Total No. of Questions – [4]

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PAPER CODE	U123-201A(RE)

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) The system of equations 2x + 3y =1, x +y = 3 has A] One free parameter solution B] No solution C] Two free parameter solution D] Unique solution	[2]	CO1	Understand
	ii]Let A be 3 by 3 orthogonal matrix then Rank of matrix A is A] Rank A = 1 B] Rank A = 2 C] Rank A = 3 D] Rank A = 4	[2]	CO1	Understand
	iii)Rank of the matrix A= $\begin{bmatrix} 2 & 3 & 4 \\ 4 & 6 & 8 \\ 6 & 9 & 12 \end{bmatrix}$ is A] Rank A = 1 B] Rank A = 2 C] Rank A = 3 D] Rank A = 4	[2]	CO1	Understand
	iv) The homogeneous system of linear equations 2x+3y = 0, 8x+13y=0 has A] Only trivial solution B] Non trivial solutions C] No solutions D] None of the above	[2]	CO1	Understand
	v)Let A be the Nonsingular matrix of order 'n' then rank of A is A] Less than n B] greater than n C] Equal to n D] None of above	[2]	CO1	Understand

	vi) Which of the following is not a subspace of the vector Space V= $\mathbb{R}^3$ A] W= $\{ (x,x,x) \mid x\varepsilon\, \mathbb{R}\}$ B] W= $\{(0,0,0)\}$ C} W= $\{(x,3x,0) \mid x \epsilon\mathbb{R}\}$ D] W= $\{(x,1,x) \mid x \epsilon\mathbb{R}\}$	[2]	CO2	Understand
	vii) Set of vectors S= $\left\{\begin{bmatrix}1\\-1\\1\end{bmatrix},\begin{bmatrix}1\\0\\0\end{bmatrix}\right\}$ 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 $A=\begin{bmatrix}1&2&3\\2&4&6\\3&6&9\end{bmatrix}$ are A] $B=\{[1\quad 2\quad 3]\},[0\quad 0\quad 0],[0\quad 0\quad 1]$ B] $B=\{[1\quad 2\quad 3]\},[0\quad 0\quad 1]$ C] $B=\{[1\quad 2\quad 3]\},[2\quad 4\quad 6],[3\quad 6\quad 10]$ D] $B=\{[1\quad 2\quad 3]\}$	[2]	CO2	Understand
	ix) Column space Basis of the matrix $A=\begin{bmatrix}1&-1&-1\\0&0&-1\\1&-1&-1\end{bmatrix}$ are A] $B=\left\{\begin{bmatrix}1\\0\\1\end{bmatrix},\begin{bmatrix}-1\\0\\-1\end{bmatrix}\right\}$ B] $B=\left\{\begin{bmatrix}1\\0\\1\end{bmatrix},\begin{bmatrix}-1\\-1\\-1\end{bmatrix}\right\}$ C] $B=\left\{\begin{bmatrix}1\\0\\1\end{bmatrix},\begin{bmatrix}-1\\0\\-1\end{bmatrix},\begin{bmatrix}-1\\-1\\-1\end{bmatrix}\right\}$ D] $B=\left\{\begin{bmatrix}0\\0\\0\end{bmatrix},\begin{bmatrix}1\\0\\0\end{bmatrix}\right\}$	[2]	CO2	Understand
	x) Dimensions of vector space of all 5 by 5 Skew symmetric matrices are A] 5 B] 10 C] 15 D] 25	[2]	CO2	Remember
	xi) If A : $\mathbb{R}^3 \to \mathbb{R}^3$ is singular transformation with rank of the matrix two then Nullity of Linear Transform is A] Nullity of A = 0 B] Nullity of A = 1 C] Nullity of A = 2 D] Nullity of A = 3	[2]	CO3	Apply
	xii) If A : $\mathbb{R}^3 \to \mathbb{R}^3$ Orthogonal transformation, then Dimensions of Kernel A are A] $Dim\,Ker\,A=0$ B] Dim Ker A = 1 C] $Dim\,Ker\,A=2$ D] Dim Ker A = 3	[2]	CO3	Understand

	xiii) If $A : \mathbb{R}^2 \to \mathbb{R}^2$ 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 $A = \begin{bmatrix} 1 & 1 & 2 \\ 1 & 2 & 3 \\ 1 & 1 & 3 \end{bmatrix}$, 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] $Image\ Basis = \left\{ \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}, \begin{bmatrix} 1 \\ 2 \\ 1 \end{bmatrix}, \begin{bmatrix} 2 \\ 3 \\ 3 \end{bmatrix} \right\}$	[2]	CO3	Understand
	xv) Let $A : \mathbb{R}^3 \to \mathbb{R}^3$ is any Linear Transformation and Nullity of A= 3 then rank of the matrix A is A] $\rho(A) = 0$ B] $\rho(A) = 1$ C] $\rho(A) = 2$ D] $\rho(A) = 3$	[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 $S = \left\{ \begin{bmatrix} 2 \\ 2 \\ 1 \end{bmatrix}, \begin{bmatrix} 1 \\ 3 \\ 1 \end{bmatrix}, \begin{bmatrix} 1 \\ 2 \\ 2 \end{bmatrix} \right\}$	[5]	CO4	Apply
	b) For the vectors $v_1 = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$ $v_2 = \begin{bmatrix} -1 \\ 1 \\ 2 \end{bmatrix}$ $v_3 = \begin{bmatrix} 3 \\ 2 \\ 2 \end{bmatrix}$ Find I) $\langle V_2, V_3 \rangle$ 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 = $\{v_1 = 1,\ v_2 = t,\ v_3 = t^2\}$ of polynomial space, with the inner product $\langle u, v\rangle = \int_0^1 uvdt$	[5]	CO4	Apply
Q.3	**Solve any two out of three**			
	a) Find all Eigen values of the matrix A= $\begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$ and hence find Eigen Vector corresponding to Eigen Value $\lambda = 5$ hence determine algebraic multiplicity and geometric multiplicity of Eigen value $\lambda = 5$	[5]	CO5	Remember
	b) Does the matrix $A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$ is diagonalizable and if yes find diagonalization of it	[5]	CO5	Understand
	c) Verify Cayley Hamilton theorem for the matrix $A = \begin{bmatrix} 2 & 1 & 1 \\ 3 & -1 & 2 \\ 2 & 1 & 3 \end{bmatrix}$ 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 $Q(x, y) = 25xy$	[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 $Q(x,y,z) = 2x^2 + 4xy + 2y^2 + z^2$ and hence determine the nature and rank of the quadratic form .	[5]	CO6	Remember