



- 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**)

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- 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. $A_1, A_2, A_3, \dots, A_9$ 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.
- b. Explain the working of Minimum Shift Keying, modulator and demodulator, with the help of block diagram and waveform.

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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
- b. Derive the expression for the probability of error of the matched filter.

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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?
- 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.

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Q5

- a. What are the random processes? Explain Central limit theorem.
- b. Justify that distance of 16-QAM is greater than 16-Ary PSK & less than QPSK.

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Q6 Write a short note on (Any **Three**)

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- 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.
