

- N.B. : (1) Question No 1 is Compulsory.
 (2) Attempt any three questions out of the remaining five.
 (3) All questions carry equal marks.
 (4) Assume suitable data, if required and state it clearly.

- 1 Attempt any FOUR [20]
- a Calculate the entropy of the following symbols in bits/symbol and decit/symbol. The symbols are S_1 , S_2 , and S_3 with probabilities 0.6, 0.3 and 0.1 respectively.
- b Determine VRC bit for the data sequence 11110011 and show that it can detect 1-bit error.
- c Compare ISI and ICI
- d Explain AWGN and matched filter
- e Find the bandwidth for transmitting 120 bps using QPSK, 4-ary FSK, MSK, 8-ary PSK, and 16-ary QASK
- 2 a Calculate the maximum capacity of a Gaussian channel with a bandwidth of 3 kHz and SNR of 30dB. If the bandwidth is doubled, calculate the new channel capacity. [10]
- b Parity bits equations of a (6,3) linear block code are given below. Construct generator matrix, parity check matrix and implement encoder & decoder. [10]
 $P_3 = D_3 + D_2 + D_1$, $P_2 = D_3 + D_2$, and $P_1 = D_2 + D_1$
- 3 a Implement (7,4) cyclic code encoder and decoder using the generator polynomial [10]
 $G(x) = x^3 + x^2 + 1$
- b Find 3-bit HRC and 3-bit checksum for the data 101011001111 and show that these codes can detect 3 continuous bit errors [10]
- 4 a Generator sequences of a convolutional encoder are given below. Calculate the impulse response of the encoder and sketch trellis diagram and using the trellis diagram determines the codeword for the input message 111. [10]
 $g^{(1)} = 111$ and $g^{(2)} = 101$

- b Sketch and compare NRZ unipolar, NRZ polar, NRZ Manchester and NRZ AMI [10]
formats in terms of bandwidth, power requirement, synchronization capability,
DC level and polarity inversion error. Data sequence is 0011.
- 5 a Find minimum variance Huffman code and Shannon-Fano code for the symbols [10]
 S_1, S_2, S_3, S_4 and S_5 with probabilities 0.2, 0.1, 0.4, 0.2 and 0.1 respectively.
Compare the efficiencies and variances of the generated codes.
- b Sketch QPSK and offset-QPSK waveforms for the input message 00011011 and [10]
explain the advantage of offset-QPSK over QPSK.
- 6 a Derive the PSD of BFSK, sketch the power spectrum and find the bandwidth. [10]
- b Find the error probability of 16-ary QASK using signal space representation and [10]
Euclidean distance.
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