

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 :

$$10 \infty 1 = 10$$

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 cryptography is known as
- a) plain text b) cipher text
 c) cracking d) decryption.



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

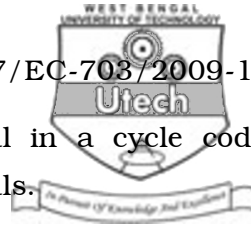
- a) 4 b) 3
c) 2 d) 1.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

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



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. $3 \times 15 = 45$

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

Dia.



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.
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).
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.

$$6 + 4 + 4 + 1$$

$$2 + 5 + 8$$

$$5 + 5 + 5$$



11. Write short notes on any *two* of following :

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

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