0712E949   Candidate's Seat No : _____

IM.Sc AIML Sem.-3 (NEP) Examination
MDC-AIML-234-T
Matrix Algebra & Discrete Mathematics

Time : 2-00 Hours]   December-2024   [Max. Marks : 50

Instructions: All questions are compulsory. Use of non-programmable scientific calculator is allowed.

Q.1   **(a)**   Find Adjoint of A using Vedic method.   (05)

$$A = \begin{bmatrix} 6 & 8 & 10 \\ 27 & 36 & 45 \\ 21 & 28 & 35 \end{bmatrix}$$

(b)   Find Determinant of B.   (05)

$$B = \begin{pmatrix} 7 & 5 & 5 & 5 & 5 \\ 5 & 7 & 5 & 5 & 5 \\ 5 & 5 & 7 & 5 & 5 \\ 5 & 5 & 5 & 7 & 5 \\ 5 & 5 & 5 & 5 & 7 \end{pmatrix}$$

OR

(a)   Using Paravartya Yojayet solve system of linear equation.   (05)
$x + 6y = 24$
$3x + 10y = 32$

(b)   Discuss about determinant of idempotent matrix, involutory matrix and orthogonal matrix.   (05)

Q.2   **(a)**   How many permutation matrices of order 4 whose trace is 0,1,2,3 and 4 respectively.   (05)

(b)   Define Rank of matrix.   (05)
Find Rank of matrix A.

$$A = \begin{bmatrix} 2 & 4 & 6 & 8 & 10 \\ 9 & 18 & 27 & 36 & 45 \\ 0 & 1 & 2 & 3 & 4 \end{bmatrix}$$

OR

(a)   Define Boolean matrix. How many Boolean matrices are possible of order 3×5.   (05)

(b)   Define Self Adjoint matrix.   (05)
True/False: 1) Every Symmetric matrix is Hermitian matrix.
              2) Every Hermitian matrix is Symmetric matrix.
Justify your answer.

Q.3   **(a)**   Define Positive Definite matrix.   (05)
Check whether given matrix A is Positive Definite matrix or not.

$$A = \begin{bmatrix} 3 & 3 & 3 & 3 \\ 9 & 9 & 9 & 9 \\ 27 & 27 & 27 & 27 \\ 81 & 81 & 81 & 81 \end{bmatrix}$$

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(P.T.O)

(b) Check whether Cholesky method is appropriate for system of linear equation or not. **(05)**

$x + 2y + 3z = 1$

$2x + 3y + 4z = 2$

$3x + 4y + 5z = 3$

OR

(a) Discuss about root of quadratic and cubic equation. **(05)**

What can you say about root of following cubic equation.

1) $x^3 + 3x - 2024$

2) $x^3 + 3x - 2025$

(b) The problem of solving the following system of linear equations is ill-conditioned or **(05)** not.

$x + 2y = 4$

$2x + 3.999y = 8$

Q.4 **(a)** Define Tau Function. **(05)**

How Many numbers are there from 1 to 100 whose number of factors are 4.

(b) Define Regular graph and complete graph. **(05)**

True/False: 1) Every Regular graph is complete graph.

2) Complete graph K_n has $\frac{n(n+1)}{2}$ edges.

Justify your answer.

OR

(a) Check whether following forms a group or not. **(05)**

1) (R, Δ) *where* $a\Delta b = a^b$ and R denote set of Real numbers.

2) (Z^+, Δ) where $a\Delta b = 2^{ab}$ and Z^+ denote set of positive integers.

(b) Prove or Disprove: Prime numbers are of the form $6K \pm 1$ except 2 and 3. **(05)**

Q.5 Attempt any **TEN** out of **TWELVE:** (Each carries 01 mark) **(10)**

(1) Find number of odd factors of 2600.

(2) Define order of an element.

(3) Define Vandermonde matrix.

(4) Find Sum of all possible values of x.

$(x^2 - 5x + 5)^{x^2 + 4x - 60} = 1$

(5) Define 3rd root of unity.

(6) If A = (1 2 3 4 5) then find A^4.

(7) If one root of Quadratic equation is $3 + \sqrt{3}i$ then other root is ___

(8) How many elements of order 73 in $(Z_{10,001}, +_{10,001})$?

(9) If A = $\begin{bmatrix} 2 & 4 & 6 \\ 7 & 14 & 21 \\ 1 & 2 & 9 \end{bmatrix}$ and B = any matrix of order of 3 then det (AB) = ___

(10) Which of the following is/are not false?

A) $(Z_n, +_n)$ forms an abelian group.

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B) $(Z_n, \times_n)$ forms an abelian group.

C) $(GL_2(R), \times)$ form a non-abelian group.

D) $(SL_2(R), \times)$ form a non-abelian group.

E) n^{th} root of unity forms an abelian group.

(11) Which of the following is/are not false?

A) A vertex of degree 1 is called pendant vertex.

B) A vertex of degree 0 is called isolated vertex.

C) A vertex of degree more than 1 is called intermediate vertex.

D) A graph without vertex is called Null graph.

E) A tree of vertex 5 have 4 edges.

(12) $\binom{2024}{2} + \binom{2024}{3} + \cdots + \binom{2024}{2024} = \underline{\quad}$

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