

A

Reg. No. :

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Question Paper Code: U2M08

B.E./B.Tech. DEGREE EXAMINATION, MAY 2022

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)

1. 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
2. If $A = \begin{pmatrix} a & 1 \\ 3 & b \end{pmatrix}$ has Eigen values of 2,-2 then a and b are _____ CO1-App
(a) 1,-1 (b) -1,-1 (c) 1,1 (d) 0,1
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) $\frac{57}{23}, \frac{5}{23}$
4. 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
5. Gauss Seidel method iteration converges if the coefficient matrix is _____ dominant CO3- U
(a) Squarely (b) Logically (c) Diagonally (d) Symmetrically
6. 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. In a vector space find $\|\alpha x\| = _____$ CO6-U
 (a) $|\alpha| + \|x\|$ (b) $|\alpha| - \|x\|$ (c) $|\alpha| \|x\|$ (d) $|\alpha| / \|x\|$
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. Construct the matrix of the quadratic forms $2x_1x_2 + 2x_2x_3 - 2x_3x_1$ 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 CO4-App
 standard Basis of $V_2(\mathbb{R})$
15. Explain inner product space CO6-U

PART – C (5 x 16= 80Marks)

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

$$A = \begin{pmatrix} 2 & -1 & 2 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{pmatrix}.$$

Or

- (b) Apply the orthogonal transformation reduce the following quadratic CO1- (16)
 forms into canonical form $Q = 6x^2 + 3y^2 + 3z^2 - 4xy - 2yz + 4zx$, find App
 its rank, index, signature and nature
17. (a) (i) Apply Gauss elimination method to solve $2x+y+4z=12, 8x-$ CO2-App (8)
 $3y+2z=1, 4x+11y-z=33$
- (ii) Apply Gauss Jordan method to solve $10x+y+z=12,$ CO2-App (8)
 $2x+10y+z=13, x+y+5z=7$

Or

- (b) Solve the following using triangularisation method $x+y+z=9, 2x-3y+4z=13, 3x+4y+5z=40$ CO2 - App (16)

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 CO4-App (16)

the matrix $\begin{pmatrix} 1 & 2 & 1 \\ 0 & 1 & 1 \\ -1 & 3 & 4 \end{pmatrix}$ with respect the standard basis of $V_3(R)$

Or

- (b) Let $T : R^2 \rightarrow R^3$ be the linear mapping defined by $T(a_1 + a_2, a_1 - a_2, a_2)$, Calculate nullity(T), rank(T), Also check the rank nullity theorem CO4-App (16)

20. (a) Apply Gram-Schmidt process to construct an orthonormal basis for $V_3(R)$ with standard inner product for the basis $\{V_1, V_2, V_3\}$ where $V_1 = (1,0,1), V_2 = (1,0,-1)$ and $V_3 = (0,3,4)$. CO5-App (16)

Or

- (b) Show that $V_2(R)$ is an inner product space with inner product defined by $\langle x, y \rangle = x_1y_1 + x_2y_1 + x_1y_2 + 4x_2y_2$ where $x = (x_1, x_2)$ and $y = (y_1, y_2)$ CO5-App (16)

