Course Code MAT3002	Applied Linear Algebra	Course Type:	LT
		Credits:	3
		Version:	1.1
Prerequisites	Elementary knowledge of Matrices.		

Course Objectives:

1. To make understand the importance of matrix theory in solving systems of linear equations.
2. To study concepts of vector spaces.
3. To study linear transform on vector spaces and learn how to apply in computer graphics.
4. To learn concepts of length, angle and other geometrical concepts of vectors.
5. To study decomposition of matrices and learn how to apply in computer science.

Course Outcomes (COs):

By the end of the course, the students will be able to

CO1: Solve systems of linear equations with the concept of matrix theory. (KL3)

CO2: Solve the problems based on the concepts of vector spaces, basis, and dimensions. (KL2)

CO3: Use matrix representation of linear transformation for solving the application-based problems in computer graphics. (KL4)

CO4: Use the Gram-Schmidt process to obtain an orthonormal basis. (KL4)

CO5: Apply the concepts of Inner product space for solving the problems in the area of computer science. (KL3)

Correlation of COs with POs

CO/PO	CKL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PO3
PKL		3	5	6	5	6	3	3	3	NA	M	3	M			
CO1	3	3	2	2	2	2			1	0	2	1				
CO2	2	3	2	1	2	1			3	0	2	1				
CO3	4	3	3	2	3	2			3	0	2	1				
CO4	4	3	3	2	3	2			3	0	2	1				
CO5	3	3	2	2	2	2			1	0	2	1				

COs	Topics to be discussed	Lectures
CO1	**System of Linear Equations and Matrices** Matrix representation of system of linear equations, Elementary Operations, System in triangular and Echelon form, Rank of Matrices, Eigen values and Eigen vectors - properties of Eigen values and Eigen vectors, Existence of solution, Methods of solution - Gaussian elimination and Gauss Jordan methods - inverse matrix by Gauss Jordan methods - LDU factorization - Applications to Traffic flow/ Network Analysis, Chemical balancing, Electrical networks and Cryptography.	**9**
CO2	**Vector Spaces and Subspaces** Vector spaces and subspaces - Linear Independence and dependence, Basis and Dimension - Row, Column and Null spaces - Rank and Nullity - Bases for subspaces.	**5**

CO3	**Linear Transformations** Definition and Examples - properties - Range and Kernel – Invertible linear transformations - Matrices of linear transformations - Vector space of linear transformations - change of bases - similarity - Application in computer graphics.	**6**
CO4	**Inner Product Spaces** Inner products - The lengths and angles of vectors - Matrix representations of inner products - Orthogonal projections - Gram - Schmidt orthogonalization.	**5**
CO5	**Applications of Inner Product Spaces** QR factorization - Singular Value Decomposition - relations of fundamental subspaces - Least square solutions.	**5**
	Guest Lectures by experts on contemporary topics	**2**
	Total Lectures: **(1 Lecture = 1.5 hrs.)**	**32**

Mode of Teaching and Learning:
Class room teaching
Use of mathematical software's (such as MATLAB, MATHEMATICA, SAGE, ETC.) as teaching aid
Minimum of 2 hours lectures by experts on contemporary topics

Mode of Evaluation and assessment: Digital Assignments, Continuous Assessment Tests, Final Assessment Test and unannounced open book examinations, quizzes, student's portfolio generation and assessment, innovative assessment practices.

Text Books:

1. Jin Ho Kwak and Sungpyo Hong, Linear Algebra, 2nd edition, Springer, 2004.
2. Steven J. Leon, Linear Algebra with applications, 10th edition, Pearson Education Ltd, 2021.
3. Ron Larson, Elementary Linear Algebra, 8th edition, Cengage Learning, 2017.

Reference Books:

1. Stephen Andrilli and David Hecker, Elementary Linear Algebra, 4th edition, Academic Press, 2010.
2. Gilbert Strang, Introduction to Linear Algebra, 4th edition, Wellesley-Cambridge Press, 2011.
3. Bernard Kolman and David R. Hill, Introductory Linear Algebra - An applied first course, 9th edition, Pearson education, 2011.
4. David Poole, Linear Algebra: A Modern Introduction, 4th edition, Cengage Learning, 2015.
5. Seymour Lipschutz, Schaum's Outline of Linear Algebra, 3rd edition, McGraw Hill Education, 2017.
6. Howard Anton and Cheris Rorres, Elementary Linear Algebra with Supplementary Applications, 11th edition, Willey, 2023.

Recommendation by the Board of Studies on	**22-04-2017/ Revised on 15 March 2024**
Approval by Academic council on	**Academic Council - 1 (07/09/17)/** **Academic Council - 13 (23/05/24)/**
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