Total No. of Questions – [4]   Total No. of Printed Pages:4

G.R./PRN No.	

PAPER CODE	U112-201A(Reg)

DECEMBER 2022 (INSEM+ ENDSEM) EXAM

F.Y. B. TECH. (SEMESTER - I)

COURSE NAME: LINEAR ALGEBRA

COURSE CODE: ES10201A

(PATTERN 2020)

Time: [2Hr]   [Max. Marks: 60]

(*) Instructions to candidates:

1) **Figures to the right indicate full marks.**
2) **Use of scientific calculator is allowed**
3) **Use suitable data where ever required**

Question No.	Question Description	Marks	CO mapped	Blooms Taxonomy Level
Q.1	i) In solving the system of equations AX=B in three variables if system has two free parameter solutions then Rank of matrix A is A] RankA = 0 B] RankA = 1 C] RankA = 2 D] RankA = 3	[2]	CO1	Understand
	ii]Let A be 3 by 3 singular matrix then Rank of matrix A is A] RankA = 3 B] RankA ≥ 3 C] Rank A $\leq$ 2 D] RankA = 0	[2]	CO1	Understand
	iii)Rank of the matrix A= $\begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$ is A] RankA = 1 B] RankA = 2 C] RankA = 3 D] RankA = 4	[2]	CO1	Understand
	iv) In solving the homogeneous system of linear equations AX = 0 where A is the singular matrix of order 3 then above system has A] Only trivial solution B] Non trivial solutions C] AX=0 has no solutions D] None of the above	[2]	CO1	Understand
	v)Let A be the orthogonal matrix of order 3 then rank of A is A] Less than 3 B] greater than 3 C] Equal to 3 D] None of above	[2]	CO1	Understand

	vi) Which of the following is a subspace of the vector Space V= $\mathbb{R}^2$ A] W= {(0,0)} B] W= {(1,0)} C] W= $\{(x,2) \mid x \in \mathbb{R}\}$ D] W= $\{(x,3x+3) \mid x \in \mathbb{R}\}$	[2]	CO2	Understand
	vii) Set of vectors S= $\left\{\begin{bmatrix}1\\0\end{bmatrix}, \left[\begin{bmatrix}0\\0\end{bmatrix}\right]\right\}$ is A] S is Linearly Independent but does not span $\mathbb{R}^2$ B] S Linearly Independent and span $\mathbb{R}^2$ C] S is Linearly dependent but span $\mathbb{R}^2$ D] S is Linearly dependent and does not span $\mathbb{R}^2$	[2]	CO2	Understand
	viii) Row space Basis of the matrix $A = \begin{bmatrix}1 & 1 & 1 & 1\\3 & 3 & 3 & 4\\3 & 3 & 3 & 5\end{bmatrix}$ are A] $B = \{[1 \ \ 1 \ \ 1 \ \ 1]\}, [0 \ \ 1 \ \ 1 \ \ 0], [0 \ \ 0 \ \ 0 \ \ 0]$ B] $B = \{[1 \ \ 1 \ \ 1 \ \ 1]\}, [0 \ \ 0 \ \ 0 \ \ 1]$ C] $B = \{[1 \ \ 1 \ \ 1 \ \ 1], [0 \ \ 0 \ \ 0 \ \ 1], [0 \ \ 0 \ \ 0 \ \ 2]\}$ D] $B = \{[1 \ \ 1 \ \ 1 \ \ 1]\}$	[2]	CO2	Understand
	ix) Column space Basis of the matrix $A = \begin{bmatrix}2 & 2 & 2 & 2\\3 & 3 & 3 & 3\\4 & 4 & 4 & 5\end{bmatrix}$ are A] $B = \left\{\begin{bmatrix}2\\3\\4\end{bmatrix}, \begin{bmatrix}2\\3\\4\end{bmatrix}, \begin{bmatrix}2\\3\\4\end{bmatrix}, \begin{bmatrix}2\\3\\5\end{bmatrix}\right\}$ B] $B = \left\{\begin{bmatrix}2\\3\\4\end{bmatrix}, \begin{bmatrix}0\\0\\0\end{bmatrix}\right\}$ C] $B = \left\{\begin{bmatrix}2\\3\\4\end{bmatrix}\right\}$ D] $B = \left\{\begin{bmatrix}2\\3\\4\end{bmatrix}, \begin{bmatrix}2\\3\\5\end{bmatrix}\right\}$	[2]	CO2	Understand
	x) Dimensions of vector space of all 3 by 3 matrices is A] 1 B] 3 C] 6 D] 9	[2]	CO2	Remember
	xi) If A : $\mathbb{R}^3 \to \mathbb{R}^3$ is regular transformation, then Kernel of Linear Transform is A] $Ker\, A = \{(x,x,x) \mid x \in \mathbb{R}\}$ B] $Ker\, A = \{(x,0,0) \mid x \in \mathbb{R}\}$ C] $Ker\, A = \mathbb{R}^3$ D] $Ker\, A = \{(0,0,0) \mid x \in \mathbb{R}\}$	[2]	CO3	Apply
	xii) If A : $\mathbb{R}^3 \to \mathbb{R}^3$ is Non-Singular transformation, then Nullity of Linear Transform are A] Nullity of A $= 3$ B] Nullity of A $= 0$ C] Nullity of A $= 4$ D] Nullity of A ≥ 3	[2]	CO3	Understand
	xiii) If A : $\mathbb{R}^3 \to \mathbb{R}^3$ is regular transformation, then rank of Linear transform A is A] 0 B] 1 C] 2 D] 3	[2]	CO3	Understand

