U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

October 2023 Semester End Main Examinations

Programme: B.E.
Branch: CSE/ISE
Course Code: 19MA4BSLIA
Course: Linear Algebra

Semester: IV
Duration: 3 hrs.
Max Marks: 100

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

B.M.S.C.E. - EVEN SEM 2022-23

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			CO	PO	Marks
		UNIT - I			
1	a)	Solve the system of equations $x + 2y + 3z = 14$, $4x + 5y + 7z = 35$ and $3x + 3y + 4z = 21$ for complete solution. Also mention the free variables and the pivot variables.	CO1	PO1	**7**
	b)	Solve the system of equations $x + y + z = 1, 3x + y - 3z = 5$ and $x - 2y - 5z = 10$ by LU-Decomposition method.	CO1	PO1	**7**
	c)	Find the basis and dimension for Column space and Row space of the matrix $A = \begin{bmatrix} 1 & 2 & 0 & 1 \\ 0 & 1 & 1 & 0 \\ 1 & 2 & 0 & 1 \end{bmatrix}$.	CO1	PO1	**6**
		OR			
2	a)	Solve the system of equations $u + 3v + 3w + 2y = 1$, $2u + 6v + 9w + 7y = 5$ and $-u - 3v + 3w + 4y = 5$ for the complete solution.	CO1	PO1	**7**
	b)	Solve the system of equations $x + y + z = 9, 2x + 5y + 7z = 52$ and $2x + y - z = 0$ by Gauss elimination method.	CO1	PO1	**7**
	c)	Check linearly dependency or linearly independency of following set of vectors. i) $A = \{(1,-3,2), (2,1,-3), (-3,2,1)\}$ and ii) $B = \{(2,1,3), (1,3,2), (3,2,1)\}$.	CO1	PO1	**6**
		UNIT - II			
3	a)	Find the matrix representation of linear transformation $T: R^2 \to R^2$ defined by $T(x,y) = (2x+3y, 4x-5y)$ relative to $\{(1,2), (2,5)\}$ for both vector space in domain and codomain.	CO1	PO1	**7**
	b)	If $T: R^2 \to R^3$ is defined by $T(x,y) = (x, y, x + y)$. Show that T is linear transformation and also find its kernel.	CO1	PO1	**7**
	c)	Show that the linear transformation $T: R^2 \to R^2$ defined as $T(x,y) = (3x - 5y, -3x - 6y)$ is invertible and find T^{-1}.	CO1	PO1	**6**

			UNIT – III			
	4	a)	Find all the eigenvalues and corresponding eigenvectors of the matrix $A=\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$.	*CO2*	*PO1*	**7**
		b)	Diagonalize the matrix $A=\begin{bmatrix} -1 & 3 \\ -2 & 4 \end{bmatrix}$ and hence find A^4.	*CO2*	*PO1*	**7**
		c)	Find minimal polynomial and characteristic polynomial of the matrix $A=\begin{bmatrix} 3 & -1 & 0 \\ 0 & 2 & 0 \\ 1 & -1 & 2 \end{bmatrix}$.	*CO2*	*PO1*	**6**
			OR			
	5	a)	Compute the eigenspace of the linear transformation $T:\mathbb{R}^3 \to \mathbb{R}^3$ defined by the matrix $A=\begin{bmatrix} 7 & -2 & 0 \\ -2 & 6 & -2 \\ 0 & -2 & 5 \end{bmatrix}$.	*CO2*	*PO1*	**7**
		b)	Verify Cayley-Hamilton theorem for the matrix $A=\begin{bmatrix} -1 & 3 \\ -2 & 4 \end{bmatrix}$ also compute A^{-1} and A^4.	*CO2*	*PO1*	**7**
		c)	Write the Jordan canonical form of matrix whose characteristic and minimal polynomial are respectively $(x-1)^3(x-2)^2$ and $(x-1)^2(x-2)$.	*CO2*	*PO1*	**6**
			UNIT – IV			
	6	a)	Apply Gram-Schmidt orthogonalization to construct the orthonormal basis of the vector space spanned by the vectors $(1\ \ 0\ \ 1), (1,0,0), (2,1,0)$.	*CO3*	*PO1*	**7**
		b)	Find QR decomposition of the matrix $\begin{bmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{bmatrix}$.	*CO3*	*PO1*	**7**
		c)	Find the least square solution of the system of equations $-x+2y=3,\ x+y=4,\ x-2y=0$ and $3x+2y=2$.	*CO3*	*PO1*	**7**
			UNIT – IV			
	7	a)	Determine the orthogonal modal matrix and hence diagonalize the matrix $\begin{bmatrix} 1 & 5 & -2 \\ 5 & 4 & 5 \\ -2 & 5 & 1 \end{bmatrix}$.	*CO3*	*PO1*	**8**
		b)	Obtain the canonical form and hence classify the nature of the quadratic form $7x^2+6y^2+5z^2-4xy-4yz$.	*CO3*	*PO1*	**4**
		c)	Find singular value decomposition of the matrix $A=\begin{bmatrix} 2 & 2 \\ -1 & 1 \end{bmatrix}$.	*CO3*	*PO1*	**8**

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