Total No. of Questions – [4]

Total No. of Printed Pages:4

G.R./PRN No.	

PAPER CODE	U1123-201 A(Reg)

May 2023 (INSEM+ ENDSEM) EXAM
F.Y. B. TECH. (SEMESTER - II)
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) System of equations x + y + z = 2, 2x+2y+2z=0 have A] Infinite solution B] Unique solution C] No Solution D] Only trivial solution	[2]	CO1	Understand
	ii]Let A be 2 by 2 Non sigular matrix then Rank of matrix A is A] RankA = 1 B] RankA = 2 C] RankA = 3 D] RankA = 4	[2]	CO1	Understand
	iii)Rank of the matrix A= $\begin{bmatrix} 2 & 2 & 2 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{bmatrix}$ 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] $W=\{(0,0),(1,1),(2,2)\}$ B] $W=\{(x,x)\ /x\in\mathbb{R}\}$ C} $W=\{(x,1)\mid x\in\mathbb{R}\}$ D] $W=\{(x,3x+3)\mid x\in\mathbb{R}\}$	[2]	CO2	Understand
	vii) Set of vectors $S=\left\{\begin{bmatrix}0\\1\\1\end{bmatrix},\begin{bmatrix}1\\0\\0\end{bmatrix}\right\}$ is A] S is Linearly Independent but does not span $\mathbb{R}^3$ B] S Linearly Independent and span $\mathbb{R}^3$ C] S is Linearly dependent but span $\mathbb{R}^3$ D] S is Linearly dependent and does not span $\mathbb{R}^3$	[2]	CO2	Understand
	viii) Row space Basis of the matrix $A=\begin{bmatrix}1&1&1\\2&3&3\\3&3&3\end{bmatrix}$ are A] $B=\{[1\quad 1\quad 1]\},[0\quad 1\quad 1],[0\quad 0\quad 0]$ B] $B=\{[1\quad 1\quad 1]\},[0\quad 1\quad 1]$ C] $B=\{[1\quad 1\quad 1]\},[0\quad 1\quad 1],[3\quad 3\quad 3]$ D] $B=\{[1\quad 1\quad 1]\}$	[2]	CO2	Understand
	ix) Column space Basis of the matrix $A=\begin{bmatrix}2&2&2\\3&3&3\\4&4&4\end{bmatrix}$ are A] $B=\left\{\begin{bmatrix}2\\3\\4\end{bmatrix},\begin{bmatrix}2\\0\\0\end{bmatrix}\right\}$ 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] $B=\left\{\begin{bmatrix}2\\3\\4\end{bmatrix},\begin{bmatrix}2\\3\\4\end{bmatrix},\begin{bmatrix}2\\3\\4\end{bmatrix}\right\}$	[2]	CO2	Understand
	x) Dimensions of vector space of all 3 by 3 skew symmetric matrices is A] 1 B] 3 C] 6 D] 9	[2]	CO2	Remember
	xi) If $A:\mathbb{R}^2\rightarrow\mathbb{R}^2$ is regular transformation, then Kernel of Linear Transform is A] $Ker\,A=\{(x,x)\mid x\in\mathbb{R}\}$ B] $Ker\,A=\{(x,0)\mid x\in\mathbb{R}\}$ C] $Ker\,A=\mathbb{R}^2$ D] $Ker\,A=\{(0,0)\mid x\in\mathbb{R}\}$	[2]	CO3	Apply
	xii) If $A:\mathbb{R}^3\rightarrow\mathbb{R}^3$ is Singular transformation, then Dimensions of Kernel of Linear Transform are	[2]	CO3	Understand

	A] $Dim\ Ker\ A = 3$ B] Dim Ker A = 0 C] $1 \le Dim\ Ker\ A \le 3$ D] Dim Ker A ≥ 3	[2]	CO3	Understand
	xiii)If $A : \mathbb{R}^3 \to \mathbb{R}^3$ is regular transformation, then Dimension of Image A are A] Dim Image A = 0 B] Dim Image A = 1 C] Dim Image A = 2 D] Dim Image A = 3	[2]	CO3	Understand
	xiv) Let $A : \mathbb{R}^3 \to \mathbb{R}^3$ is defined as A= $\begin{bmatrix}1&1&2\\1&1&2\\1&1&2\end{bmatrix}$, 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			
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= $\left\{\begin{bmatrix}1\\2\\3\end{bmatrix}, \begin{bmatrix}1\\-1\\0\end{bmatrix}, \begin{bmatrix}-1\\0\\1\end{bmatrix}\right\}$	[5]	CO4	Apply
	b) For the vectors $v_1 = \begin{bmatrix}1\\5\end{bmatrix}$, $v_2 = \begin{bmatrix}2\\4\end{bmatrix}$ $v_3 = \begin{bmatrix}3\\3\end{bmatrix}$ Find I) $Angle\ between\ V_1\ \&\ V_2$ II) Proj(V_2, V_1) (III) $\|\| V_3 \|\|$ IV) Distance between $V_2 \&, V_3$	[5]	CO4	Remember
	c) Apply the Gram-Schmidt orthogonalization process to find orthogonal basis, for the set of the vectors S= $\{v_1 = 2 + 3t,\ v_2 = 1 + t^2\}$ of polynomial space, with the inner product $\langle u, v\rangle = \int_0^1 uv\,dt$	[5]	CO4	Apply

Q.3	**Solve any two out of three** a)Find all Eigen values of the matrix $A=\begin{bmatrix}2 & 1 & 1\\ 2 & 3 & 2\\ 3 & 3 & 4\end{bmatrix}$ and hence find Eigen Vector corresponding to Eigen Value $\lambda = 7$ hence determine algebraic multiplicity and geometric multiplicity of Eigen value $\lambda = 7$	[5]	CO5	Remember
	b) Does the matrix $A = \begin{bmatrix}7 & 2\\ -4 & 1\end{bmatrix}$ is diagonalizable and if yes find diagonalization of it	[5]	CO5	Understand
	c) Verify Cayley Hamilton theorem for the matrix $A = \begin{bmatrix}2 & -1 & 1\\ -1 & 2 & -1\\ 1 & -1 & 2\end{bmatrix}$ and use it find A^{-1} if it exists.	[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)=10xy	[5]	CO6	Understand
	b) Find Symmetric matrix corresponding to given quadratic form and hence determine the signature and Index of the quadratic form Q(x,y,z)=$6x^2 - 4xy + 4xz + 3y^2 - 2yz + 3z^2$	[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 rank of quadratic form .	[5]	CO6	Remember