

M-32/2051

ALGEBRAIC CODING THEORY–MM709/AMC418

(Semester–IV)

Time : Three Hours]

[Maximum Marks : 70

Note : Attempt *two* questions each from Section A and B.
Section C will be compulsory.

SECTION–A

- I. (a) Explain difference between error detection and error correction.
- (b) Explain efficient approaches to single error correction.
- II. (a) Discuss error-detecting and correcting codes.
- (b) Explain that, every parity a commonly used coding scheme, is much more efficient than the simple repetition scheme.
- III. (a) Explain linear codes.
- (b) Prove that, for binary vectors x and y of the same length we have

$$W_H(x + y) = W_H(x) + W_H(y) - 2 W_H(x * y)$$
 where $x * y$ is defined to have 1 only in those positions where both x and y have a_1 .

- IV. (a) Prove that for a code C , we have $C \subseteq L(C)$ and only if $C \subseteq R(C)$.
- (b) Explain syndrome decoding. (2×10=20)

SECTION-B

- V. (a) Explain regarding ISBN codes.
- (b) Discuss sphere packing bound.
- VI. Show that the complete defining set is given by $J(c) = \{1, 2, 3, 4, 6, 8, 9, 10, 12\}$ and c has generated polynomial. $g(x) = 1 + x + x^2 + x^4 + x^5 + x^8 + x^{10}$, determine the dimensions, of code and apply the $B \subset H$ bound on the minimum distance.
- VII. (a) Discuss perfect codes and Quasi-perfect codes.
- (b) Prove that in a linear code the minimum distance is equal to the minimal weight among all non-zero code words.
- VIII. Let a problem to minimize the weighted sum of two variables x and y subject to several constraints here is the formulation :
- Minimize $x + 2y$
- St. $x - y \leq 3, x + 2y \geq 6, 3x - 4y = 10$
- with bounds $4 \leq x \leq 20, 2 \leq y \leq 22$
- describe stepwise complete procedure of the above problem. (2×10=20)

SECTION-C

- IX. (a) Find the check digits for
- (i) ISBNO – 7195 – 4400 –
 - (ii) ISBNO – 04 – 013341 –
- (b) Define Hamming distance.
- (c) Write down advantages and disadvantages of Hamming codes.
- (d) What do you mean by modified linear codes.
- (e) Explain expanded codes.
- (f) What are error detecting codes with examples ?
- (g) Let H be a parity-check matrix for an $[n, k]$ -code C in $V [n, f]$. Then every set of $(s - 1)$ columns of H are linearly independent and only if C has minimum distance at least s .
- (h) Write down irreducible polynomials with examples, also discuss irreducible quadratics over $GF(3)$
- (i) Explain syndrome decoding.
- (j) Discuss Reed-Muller codes. (10×3=30)
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