Name : .....

Roll No. : .....

Invigilator's Signature : .....

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 : $10 \times 1 = 10$

   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.

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 crytography is known as

a) plain text b) cipher text

c) cracking d) decryption.

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.

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. $3 \infty 5 = 15$

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 $P(A) = 0{\cdot}5$, $P(B) = 0{\cdot}25$ and $P(C) = 0{\cdot}25$. Suppose the input symbol stream is $B\ A\ C\ A$, determine the arithmetic code for the steam. 3

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 explian the function of each block. 5

6. Describe RSA algorithm. 5

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. For a *BSC* shown below find the channel capacity of

   $p = 0{\cdot}9$. Derive the formula that you have used. 5 + 10

Dia.

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

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

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

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 + 5

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

a) Shanon – Fano algorithm

b) Golay codes

c) Quantum crytography

d) Triple error correcting codes.