.
Q – 7: For the data stream 10111001 draw the following formats.
i) Polar NRZ ii) Split phase manchester iv) AMI NRZ
Discuss the desirable properties for selection of line codes.
Q – 8: What is Inter Symbol Interference? Explain the Nyquist’s first criteria for zero ISI.

Chapter-3 & 4

Q – 1: Explain Quadrature Phase Shift Keying (QPSK) technique with neat sketch. Draw constellation diagram for QPSK.
Q – 2: With diagram and waveforms explain the principle of DPSK generator
Q – 3: Explain the principle of Quadrature Amplitude Shift Keying (QASK) transmitter
Q – 4: With diagram explain the generation of BFSK sign
Q – 5: With diagram explain the principle of Binary Phase Shift Keying (BPSK).
Q – 6: Compare ASK and FSK in terms of their figure of merits.
Q – 7: What is the difference between coherent and non-coherent detection Techniques? Discuss coherent and non-coherent detection of FSK signal

Chapter-5

Q – 1: Define cumulative Distribution Function (CDF). What are the important properties of CDF? State and prove them.
Q – 2: What is Probability Density function? State and prove its properties.
Q – 3: A random experiment consists of drawing two cards from a deck in succession (without replacing the first card drawn). Assign a value to the probability of obtaining two red aces in two draws.
Q – 4: In PCM, regenerative repeaters are used to detect pulses (before they are lost in noise) and retransmit new, clean pulses. This combats the accumulation of noise and pulse distortion. A certain PCM channel consists of n identical links in tandem. The pulses are detected at the end of each link and clean new pulses are transmitted over
the next link. If $P_e$ is the probability of error in detecting a pulse over any one link, show the $P_E$, the probability of error in detecting a pulse over the entire channel (over the n links in tandem), is $P_E \sim n P_e$, $nP_e << 1$

Q – 5: What is Chebyshev’s inequality? Where it is used? Write short note on it.
Q – 6: State and prove Central limit theorem.
Q – 7: Explain BAYES rules in detail

Chapter-6

Q – 1: State and explain Shannon’s theorem of channel capacity. What is Its importance? What are its limitations?
Q – 2: An analog signal is band limited to 4 kHz. If it is sampled at the Nyquist rate and the samples are quantized into 4 levels. The quantization levels Q1,Q2,Q3 and Q4 are independent messages and have the probabilities $p_1=p_2=1/8$ and $p_3=p_4=3/8$. Find the information rate of the source.
Q – 3: Derive the equation for channel capacity of BSC channel.
Q – 4: A source emits seven massages with probabilities 1/2, 1/4, 1/8, 1/16, 1/32, 1/64, and 1/64, respectively. Find the entropy of the source. Obtain the compact binary code and find the average length of the code word. Determine the efficiency and the redundancy of the code.
Q – 5: Define entropy. Prove that entropy is maximum when all the messages are equiprobable.
Q – 6: A binary channel matrix is given by
\[
\begin{array}{ccc}
 y_1 & y_2 \\
 x_1 & 2/3 & 1/3 & x_1,x_2=\text{input} \\
 y_1,y_2=\text{output} \\
 x_2 & 1/3 & 2/3 \\
 P(x_1)=1/2 & \text{and} & P(x_2)=1/2. \text{Determine } H(X), H(Y), H(X/Y), H(Y/X) & \text{and } I(X;Y).
\end{array}
\]
Q – 7: Define the entropy of a discrete memoryless source emitting M symbols and discuss the properties of entropy.
Q – 8: Explain Mutual information in detail. State its properties.

Chapter-7

Q – 1: Derive Hamming Bound for $(n,k)$ binary t-error correcting block code, where $n=$length of code word and $k=$length of data word $(n>k)$. Define perfect code and Hamming codes
Q – 2: For a (6,3) systematic linear block code, the three parity check digits are $c_4 = d_1+d_2+d_3$, $c_5 = d_1+d_2$, $c_5 = d_1+d_3$
   i) Construct the appropriate generator matrix for this code and code table. Determine the error correcting capability.
   ii) Decode the received words 101100, 000110, 101010.
Q – 3: 1. Construct the systematic (7,4) cyclic code using the generator polynomial 
   \[ g(x) = x^3 + x + 1 \]
   2. What are the error correcting capabilities of this code?
   3. Construct the decoding table.
   4. If the received word is 1101100, determine the transmitted data word.

Q – 4: Write short note on Convolution code.

Q – 5: Write short note on comparison of coded and uncoded system.

Q – 6: Explain the generation of linear block code using suitable example.

Q – 7: Explain the decoding of cyclic code with suitable example.

Q – 8: The generator polynomial of a (7, 4) cyclic code is \( G(D) = D^3 + D + 1 \). Obtain any one 
   code vector for the code in non systematic form.