Reg. No.												

Question Paper Code	12538

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2023

Second Semester

Computer Science and Business Systems

20BSMA202 - LINEAR ALGEBRA

(Regulations 2020)

Duration: 3 Hours Max. Marks: 100

PART-A (10 × 2 = 20 Marks)

Answer ALL Questions

		Marks, K-Level, CO
1.	If $A+B=\begin{pmatrix}1 & -1\\ 3 & 0\end{pmatrix}$ and $A-B=\begin{pmatrix}3 & 1\\ 1 & 4\end{pmatrix}$, calculate the product AB.	2,K2,CO1
2.	Define Inverse of a matrix.	2,K1,CO1
3.	If the rank of the matrix $\begin{pmatrix}2 & 1 & -1\\ 1 & 4 & 2\\ 3 & 5 & k\end{pmatrix}$ is 2, find the value of k.	2,K2,CO2
4.	When does the Gauss elimination method fail?	2,K2,CO2
5.	State Dimension theorem.	2,K1,CO3
6.	Find the linear span of $S=\{(1,0,0),(2,0,0),(3,0,0)\}\subset R^3$	2,K2,CO3
7.	Define Linear transformations.	2,K1,CO4
8.	Define Hermitian Matrix.	2,K1,CO4
9.	Write down singular value decomposition of a square matrix.	2,K1,CO5
10.	Explain Principal Component Analysis with an example.	2,K2,CO5

PART - B (5 × 16 = 80 Marks)

Answer ALL Questions

11. a) (i) Prove that $\begin{vmatrix}a-b-c & 2b & 2c\\ 2a & b-c-a & 2c\\ 2a & 2b & c-a-b\end{vmatrix}=(a+b+c)^3$. *8,K3,CO1*

(ii) Solve the equations $3x+y+2z=3;\ 2x-3y-z=-3;$ $x+2y+z=4$ by using Cramers's rule. *8,K3,CO1*

OR

b) Solve the following equations by calculating the inverse by elementary row operations: *16,K3,CO1*

$$2x_1+2x_2+2x_3-3x_4=2;\ 3x_1+6x_2-2x_3+x_4=8;$$
$$x_1+x_2-3x_3-4x_4=-1;\ 2x_1+x_2+5x_3+x_4=5$$

12.	a)	(i) Find the rank of $A = \begin{pmatrix} 1 & 2 & -1 & 3 \\ 4 & 1 & 2 & 1 \\ 3 & -1 & 1 & 2 \\ 1 & 2 & 0 & 1 \end{pmatrix}$.	8,K3,CO2
		(ii) Solve the following equations by Gauss- Elimination method $$27x + 6y - z = 85$$ $$x + y + 54z = 110$$ $$6x + 15y + 2z = 72$$	8,K3,CO2
		OR	
	b)	Solve the system of linear equations by LU decomposition method: $2x + 3y - z = 5\,;\ 4x + 4y - 3z = 3\,;\ 2x - 3y + 2z = 2.$	16,K3,CO2
13.	a)	(i) Verify whether the set V of all ordered triples of real numbers of the form $(x, y, 0)$ and defined operations $+$ and $\bullet$ by $(x, y, 0) + (x', y', 0) = (x + x', y + y', 0)$ and $c(x, y, 0) = (cx, cy, 0)$ is a vector space or not.	8,K3,CO3
		(ii) Check whether the set $S = \{-1 - x + 2x^2,\ 2 + x - 2x^2, 1 - 2x + 4x^2\}$ forms a basis for $P_2(R)$?	8,K3,CO3
		OR	
	b)	Construct a QR-decomposition for the matrix $A = \begin{pmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 1 \\ 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{pmatrix}$.	16,K3,CO3
14.	a)	Let $T: R^2 \to R^3$ be defined by $T(x, y) = (x - y, x, 2x + y)$. Let $B = \{e_1, e_2\}, e_1 = (1,0), e_2 = (0,1)$ be the basis for R^2 and $B' = \{(1,1,0), (0,1,1), (2,2,3)\}$ be a basis for R^3. Find the matrix of T in these bases.	16,K3,CO4
		OR	
	b)	Find the eigen values and eigen vectors on ordered basis β for V such that $[T]_\beta$ is a diagonal matrix where T be the linear operator on $V = R^3$ and $T(a, b, c) = (7a - 4b + 10c, 4a - 3b + 8c, -2a + b - 2c)$. Is T diagonalizable?	16,K3,CO4
15.	a)	Construct a singular value decomposition for the matrix $$A = \begin{pmatrix} 2 & 2 & -2 \\ 2 & 2 & -2 \\ -2 & 2 & 6 \end{pmatrix}$$	16,K3,CO5
		OR	
	b)	Find the principal components for the following data:	16,K3,CO5

Features	A	B	C	D
X_1	6	9	15	7
X_2	2	11	7	16