COURSE TITLE	**MATRIX ALGEBRA AND VECTOR SPACE**
COURSE CODE	**01MA1103**
COURSE CREDITS	**5**

Objective:

1 This subject aims to provide fundamentals of matrix algebra and vector calculus. The topics delivered in the syllabus are essential for engineering graduate-level courses.

Course Outcomes: After completion of this course, student will be able to:

1 Employ vector analysis in multidimensional space for data and image interpretation.

2 Apply systems of linear equations to solve problems in engineering applications.

3 Employ eigenvalue and eigenvector techniques to analyze engineering problems.

4 Apply vector calculus methods to analyze gradient, divergence, and curl.

5 Evaluate and test the convergence of improper integrals of both types and apply them in engineering-related contexts.

Pre-requisite of course:DIFFERENTIAL AND INTEGRAL CALCULUS

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	2	0	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	**Matrix Algebra - I** Definitions of some basic types of Matrices, Row Echelon form and Reduced Row Echelon form, Rank by row operation and determinant, Consistency of system of linear equations by Gauss Elimination and Gauss Jordan Method, Inverse of matrix by Gauss Jordan Method	9
2	**Matrix Algebra -II** Eigen values and Eigen vector of matrix, AM and GM, Cayley-Hamilton theorem, Diagonalization, Orthogonally Diagonalization, Quadratic form, Value class (Nature), Index and Signature of Quadratic form, Canonical forms	12
3	**Vector Space** Vector space, Subspace, Linear dependence and independence of vectors, Span, Basis and dimension of vector space, Inner product spaces and their properties	12

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Contents : Unit	Topics	Contact Hours
4	**Vector Calculus** Recall the concept of vector algebra, Scalar and vector functions, Gradient, Divergence and Curl, Directional derivatives, Conservative vector fields, Irrotational and Solenoidal function, Line integrals, Path Independence of Line Integrals, Concept of surface integrals, Green's theorem, Stoke's theorem and Divergence theorem	10
5	**Improper Integrals** Improper integrals of type I and type – II, Convergence of Improper integrals	2
6	**Application of Linear Algebra by MATLAB** Introduction to MATLAB, some basic MATLAB command related to Matrices, Row Echelon form and Reduced Row Echelon form, Rank of Matrix, Solution of system of Linear equation, Inverse of Matrix, Characteristic polynomial of Matrix, Eigen value and Eigen vector of Matrix, Power of Matrix.	0
Total Hours		**45**

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**Matrix Rank Determination with MATLAB** Matrix Rank Determination with MATLAB	2
2	**Row Echelon and Reduced Row Echelon Forms with MATLAB** Row Echelon and Reduced Row Echelon Forms with MATLAB	2
3	**Solving Systems of Linear Equations: Gauss Elimination and Gauss–Jordan Methods using MATLAB** Solving Systems of Linear Equations: Gauss Elimination and Gauss–Jordan Methods using MATLAB	2
4	**Eigenvalues and Eigenvectors: Properties and MATLAB Computation** Eigenvalues and Eigenvectors: Properties and MATLAB Computation	2
5	**Arithmetic and Geometric Means in Linear Algebra: Using MATLAB** Arithmetic and Geometric Means in Linear Algebra: Using MATLAB	2
6	**Matrix Diagonalization and Orthogonal Diagonalization** Matrix Diagonalization and Orthogonal Diagonalization	2
7	**Orthogonality and the Cayley–Hamilton Theorem in Linear Algebra** Orthogonality and the Cayley–Hamilton Theorem in Linear Algebra	2
8	**Vector Spaces and Subspaces: Concepts and Properties** Vector Spaces and Subspaces: Concepts and Properties	2

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Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
9	**Linear Dependence, Independence of vectors** Linear Dependence, Independence of vectors	2
10	**Span and Basis of Vectors** Span and Basis of Vectors	2
11	**Gradients, Divergence and Directional Derivatives in Vector Calculus** Gradients, Divergence and Directional Derivatives in Vector Calculus	2
12	**Curl of a Vector Field and Irrotational Vectors in Vector Calculus** Curl of a Vector Field and Irrotational Vectors in Vector Calculus	2
Total Hours		**24**

Textbook :

1 Introduction to Linear Algebra with Application, Jim Defranza, Daniel Gagliardi, Tata McGraw Hill, 2013

2 Elementary Linear Algebra, Anton and Rorres, Wiley India Edition, 2015

References:

1 Advanced Engineering Mathematics, Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Publication , 2011

2 Elementary Linear Algebra, Elementary Linear Algebra, Ron Larson, Cengage Learning, 2014

3 Linear Algebra and its Applications, Linear Algebra and its Applications, David C. Lay, Pearson Education, 2015

4 Linear Algebra: A first course with Applications in MATLAB, Linear Algebra: A first course with Applications in MATLAB, Larry E. Knop, CRC Press, 2016

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery					
Remember / Knowledge	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Higher order Thinking / Creative**
20.00	20.00	30.00	20.00	10.00	0.00

Instructional Method:

1 The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

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Instructional Method:

2 The internal evaluation will be done based on continuous evaluation of students in the laboratory and classroom.

3 Practical examination will be directed toward the completion of semester for assessment of performance of understudies in laboratory.

4 Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.

Supplementary Resources:

1 http:// mathworld.wolfram.com/

2 http:// en.wikipedia.org/ wiki/ Math

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