	xiv) Let $A : \mathbb{R}^3 \to \mathbb{R}^3$ is defined as $A=\begin{bmatrix}1&1&2\\1&1&3\\1&1&4\end{bmatrix}$, then Basis of Image of A are A] $Image\ Basis = \left\{\begin{bmatrix}1\\1\\1\end{bmatrix}, \begin{bmatrix}2\\3\\4\end{bmatrix}\right\}$ B] $Image\ Basis = \left\{\begin{bmatrix}1\\1\\1\end{bmatrix}\right\}$ C] $Image\ Basis = \left\{\begin{bmatrix}1\\1\\1\end{bmatrix}, \begin{bmatrix}0\\0\\0\end{bmatrix}\right\}$ D] $Image\ Basis = \left\{\begin{bmatrix}1\\1\\1\end{bmatrix}, \begin{bmatrix}1\\1\\1\end{bmatrix}, \begin{bmatrix}2\\3\\4\end{bmatrix}\right\}$	[2]	CO3	Understand
	xv) Let $A : \mathbb{R}^3 \to \mathbb{R}^3$ is any Linear Transformation and with Nullity of A= 3 then possible matrix of Linear Transform is A] $A = \begin{bmatrix}1&0&0\\0&1&0\\0&0&1\end{bmatrix}$ B] $A = \begin{bmatrix}0&0&0\\0&0&0\\0&0&0\end{bmatrix}$ C] $A = \begin{bmatrix}1&0&0\\0&0&0\\0&0&0\end{bmatrix}$ D] None of the Above	[2]	CO3	Understand
Q2	**Solve any two out of three**			
	a) Apply the Gram-Schmidt orthogonalization process to find orthogonal basis, for the set of the vectors $S=\left\{\begin{bmatrix}1\\1\\1\end{bmatrix}, \begin{bmatrix}1\\-1\\1\end{bmatrix}, \begin{bmatrix}-1\\1\\1\end{bmatrix}\right\}$	[5]	CO4	Apply
	b) Let P(t) be vector space of polynomials and for f(t) , g(t) in P(t) With inner product $\langle f(t) , g(t)\rangle = \int_{-1}^{1} f(t)g(t)dt$ If $f(t)=t^2$ $\& g(t)=t-3$ Find i) $\lVert g(t) \rVert$ ii)Projection of f(t) on g(t) iii) Does f(t) and g(t) orthogonal ?	[5]	CO4	Remember
	c) Apply the Gram-Schmidt orthogonalization process to find orthogonal basis, for the set of the vector $s = \{ v_1 = t+1 , v_2 = t^2\}$ of polynomial space, with the inner product $\langle u, v\rangle = \int_{-1}^{1} uv dt$	[5]	CO4	Apply
Q.3	**Solve any two out of three** a)Find all Eigen values and Eigen Vectors of the matrix $A = \begin{bmatrix}7&1\\-9&1\end{bmatrix}$	[5]	CO5	Remember

	b) Does the matrix $A = \begin{bmatrix} 2 & 2 \\ 2 & 2 \end{bmatrix}$ is diagonalizable and if yes find diagonalization of it	[5]	CO5	Understan
	c) Verify Cayley Hamilton theorem for the matrix $A = \begin{bmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{bmatrix}$ and use it find A^{-1} if it exist.	[5]	CO5	Apply
Q.4	**Solve any two out of three**			
	a) Using orthogonal diagonalization find canonical form of the quadratic form Q(x,y)=$-2x^2 - 2y^2 + 2xy$	[5]	CO6	Understan
	b) Find Symmetric matrix corresponding to given quadratic form and hence determine the signature and Index of the quadratic form Q(x,y,z)=$2xy + 2xz + 2yz$	[5]	CO6	Remember
	c) Find Symmetric matrix corresponding to quadratic form Q(x,y,z)=$-2x^2 + 2xy - 2xz - 2y^2 + 2yz - 2z^2$ and hence determine the nature and canonical form .	[5]	CO6	Remember