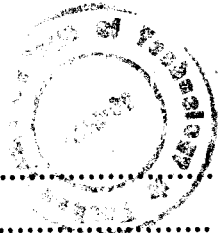


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**CS/B.Tech(ECE-NEW)/SEM-7/EC-703/2009-10  
2009**

**CODING AND INFORMATION THEORY**

Time Allotted : 3 Hours

Full Marks : 70

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words  
as far as practicable.*

**GROUP - A  
( Multiple Choice Type Questions )**

1. Choose the correct alternatives for any ten of the following :  
10 × 1 = 10

i) A code with minimum distance  $d_{\min} = 5$ . How many errors it can correct ?

- a) 3
- b) 2
- c) 4
- d) 1.

ii) A ( 7, 4 ) cyclic code is generated by a generator polynomial of degree

- a) 3
- b) 2
- c) 4
- d) 5.

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- iii) The generator polynomial of a cyclic code is a factor of
- a)  $X^n + 1$                       b)  $X^{(n+1)} + 1$   
c)  $X^{(n+2)} + 1$                 d) none of these.
- iv) The entropy of information source is maximum when symbol occurrences are
- a) equiprobable                      b) different probability  
c) both (a) and (b)                d) none of these.
- v) Measure of information ( $m_k$ ) of a message  $m_k$  with probability  $p_k$  is given by
- a)  $\log_b (1/p_k)$                       b)  $\log_b (p_k)$   
c)  $\log_b (1 - p_k)$                 d)  $\log_b (1/1 - p_k)$ .
- vi) The ideal communication channel is defined for a system which has
- a) - Finite C                              b)  $BW = 0$   
c)  $S/N = 0$                               d) Infinite C.
- vii) Which of the following technique is used for Viterbi algorithm for decoding ?
- a) Code tree                              b) Trellis  
c) State diagram                        d) Parity generator.
- viii) A message that is sent in cryptography is known as
- a) plain text                              b) cipher text  
c) cracking                                d) decryption.

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ix) The Hamming distance between  $v = 1001011$  and  $w = 0100010$  is

- a) 3
- b) 4
- c) 2
- d) 1.

x) If a telephone channel has a bandwidth of 3000 Hz and the SNR = 20 dB, then the channel capacity is

- a) 3 kbps
- b) 1.19 kbps
- c) 2.19 kbps
- d) 1.19 bps.

xi) The number of undetectable errors for a  $(n, k)$  linear code is

- a)  $2^{n-k}$
- b)  $2^n$
- c)  $2^n - 2^k$
- d)  $2^k$ .

xii) A polynomial is called Monic if its leading coefficient is

- a) 0
- b) 1
- c) odd
- d) even.

xiii) A  $(8, 4)$  linear code has a code rate of

- a) 8
- b) 4
- c) 2
- d) 0.5.

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xiv) If  $H = \begin{bmatrix} 1001011 \\ 0101110 \\ 0010111 \end{bmatrix}$ , then the code rate corresponding

to the message  $u = 1011$  is

- a) 0001101                      b) 1001011
- c) 1001101                      d) 0001011.

xv) An encoder for a ( 4, 3, 2 ) convolution code has a memory order of

- a) 4                                      b) 3
- c) 2                                      d) 1.

**GROUP - B**

**( Short Answer Type Questions )**

Answer any *three* of the following.                      3 × 5 = 15

2. a) What are the drawbacks of Prefix coding that lead to the discovery of Arithmetic coding ?                      2
- b) Let the alphabet consists of only three symbols A, B and C with probabilities of occurrence  $P ( A ) = 0.5$ ,  $P ( B ) = 0.25$  and  $P ( C ) = 0.25$ . Suppose the input symbol stream is B A C A, determine the arithmetic code for the steam.                      3

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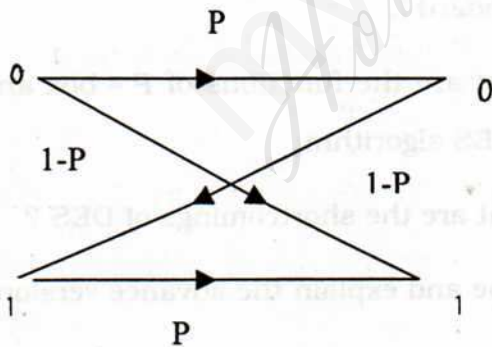
- 3. a) Prove that the syndrome polynomial in a cycle code solely depends on the error polynomials. 2
- b) Say  $g(x) = (x^3 + x + 1)$  for a  $(7, 4)$  cycle code. Determine the parity check polynomial  $h(x)$ . 2
- c) Determine the generator matrix for  $g(x) = (x^3 + x + 1)$ . 1
- 4. a) What is Entropy? 2
- b) Consider a source  $X$  which produces five symbols with probabilities  $1/2, 1/4, 1/8, 1/16$  and  $1/16$ . Find the source entropy. 3
- 5. Draw the block diagram of a typical data transmission system and explain the function of each block. 5
- 6. Describe RSA algorithm. 5

**GROUP - C**

**( Long Answer Type Questions )**

Answer any three of the following. 3 × 15 = 45

- 7. For a BSC shown below find the channel capacity of  $p = 0.9$ . Derive the formula that you have used. 5 + 10



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8. The parity check bits of a ( 8, 4 ) block code are generated by

$$C_5 = d_1 \oplus d_2 \oplus d_4, C_6 = d_1 \oplus d_2 \oplus d_3$$

$$C_7 = d_1 \oplus d_3 \oplus d_4, C_8 = d_2 \oplus d_3 \oplus d_4$$

- a) Find the generator matrix and the parity check matrix for this code.
- b) Find the minimum weight of this code.
- c) Find the error detecting and the error correcting capability of this code.
- d) Show through an example that this code can detect three errors/code word. 6 + 4 + 4 + 1

- 9.
- a) What are the problems of symmetric key cryptography.
  - b) State the differences between symmetric key & asymmetric key cryptography.
  - c) Explain the main concepts in DES ( Data Encryption Standard ). 2 + 5 + 8

- 10.
- a) What are the functions of P - box and S - box in case of DES algorithm.
  - b) What are the shortcomings of DES ?
  - c) Name and explain the advance version of DES. 5 + 5 + 1

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11. Write shote notes on any two of following :  $2 \times 7 \frac{1}{2}$

- a) Shanon - Fano algorithm
  - b) Golay codes
  - c) Quantum cryptography
  - d) Triple error correcting codes.
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