

- NB.**
1. Question No. 1 is compulsory.
  2. Attempt any three out of remaining five questions.
  2. Figures to right indicate full marks.
  3. Assume data wherever required and state it clearly.

- Que.1** Answer the following (Any Four) 20
- a. Explain autocorrelation and covariance of random variable.
  - b. What are the properties of CDF?
  - c. What is Entropy of an information source? When is entropy maximum?
  - d. Give a comparison between the basic digital modulation techniques (ASK, FSK and PSK).
  - e. Explain role of hamming distance in error detection & correction?
  - f. Justify/Contradict: Syndrome depends on error pattern and received code word.
- Q2**
- a. The nine symbols viz. A1, A2, A3, ... A9 have corresponding probability of occurrences as 0.12, 0.2, 0.08, 0.25, 0.02, 0.04, 0.06, 0.13, 0.1. Determine the Huffman code, calculate the average code word length, entropy and coding efficiency. 10
  - b. Explain the working of Minimum Shift Keying, modulator and demodulator, with the help of block diagram and waveform. 10
- Q3**
- a. Linear block code having following parity check equations –  
 $c_4 = d_1 + d_2 + d_3$ ,  $c_5 = d_1 + d_2$ ,  $c_6 = d_1 + d_3$ . Calculate G & H matrix, error detection & Correction capacity of the code, decode the received codeword-----101100 10
  - b. Derive the expression for the probability of error of the matched filter. 10
- Q4**
- a. Discuss the problem of inter symbol interference (ISI). Explain the measures to be taken to reduce ISI. How to study ISI using eye pattern? 10
  - b. Generator vectors of convolution encoder are  $g_1 = 101$ ,  $g_2 = 110$ ,  $g_3 = 011$ . Draw encoder, State table, State diagram & code trellis. Calculate the code word for the message vector 101011. 10
- Q5**
- a. What are the random processes? Explain Central limit theorem. 10
  - b. Justify that distance of 16-QAM is greater than 16-Ary PSK & less than QPSK. 10
- Q6** Write a short note on (Any Three) 20
- a) Nyquist criterion for zero ISI
  - b) Systematic and non-systematic block codes
  - c) Power spectral density and bandwidth of 16-Ary PSK.
  - d) Coherent and non-coherent digital detection techniques.

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