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2101E1226

Candidate's Seat No :________

MSc AIML Sem.-1 Examination

Linear Algebra and Numerical Methods

January-2025

Time : 3-00 Hours] **[Max. Marks : 100**

Instructions:

- Write both the Sections in the separate answer book.
- Both Sections have equal weightage

SECTION - I

Q.1 a) Find a real root of the equation f(x) = $x^3 + 2x^2 + x - 1$, stating with 0, 1 using False Position method correct upto 2 decimal places (10)

Q.1 b) Find a real root of the equation f(x) = $x^3 + 2x^2 + x - 1,\ x_0 = 0$ using Newton Raphson method correct upto 2 decimal places (10)

OR

Q.1 a) Find the solution of the following system of equations using Gauss Elimination (10)

$$\begin{aligned} x + y \quad &= 3 \\ -3x \quad + 2z &= 0 \\ y - 2z &= 2 \end{aligned}$$

Q.1 b) Use Cramer's rule to compute the solution of the system of equations (10)

$$\begin{aligned} x + y \quad &= 3 \\ -3x \quad + 2z &= 0 \\ y - 2z &= 2 \end{aligned}$$

Q.2 Explain any two of the following: (20)

a) Stochastic Matrix, Steady State Vector

b) Upper Triangular Matrix, Lower Triangular Matrix

c) Singular Matrix, Non-Singular Matrix

Q.3 $A = \begin{bmatrix} 2 & 0 & -1 \\ 4 & -5 & 2 \end{bmatrix}, B = \begin{bmatrix} 1 & 2 \\ 5 & 1 \end{bmatrix}, C = \begin{bmatrix} 7 & 3 & -4 \\ 3 & 6 & -1 \end{bmatrix}$ find (10)

a) C − 2A

b) BA

c) $A \odot B$

d) $A^T + C^T$

e) Let $x = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$. Compute $x^T B x$

OR

Q.3 Find the general solution of the following using Gauss Jordan method (10)

x + 4y − 5z = 0

2x − y + 8z = 9

(P.T.O)

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SECTION - II

Q.4 For the following matrix $A = \begin{bmatrix} 2 & 3 \\ 4 & 1 \end{bmatrix}$, find (20)

a) Characteristic Equation
b) Eigen Values
c) Corresponding Eigen Vectors
d) Diagonalize the matrix

OR

Q.4 a) $A = \begin{bmatrix} 1 & 0 & -2 \\ -3 & 1 & 4 \\ 2 & -3 & 4 \end{bmatrix}$ (10)

For the matrix A, compute
i) Determinant
ii) Adjoint
iii) Inverse.

Q4 b) Find the largest eigenvalue and the corresponding eigen vector of $\begin{bmatrix} 4 & 3 \\ 1 & 2 \end{bmatrix}$ staring from $\begin{bmatrix} 1 \\ 1 \end{bmatrix}$ using Power Method (10)

Q.5 Explain any five of the following with an example: (20)

a) Polynomial time
b) Class P
c) Class NP
d) Class NP-Complete
e) Class NP-Hard
f) Hamiltonian Cycle

Q.6 a) Is $\begin{bmatrix} 3 \\ 3 \end{bmatrix}$ an eigen vector of $\begin{bmatrix} 1 & 6 \\ 5 & 2 \end{bmatrix}$? Find the corresponding eigen value. (5)

Q.6 b) Is $\lambda = 7$ an eigen value of $\begin{bmatrix} 1 & 6 \\ 5 & 2 \end{bmatrix}$? Find the corresponding eigen vector. (5)

OR

Q.6 a) Explain how Singular Value Decomposition can be used for image processing. (5)

b) Explain any one application of Principal Component Analysis. (5)