

Int. M.Sc. (AIML) (NEP) Sem.-3 Examination

MDC-AIML-234T

Matrix Algebra and Discrete Maths

Time : 2-00 Hours]

November-2025

[Max. Marks : 50

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

**Q.1 (a)** Find the inverse of  $A$  for the matrix  $A = \begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{bmatrix}$  using the Vedic sutra "Urdhya Tiryak". (05)

**(b)** Solve the system of the following equations by using the sutra "Anurupye Sunayamanyat" (05)

$$\begin{aligned} 6x + 7y &= 8 \\ 19x + 14y &= 16 \end{aligned}$$

OR

**(a)** Solve the following system of linear equations using sutra "Paravartya" (05)

$$\begin{aligned} -3x - 2y + 4z &= -15 \\ 2x + 5y - 3z &= 3 \\ 4x - y + 7z &= 15 \end{aligned}$$

**(b)** Solve the system of the following equations by using sutra "Sankalan-Vyavakalanabhyam" (05)

$$\begin{aligned} 45x - 23y &= 113 \\ 23x - 45y &= 91 \end{aligned}$$

**Q.2 (a)** Define the rank of the matrix. Also, find out the rank of the matrix

$$A = \begin{bmatrix} 2 & 4 & 8 & 16 \\ 16 & 8 & 4 & 2 \\ 4 & 8 & 16 & 2 \\ 2 & 16 & 8 & 4 \end{bmatrix} \quad (05)$$

**(b)** Find the solution of the following system of linear equations using the Gauss-Elimination method. (05)

$$\begin{aligned} 4x - 8y + 3z &= 16 \\ -x + 2y - 5z &= -21 \\ 3x - 6y + z &= 7 \end{aligned}$$

OR

E1265-2

- (a) Find out the inverse of the matrix B using row operations: (05)

$$B = \begin{bmatrix} 1 & 2 & 5 \\ 0 & -1 & 2 \\ 2 & 4 & 11 \end{bmatrix}$$

- (b) Find the solution of the following system of linear equations using the Gauss-Elimination method. (05)

$$\begin{aligned} -4w + x + y &= -10 \\ w - 4x + z &= 1 \\ w - 4y + z &= -7 \\ x + y - 4z &= 10 \end{aligned}$$

- Q.3 (a) Find the solution of the following system of linear equations using the Gauss-Jacobi method up to 4 decimal places and show step-by-step iterations for each variable. (05)

$$\begin{aligned} 3x + 6y + 2z &= 0 \\ 3x - y + z &= 1 \\ 3x + 3y + 7z &= 4 \end{aligned}$$

- (b) Solve the following linear system by Cholesky's method. (05)

$$\begin{aligned} x + 3z &= 14 \\ 16y + 8z &= 16 \\ 3x + 8y + 14z &= 54 \end{aligned}$$

OR

- (a) Find the solution of the following system of linear equations using the Gauss-Seidel method up to 4 decimal places, and show step-by-step iterations for each variable. (05)

$$\begin{aligned} 4x + y - z &= 5 \\ -x + 3y + z &= -4 \\ 2x + 2y + 5z &= 1 \end{aligned}$$

- (b) Solve the following linear system by Doolittle's method, showing the details, in particular the LU-factorization. (05)

$$\begin{aligned} 2x + 2y + 4z &= -2 \\ 4x + 5y + 13z &= -7 \\ 10x + 14y + 43z &= -25 \end{aligned}$$

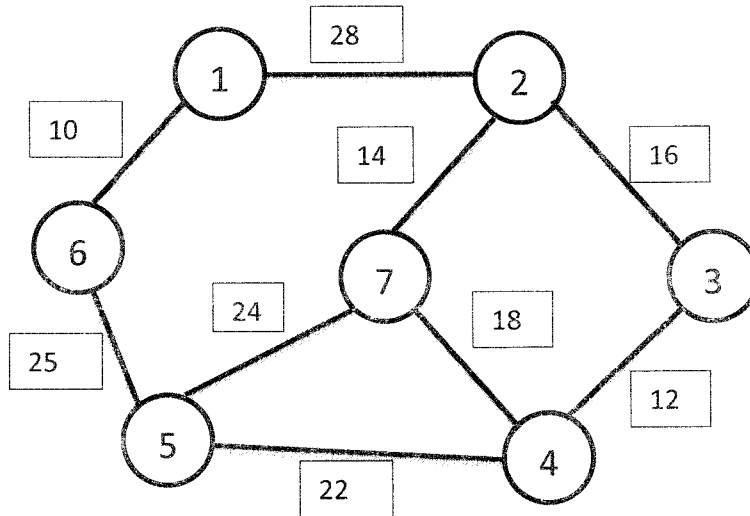
- Q.4 (a) Prove that identity of a group is unique and inverse of an element in the group is unique. (05)

- (b) Let  $G$  be a self-complementary graph with  $n$  vertices. Prove that  $G$  must have exactly  $\frac{n(n-1)}{4}$  edges. (05)

OR

E1265-3

- (a) Using Euclidean algorithm, find the greatest common divisor of the numbers 125 and 220. (05)
- (b) Construct the minimum spanning tree (MST) for the given graph using Prim's Algorithm: (05)



Q.5 Attempt any FIVE out of SEVEN: (10)

- (1) Define a Diagonal matrix and a Scalar matrix with an example.
- (2) Define a Nilpotent matrix. Also, find out order  $k$  for matrix  $D$  such that  $D^k = 0$ .

$$D = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 0 \\ 2 & 0 & 0 \end{bmatrix}$$

- (3) For the following system of linear equations, what is the value of  $(x, y, z)$  in the second iteration?

$$\begin{aligned} 4x + y - z &= 5 \\ -x + 3y + z &= -4 \\ 2x + 2y + 5z &= 1 \end{aligned}$$

- (4) Check whether the following system is diagonally dominant or not? Justify your answer.  
 $10x - 4y + z = 7, x + 5y - 2z = 5, 8x - 4y - 3z = 6$
- (5) Define: Compliment of the graph
- (6) State (only) Lagrange's theorem
- (7) A graph has 6 vertices with degrees: 2,3,2,4,3 and one unknown degree. If the graph has 9 edges, find the missing degree.

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