Reg. No: | | | | | | | | | | | | |

Question Paper Code: R2M08

B.E./B.Tech. DEGREE EXAMINATION, NOV 2024

Second Semester

Computer Science and Business Systems

R21UMA208 - LINEAR ALGEBRA AND NUMERICAL TECHNIQUES

(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. The sum of square of the Eigen values of $A=\begin{pmatrix} 2 & 0 & 0 \\ 3 & 2 & 0 \\ 8 & 9 & 2 \end{pmatrix}$ is CO1-App

   (a) 100 (b) 38 (c) 12 (d) 2

3. When Gauss elimination method is used to solve AX=B, A is transferred in a ______________ matrix CO6- U

   (a) Lower triangular (b) Upper triangular (c) Square (d) Zero

4. Solve the linear system $x+3y=7; 3x+4y=11$ by gauss –Jordan method CO2-App

   (a) 1,2 (b) 1,1 (c) 1,0 (d) 0,1

5. Newton's method is also called _______method CO6- U

   (a) Tangent (b) Slop (c) Secant (d) False

6. Newton forward interpolation formula is used for______ CO6- U

   (a) Open (b) Unequal (c) Equal (d) Closed

7. The trivial subspace of a vector space V are________ CO6 – U

   (a) {0} (b) V (c) W (d) {0}and V

8. The dim(R^3) is ________ CO6–U

(a) 1 (b) 2 (c) 3 (d) 0

9. For any two vectors x and y in an inner product space V,find $\|x+y\| \le$ _____ CO6 - U

(a) $\|x\|+\|y\|$ (b) $\|x\|\|y\|$ (c) $\|x\|-\|y\|$ (d) $\|x\|/\|y\|$

10. x is called a unit vector then find $\|x\| =$ _____ CO6 - U

(a) 0 (b) 1 (c) 2 (d) 3

PART – B (5 x 2= 10 Marks)

11. The Product of two Eigen values of $\begin{pmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{pmatrix}$ is 16 .Find the third Eigen value. CO1 -App

12. Solve the linear system $\boldsymbol{x+y=2; 2x+3y=5}$ by gauss –jordan method CO2- App

13. Using Lagrange's formula, to find the quadratic polynomial that takes these value. CO3 -App

x	0	1	3
y	0	1	0

then find y(2).

14. Show that $W = \{(a,0,0)/a \in R\}$ is a subspace of R^3 CO4- App

15. If $x = (2,1+i,i)$ and $y = (2-i,2,1+2i)$ .Find $\langle x, y\rangle$ CO5- App

PART – C (5 x 16= 80Marks)

16. (a) Using Cayley Hamilton theorem CO1- App (16)

find A^4 and A^{-1} when A = $\begin{pmatrix} 2 & -1 & 2 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{pmatrix}$.

Or

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

17. (a) (i) Apply Gauss elimination method to solve CO2-App (8)

$2x+y+z=5, 3x+5y+2z=15, 2x+y+4z=8$.

(ii) Apply Gauss Jordan method to solve CO2-App (8)

$10x+y+z=12$, $2x+10y+z=13$, $x+y+5z=7$

Or

(b) Solve the following using triangularization method CO2-App (16)

$x+y+z=9, 2x-3y+4z=13, 3x+4y+5z=40$

18. (a) (i) Using Lagrange's interpolation formula find f(3) for the following data CO3 -App (8)

X	0	1	2	5
Y	2	3	12	147

(ii) Using Newton's divided difference ,find the value of f(8) from the table CO3 -App (8)

x	4	5	7	10	11	13
f(x)	48	100	294	900	1210	2028

Or

(b) Find the numerically largest dominant eigen value of CO3- App (16)

$$A=\begin{bmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{bmatrix}$$ by power method.

19. (a) (i) Verify the vectors (2,1,0) , (-3,-3,1) ,(-2,1,-1) in R^3 is a basis of R^3 CO4-App (8)

(ii) If T: $R^2 \rightarrow R^2$ be linear transformation defined by $T(a_1, a_2) = (a_1 + a_2, a_1)$ then find nullity(T) ,rank(T), Is T one-to-one? Is T onto? Also check the rank nullity theorem CO4-App (8)

Or

	(b)	(i) Find the dimension of the subspace spanned by the vectors (1,0,2) ,(2,0,1) ,(1,0,1) in $V_3(R)$	CO4-App	(8)
		(ii) Find the matrix of the linear transformation T: $R^2 \rightarrow R^2$ defined by T(a,b) =(2a-3b,a+b) for the standard basis of R^2	CO4-App	(8)
20.	(a)	(i) Show that the following function defines an inner product on $V_2(R)$ where $x = (x_1, x_2)$ and $y = (y_1, y_2)$ and $\langle x, y \rangle = x_1 y_1 + 2x_2 y_2$	CO5-App	(8)
		(ii) If $x = (1+i, 2, i)$ and $y = (3i.2+3i, 4)$ then verify Schwarz's inequality.	CO5-App	(8)
		Or		
	(b)	Apply Gram-Schmidt process to construct an orthonormal basis for $V_3(R)$ with the standard inner product for the basis $\{v_1, v_2, v_3\}$ where $v_1 = (1,-1,0)$, $v_2 = (2,-1,-2)$ and $v_3 = (1,-1,2)$	CO5-App	(16)