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Paper Code : EC604B INFORMATION THEORY & CODING

UPID : 006035

Time Allotted : 3 Hours   *Full Marks :70*

The Figures in the margin indicate full marks.
Candidate are required to give their answers in their own words as far as practicable

Group-A (Very Short Answer Type Question)

1. Answer any ten of the following :   [1 x 10 = 10]

(I)   In any linear feed forward path of a (4, 3, 2) convolution encoder, we need maximum shift registers
a) 4   b) 3 c) 2   d) 1

(II)   Entropy is
a) Average information per message   b) Information in a signal   c) Amplitude of signal   d) All of the above

(III)   The channel capacity is
a) The maximum information transmitted by one symbol over the channel   b) Information contained in a signal   c) The amplitude of the modulated signal d) All of the above

(IV)   To detect up to 5 errors, the minimum hamming distance in a block code must be
[a] 5   [b] 6   [c] 11   [d] none

(V)   In which code if a codeword is rotated, the result is another codeword

(VI)   A polynomial is called monic if
a) Odd terms are unity   b) Even terms are unity   c) Leading coefficient is unity d) Leading coefficient is zero
b)   Even terms are unity

(VII)   H(Y) is minimum when probability of occurrence of input symbols are
[a] 1.38   [b] 0.5   [c] 7.55   [d] none of these

(VIII)   Which among the following represents the code in which code words consists of message bits and parity bits separately?
a) Linear Block Code b) Systematic Cyclic Code c) c) Hamming Code   d) both a and b

(IX)   The generator polynomial of a (7,4) cyclic code has the degree of
[a] 2   [b] 3   [c] 4   [d] 5

(X)   What are the different decoding methods of convolution code?

(XI)   The capacity of Gaussian channel is ____ bits/s.
a. C=2B(1+S/N)   b. C=B2(1+S/N)   c. C=B(1+S/N)   d. C = B(1+S/N)2

(XII)   A code is with minimum distance dmin = 5. How many errors can it correct ?
a) 3   b) 2   c) 4   d) 1

Group-B (Short Answer Type Question)

Answer any three of the following :   [5 x 3 = 15]

2.   Show that the channel capacity for a continuous channel is given by C=Blog2[1+S/N] bit/sec   [5]

3.   What are the differences between linear block codes and convolutional codes?   [5]

4.   Calculate the channel capacity of an AWGN channel with a bandwidth of 3 MHz and S/N ratio of 40 dB.   [5]

5.   Prove that, information content in a message, "Sun rises in the east" is 0.   [5]

6.   Design a multiplication and addition table for GF(5)   [5]

Group-C (Long Answer Type Question)

Answer any three of the following :   [15 x 3 = 45]

7.   What is Hamming distance? Give relation between minimum distance and error detecting and correcting   [15]
capability. Describe a Hamming code.

8.   (a) Determine the Shanon Fano code for the following messages with the given probabilities: X1 = 0.15,   [10]
X2 = 0.20, X3 = 0.10, X4 = 0.05, X5 = 0.25, X6 = 0.12, X7 = 0.13 and find out the coding efficiency.

(b) Calculate the channel capacity of an AWGN channel with a bandwidth of 1 MHz and S/N ratio of 40   [5]
Db.

9.   (a) Encode 1101 using hamming code and explain how error can be detected?   [12]

(b) Differentiate between source coding and channel coding. [3]

10. One parity check code has parity check matrix as : [15]
    i) Determine generator matrix
    ii) Find the code word that begins with [101]
    If received word is [110110], then decode this word.

11. (a) Explain different types of channel models. [7]

    (b) For a BSC, input source alphabet is X = {0, 1} with probabilities {0.6, 0.4}; and output alphabet is Y = {0, 1}.Find the channel matrix. [8]

*** END OF PAPER ***