05 AUG 2023

Reg. No.												

Question Paper Code	12116

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 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.	Write any two properties of determinants.	2,K1,CO1
2.	Solve the system of equations $9x - 3y = 21$; $2x + 3y = 1$ by Cramer's rule.	2,K2,CO1
3.	Write the procedure involved in Gaussian elimination method.	2,K1,CO2
4.	Express the system $3x + 4y + 5z = 18$; $2x - y + 8z = 13$; $5x - 2y + 7z = 20$, in matrix form.	2,K2,CO2
5.	Determine whether the following set is basis or not. $\{(1,0,-1),(2,5,1),(0,-4,3)\}$.	2,K2,CO3
6.	Let $V = R^2$ and $S = \{(0,1),(1,0)\}$. Check whether S is orthogonal basis or not.	2,K2,CO3
7.	Define Positive definite matrix.	2,K1,CO4
8.	Show that $A = \begin{bmatrix} 3 & 1-i \\ 1+i & -2 \end{bmatrix}$ is a Hermitian matrix.	2,K2,CO4
9.	What is Singular value decomposition?	2,K1,CO5
10.	What is the principal component analysis?	2,K1,CO5

PART - B (5 × 16 = 80 Marks)

Answer ALL Questions

11. a) (i) Using properties of determinants, prove that $\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix} = (a+b+c)(ab+bc+ca-a^2-b^2-c^2)$. 8,K3,CO1

(ii) Solve the following system of equations by matrix inversion method. $3x + y - z = 3$; $2x - 8y + z = -5$; $x - 2y + 9z = 8$. 8,K3,CO1

OR

b) Solve the following system of equations by Cramer's rule. $x + 3y + 3z = 16$; $x + 4y + 3z = 18$; $x + 3y + 4z = 19$. 16,K3,CO1

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

12. a) (i) Find the rank of a matrix $A = \begin{bmatrix} 4 & 2 & 1 & 3 \\ 6 & 3 & 4 & 7 \\ 2 & 1 & 0 & 1 \end{bmatrix}$. 8,K3,CO2

(ii) Solve the following system of equations by Gaussian elimination method. $x + y + z = 9; 2x - 3y + 4z = 13; 3x + 4y + 5z = 40$. 8,K3,CO2

OR

b) (i) Solve the system of equations $x + 2y + z = 3;\ 2x + 3y + 3z = 10; 3x - y + 2z = 13$ by LU- decomposition method. 8,K3,CO2

(ii) Solve the following system of equations by using tools of matrices. $10x + y + z = 12; 2x + 10y + z = 13; x + y + 5z = 7$. 8,K3,CO2

13. a) (i) Show that the following set of vectors $-1 + 2x + 4x^2$, $3 - 4x - 10x^2$ and $-2 - 5x - 6x^2$ forms a basis in $P_2(R)$. 6,K3,CO3

(ii) Find the QR decomposition of a matrix $A = \begin{bmatrix} 1 & 1 \\ 1 & 2 \end{bmatrix}$ by Gram-Schmidt orthogonalisation process. 10,K3,CO3

OR

b) Let R^3 have the Euclidean inner product. Use the Gram-Schmidt process to transform the basis $\{u_1, u_2, u_3\}$ into an orthonormal basis, where $u_1 = (1,0,1), u_2 = (1,3,1)$ and $u_3 = (3,2,1)$. 16,K3,CO3

14. a) (i) Find the eigen values and eigen vectors of the matrix $A = \begin{bmatrix} 2 & 2 & 0 \\ 2 & 1 & 1 \\ -7 & 2 & -3 \end{bmatrix}$. 8,K3,CO4

(ii) Let $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$. Show that A is a positive definite matrix. 8,K3,CO4

OR

b) (i) Let T: $R^3 \rightarrow R^3$ a linear transformation defined by $T(a, b, c) = (3a, a - b, 2a + b + c)$. Write the matrix of the linear transformation with respect to the standard basis. 8,K3,CO4

(ii) Show that the matrix $A = \frac{1}{2}\begin{bmatrix} 1 & -i & -1 + i \\ i & 1 & 1 + i \\ 1 + i & -1 + i & 0 \end{bmatrix}$ is Unitary. 8,K3,CO4

15. a) Find a singular value decomposition of the matrix $A = \begin{bmatrix} 2 & 2 & -2 \\ 2 & 2 & -2 \\ -2 & -2 & 6 \end{bmatrix}$. 16,K3,CO5

OR

b) Obtain the population principal components from the covariance matrix $\Sigma = \begin{pmatrix} 0 & 1 & -1 \\ 1 & 0 & 1 \\ -1 & 1 & 0 \end{pmatrix}$. 16,K3,CO5