RV College of Engineering

DEPARTMENT OF MATHEMATICS

Academic year 2023-2024 (Odd Semester 2023)

Date	**19th March 2024**	**Time**	**10:00 a.m. – 11:30 a.m.**	
TEST	**IMPROVEMENT**	**Maximum Marks**	**50**	
Course Title	**Mathematics for Artificial Intelligence & Machine Learning**	**Course Code**	**MAT231ET**	
Semester	**III**	**Programs**	**AIML**	

Instructions: i) Answer all questions.

Sl. No.	**Questions**	M	CO	BT
1a	Prove that the set of vectors $V = \{(x,y) \| x, y \in \mathbb{R}\}$ closed under usual vector addition and scalar multiplication is a field over the field $\mathbb{Q}$.	06	1	2
1b	Show that the set of all 2×2 symmetric matrices is a subspace of $M_{2\times2}$, the set of all 2×2 matrices, over the field $\mathbb{C}$.	04	1	2
2a	Show that the mapping $T: M(\mathbb{R}) \to M(\mathbb{R})$ defined by $T(A) = AC - CA$, for all matrices $A \in M(\mathbb{R})$ and a fixed matrix C is a linear transformation.	04	2	3
2b	Show that the polynomials $\{1+2t+t^2, 2+2t-t^2, 1+3t+2t^2, 1-t-3t^2\}$ are linearly dependent in $\mathbb{P}_2$. Extract a linearly independent subset. Also find the basis and dimension of the subspace spanned by them.	06	4	3
3	Find the bases and dimension of the four fundamental sub spaces of the matrix $A = \begin{bmatrix} 2 & 4 & -2 & 1 \\ -2 & -5 & 7 & 3 \\ 1 & 3 & -6 & 5 \end{bmatrix}$.	10	3	3
4a	Given $T(1,2,1) = (7,0,3,5)$, $T(2,1,1) = (5,2,2,3) T(-1,2,1) = (5,-4,3,5)$, obtain the linear transformation $T: \mathbb{R}^3 \to \mathbb{R}^4$ and hence the basis of the range space of the linear transformation.	06	3	2
4b	Let $u_1 = (2,5,-1), u_2 = (-2,1,1)$ and $y = (1,2,3)$. $W = span\{u_1, u_2\}$. Obtain the orthogonal projection of y onto the space W and hence obtain the shortest distance between y and W.	04	4	4
5	Obtain the QR factorization of the matrix $A = \begin{bmatrix} 1 & -2 & -2 \\ 2 & -4 & 1 \\ -2 & 0 & 4 \\ 1 & 0 & -2 \\ 2 & -2 & -2 \end{bmatrix}$.	10	2	4

BT-Blooms Taxonomy, CO-Course Outcomes, M-Marks

Marks Distribution	Particulars	CO1	CO2	CO3	CO4	L1	L2	L3	L4	L5	L6
	Test Max Marks	10	14	16	10	-	16	20	14	-	-