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Question Paper Code: U2M08

B.E./B.Tech. DEGREE EXAMINATION, NOV 2023

Second Semester

Computer Science and Business Systems

21UMA208- LINEAR ALGEBRA AND NUMERICAL METHODS

(Regulations 2021)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

- If the Eigen value of a matrix A are 1,2,3 then the Eigen value of A^T CO1-App
(a) 2,4,6 (b) 1,4,9 (c) 2,8,18 (d) 1,2,3
- If the Eigen value of the matrix $A = \begin{pmatrix} 1 & 1 \\ 3 & -1 \end{pmatrix}$ are 2,-2 then the Eigen CO1-App
value of A^{-1} are____
(a) $\frac{1}{2}, -\frac{1}{2}$ (b) 2,-2 (c) 1,-1 (d) 1,3
- Solve the linear system $5x+4y=15, 3x+7y=12$ gauss –Jordan method CO2-App
(a) $\frac{57}{23}, \frac{15}{23}$ (b) $\frac{15}{23}, \frac{15}{23}$ (c) $\frac{5}{23}, \frac{15}{23}$ (d) $\frac{57}{23}, \frac{5}{23}$
- By Gauss elimination method, solve $x + y = 2, 2x + 3y = 5$ CO2-App
(a) 1,2 (b) 1,1 (c) 1,0 (d) 0,1
- Gauss Seidel method iteration converges if the coefficient matrix is CO3- U
_____ dominant
(a) Squarely (b) Logically (c) Diagonally (d) Symmetrically
- The order of convergence of Newton's method is _____ CO3- U
(a) 1 (b) 2 (c) 3 (d) 0

7. In a vector space V , for every $x, y \in V$ then property $x+y=y+x$ is known as _____ CO6-R
 (a) Commutative (b) Associative (c) identity (d) Inverse
8. The $\dim(\mathbb{R}^3)$ is _____ CO6-U
 (a) 1 (b) 2 (c) 3 (d) 0
9. $\langle x, x \rangle = 0$ if and only if then find x _____ CO6-U
 (a) $x=1$ (b) $x \neq 1$ (c) $x=0$ (d) $x \neq 0$
10. The norm of $(3, -4, 0)$ is _____ CO6-R
 (a) 3 (b) -4 (c) 0 (d) 5

PART – B (5 x 2= 10 Marks)

11. If the Eigen value of the matrix $A = \begin{pmatrix} 1 & 1 \\ 3 & -1 \end{pmatrix}$ are 2, -2 then find the Eigen value of A^{-1} CO1-App
12. Apply Gauss –Jordan method solve the linear system $x + y = 2; 2x + 3y = 5$. CO2-App
13. Explain Newton's backward interpolation formula CO6-R
14. Find the matrix of $T : V_2(\mathbb{R}) \rightarrow V_3(\mathbb{R})$ given by $T(a, b) = (a + 3b, 0, 2a - 4b)$ for the standard Basis of $V_2(\mathbb{R})$ CO4-App
15. Explain rank-nullity theorem CO6-U

PART – C (5 x 16= 80Marks)

16. (a) Using Cayley Hamilton theorem find A^4 and A^{-1} when $A =$ CO1-App (16)

$$\begin{pmatrix} 7 & 2 & -2 \\ -6 & -1 & 2 \\ 6 & 2 & -1 \end{pmatrix}.$$

Or

- (b) Apply the orthogonal transformation reduce the following quadratic forms into canonical form CO1- App (16)
 $Q = 6x^2 + 3y^2 + 3z^2 - 4xy - 2yz + 4zx$, find its rank, index, signature and nature

17. (a) (i) Apply Gauss elimination method to solve $2x+y+4z=12, 8x-3y+2z=1, 4x+11y-z=33$ CO2-App (8)
- (ii) Apply Gauss Jordan method to solve $10x+y+z=12, 2x+10y+z=13, x+y+5z=7$ CO2-App (8)

Or

- (b) Solve by using LU decomposition method CO2 -App (16)
- $2x+5y+2z=18; x+2y+3z=14; 3x+y+5z=20$
18. (a) (i) Using Lagrange's interpolation formula calculate the profit in the year 2000 from the following data : CO3-App (8)

year	1997	1999	2001	2002
Profit (Rs.in lakhs)	43	65	159	248

- (ii) Apply Newton Raphson Method Calculate a root of $x \log_{10} x - 1.2 = 0$ correct to 3 decimals. CO3-App (8)

Or

- (b) Calculate the dominant Eigen value and corresponding Eigen vector of A. if CO3-App (16)

$$A = \begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$$

19. (a) Construct the linear transformation $T : V_3(R) \rightarrow V_3(R)$ determine by the matrix $\begin{pmatrix} 1 & 2 & 1 \\ 0 & 1 & 1 \\ -1 & 3 & 4 \end{pmatrix}$ with respect the standard basis of $V_3(R)$ CO4-App (16)

Or

- (b) Let $T : R^2 \rightarrow R^2$ by $T(a_1 + a_2, a_1)$, Calculate nullity(T), rank(T), Is T one-to-one and Is T is onto? CO4-App (16)

20. (a) (i) Show that the following function defines an inner product on $V_2(\mathbb{R})$ where $x = (x_1, x_2)$ and $y = (y_1, y_2)$ and CO5-App (8)

$$\langle x, y \rangle = 6x_1y_1 + 7x_2y_2$$

(ii) If $x = (2, 1 + i, i)$ and $y = (2 - i, 2, 1 + 2i)$ then verify CO5-App (8)
Schwarz's inequality.

Or

(b) Show that $V_2(\mathbb{R})$ is an inner product space with inner product CO5-App (16)

defined by $\langle x, y \rangle = x_1y_1 + x_2y_1 + x_1y_2 + 4x_2y_2$ where

$$x = (x_1, x_2) \text{ and } y = (y_1, y_2)$$