Total No. of Questions – [4]

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U112-201A (RE)

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U123-201A (BE)

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 four variables if system has three 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 orthogonal 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= $\begin{bmatrix}1 & 1 & 1\\1 & 2 & 1\\1 & 1 & 1\end{bmatrix}$ 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 Nonsingular 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 Skew symmetric 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 not a subspace of the vector Space V= $\mathbb{R}^2$ A] W= $\{(0,0),(1,1),(2,2)\}$ B] W= $\{(0,0)\}$ C} W= $\{(x,0)\mid x \in \mathbb{R}\}$ D] W= $\{(x,3x)\mid x \in \mathbb{R}\}$	[2]	CO2	Understand
vii) Set of vectors S= $\left\{\begin{bmatrix}1\\1\end{bmatrix},\begin{bmatrix}1\\2\end{bmatrix}\right\}$ 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 $A=\begin{bmatrix}1&1&1\\2&3&3\\3&3&3\end{bmatrix}$ are A] $B=\{[1\ \ 1\ \ 1]\},[0\ \ 1\ \ 1],[0\ \ 0\ \ 0]$ B] $B=\{[1\ \ 1\ \ 1]\},[0\ \ 1\ \ 1]$ C] $B=\{[1\ \ 1\ \ 1]\},[0\ \ 1\ \ 1],[3\ \ 3\ \ 3]$ D] $B=\{[1\ \ 1\ \ 1]\}$	[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] $B=\left\{\begin{bmatrix}0\\0\\0\end{bmatrix},\begin{bmatrix}2\\0\\0\end{bmatrix}\right\}$	[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 : $\mathbb{R}^3 \to \mathbb{R}^3$ is regular transformation, then Kernel of Linear Transform is A] $Ker\ A=\{(x,x,x)\mid x\mathcal{E}\mathbb{R}\}$ B] $Ker\ A=\{(x,0,0)\mid x\mathcal{E}\mathbb{R}\}$ C] $Ker\ A=\mathbb{R}^3$ D] $Ker\ A=\{(0,0,0)\mid x\mathcal{E}\mathbb{R}\}$	[2]	CO3	Apply
xii) If A : $\mathbb{R}^3 \to \mathbb{R}^3$ is Non-Singular transformation, then Dimensions of Kernel of Linear Transform are A] $Dim\ Ker\ A=3$ B] Dim Ker A = 0 C] $1 \le Dim\ Ker\ A \le 2$ D] Dim Ker A $\geq$ 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= $\begin{bmatrix}1&1&2\\1&1&3\\1&1&4\end{bmatrix}$, 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) For the vectors $v_1 = \begin{bmatrix}1\\2\\3\end{bmatrix}$ $v_2 = \begin{bmatrix}-1\\1\\0\end{bmatrix}$ $v_3 = \begin{bmatrix}-1\\0\\1\end{bmatrix}$ Find I) $\langle V_2,\ V_3\rangle$ II) Proj(V_2, V_1) III)) $\|\ V_3\ \|$ IV) Angle 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 = $\{v_1 = t,\ v_2 = t^2,\ v_3 = t^3\}$ of polynomial space,with the inner product $\langle u, v\rangle = \int_{-1}^{1} uvdt$	[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 $A = \begin{bmatrix} 7 & 0 \\ -4 & 3 \end{bmatrix}$ is diagonalizable and if yes find diagonalization of it	[5]	CO5	Understand
	c) Verify Cayley Hamilton theorem for the matrix $A = \begin{bmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{bmatrix}$ 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)=14xy	[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 canonical form .	[5]	CO6	Remember