QP Code: P25C035

Reg. No : .....
Name : .....

ST MARY'S COLLEGE (AUTONOMOUS), THRISSUR-20

III SEMESTER (CBCSS-PG) DEGREE EXAMINATIONS, OCTOBER 2025
MTH3E01 : CODING THEORY
2024 Admission Onwards

Time: 3 Hours **Maximum Weightage: 30**

Section A

Answer **all**. Weightage **1** for each question. **(8x1 = 8 Weightage)**

1. Let $u = 01011$, $v = 11010$, $w = 01100$ verify that $wt(v+w) \leq wt(v) + wt(w)$ and $d(v,w) \leq d(v,u) + d(u,w)$
2. Suppose $p = 0.90, |M| = 3, n = 3$ and $C = \{101, 111, 011\}$. Find $\theta_p(C, 011)$
3. Let S be a subset of K^7, let $C =< S >$ and assume $C^{\perp}$ has dimension 3
   i) Find the dimension of C
   ii) Find the number of words in C
4. Can there exist perfect code for $n = 15, d = 3$?
5. Find an upper bound for the size or dimension for a linear code with $n = 7$ and $d = 3$
6. Find all words v of length 6 such that $\pi^2(v) = v$
7. Find the number of proper linear cyclic code of length $n = 5$
8. Find all irreducible polynomials of degree 4 over K.

Section B

Answer **any two** questions from each module. Weightage **2** for each question.
(6x2 = 12 Weightage)

Unit - I

9. Find a basis for $C =< S >$ where $S = \{0110, 1010, 1100, 0011, 1111\}$
10. Find a generator matrix of $C = \{00000, 11100, 00111, 11011\}$ and give the parameters (n, k, d).
11. Determine whether the following pair of matrices G_1 & G_2 generate equivalent codes

$$G_1 = \begin{bmatrix} 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 \end{bmatrix} \quad G_2 = \begin{bmatrix} 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 \end{bmatrix}$$

Turn Over

Unit - II

12. Prove that C_{24} is self dual.

13. Find the Generator Matrix $G(1,3)$

14. Define maximum distance seperable code and prove that every $n-k$ rows of its parity check matrix are linearly independent.

Unit - III

15. Find a basis & generator matrix for the linear cyclic code of length n with generator polynomial $g(x)$
    i) $n=7, g(x)=1+x^2+x^4$
    ii) $n=9, g(x)=1+x^3+x^6$

16. Construct a parity check matrix for a cyclic hamming code of length 7.

17. Let C be a linear cyclic code of length n and dimension k with generator $g(x)$ and if $1+x^n=g(x)h(x)$. Prove that $C^{\perp}$ is a cyclic code of dimension $n-k$ with generator $x^k h(x^{-1})$

Section C

Answer **any two** questions. Weightage **5** for each question. **(2x5 = 10 Weightage)**

18. Let $H=\begin{bmatrix}1&0&1\\1&1&1\\0&0&1\\1&1&0\\1&0&0\\0&1&0\\0&0&1\end{bmatrix}$ be a parity check matrix for a linear code C. Find
    i) A generator matrix for $C^{\perp}$
    ii) A generator matrix for C

19. List the cosets of the linear code C having the generator matrix
    $G=\begin{bmatrix}1&0&1&1&0\\0&1&0&1&1\\0&0&1&0&1\end{bmatrix}$

20. Show that the dual of $RM(r,m)$ is $RM(m-1-r,m)$, $r<m$

21. Find a parity check matrix for linear cyclic code of length 7 with generator $g(x)=1+x+x^2+x^4$

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