Shiv Nadar University Chennai

Mid Semester Examinations 2023-2024 Odd

Question Paper

Name of the Program: Common to B.Tech. AI & DS, B.Tech. CSE (IoT), B.Tech. CSE (CS)	Semester: 01
Course Code & Name: MA1001 LINEAR ALGEBRA	
Regulation 2021	
Time: 2 Hours	Answer All Questions	Marks: 50

Q.No.		Questions	Marks	CO	KL
1	a	Let $S = \{(a_1, a_2): a_1, a_2 \in R\}$. For $(a_1, a_2), (b_1, b_2) \in S$ and $c \in R$, define $(a_1, a_2) + (b_1, b_2) = (a_1 + b_1, 0)$ and $c(a_1, a_2) = (ca_1, 0)$. Is S is a vector space? Justify your answer.	2	CO1	KL2
	b	List all the four subspaces of $P_3(x)$, where $P_3(x)$ is the set of all polynomials of degree less than or equal to 3.	2	CO1	KL2
2	a	Find the condition on (a, b, c) so that $(a, b, c) \in R^3$ belong to the space generated by $u = (2,1,0)$, $v = (1,-1,2)$ and $w = (0,3,-4)$.	2	CO1	KL3
	b	Under what condition on the scalars $a \in F$ are the vectors $(1 + a, 1 - a)$ and $(1 - a, 1 + a)$ in $V_2(F) = R^2$ are linearly dependent?	2	CO1	KL1
3	a	Determine whether the set $\{1 + 2x + x^2,\ 3 + x^2,\ x + x^2\}$ is a basis of $P_2(R)$.	2	CO1	KL3
	b	Find the basis and dimension of the subspace W of R^4 generated by the vectors $(1, -2, 5, -3)$, $(2, 3, 1, -4)$ and $(3, 8, -3, -5)$.	2	CO1	KL3
4	a	Check whether the $T: R^3 \to R^2$ defined by $T(x, y, z) = (\lvert x \rvert, y + z)$ is linear or not.	2	CO2	KL2
	b	Let V and W be vector spaces over R and $T: V \to W$ be a linear transformation. Prove that $N(T)$ is a subspace of V.	2	CO2	KL2
5	a	Define rank and nullity of a linear transformation $T: V \to W$.	2	CO2	KL1
	b	Let $T: R^2 \to R^2$ be a linear transformation defined by $T(a_1, a_2) = (a_1 + a_2, a_1)$. Check whether T is one-one.	2	CO2	KL2
6	a	Can you express the vector $x = \begin{bmatrix} 3 & 1 \\ 1 & -1 \end{bmatrix}$ in vector space of 2×2 matrices, $M_{2\times2}(R)$ as a linear combination of $x_1 = \begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}$, $x_2 = \begin{bmatrix} 0 & 0 \\ 1 & 1 \end{bmatrix}$, $x_3 = \begin{bmatrix} 0 & 2 \\ 0 & -1 \end{bmatrix}$. If so, find the expression of x in terms of x_1, x_2, and x_3.	10	CO1	KL3
7	a	Let $T: R^3 \to R^3$ be a linear transformation defined by $T(x_1, x_2, x_3) = (x_1 + 2x_2, x_2 - x_3, x_1 + 2x_3)$. Find dim $(N(T))$, dim $(R(T))$ and then verify dimension theorem (rank-nullity theorem).	10	CO2	KL3
8	a	Define $T: P_n(R) \to P_{n+1}(R)$ by $T\left(f(x)\right) = \int_0^x f(t)dt$. Verify whether T is linear. Is T is one-to-one and onto?	10	CO2	KL3

KL – Bloom's Taxonomy Levels

(KL1: Remembering, KL2: Understanding, KL3: Applying, KL4: Analyzing, KL5: Evaluating, KL6: Creating)

CO – Course Outcomes
