

ENGINEERING MATHEMATICS-I
MATRIX ALGEBRA & MULTIVARIABLE CALCULUS
Common to all branches

Course Code - Category: CSE 111 - BS

Credits:3

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Sessional Marks:40

End Exam: 3 Hours

End Exam Marks:60

Course Objective:

To provide the students with sufficient knowledge in calculus and matrix algebra, this can be used in their respective fields.

Course outcomes:

By the end of the semester, the student will be able to:	
CO1	Apply elementary transformations to reduce the matrix into the echelon form and normal form to determine its rank and interpret the various solutions of system of linear equations
CO2	Identify the special properties of a matrix such as the eigen value, eigen vector, employ orthogonal transformations to express the matrix into diagonal form, quadratic form and canonical form
CO3	Equip themselves familiar with the functions of several variables and mean value theorems
CO4	Evaluatedoubleandtripleintegralstechniquesoveraregion in twodimensionalandthree dimensional geometry
CO5	Familiarize with special functions to evaluate some proper and improper integrals using beta and gamma functions

SYLLABUS

Unit - I: Linear Equations

10 Periods

Rank of matrix, normal form of a matrix, PAQ form, Gauss Jordan Method of finding the inverse, consistency of linear system of equations.

Learning outcome: At the end of this unit student will be able to

- Solve the system of equations using the rank.

Unit - II: Linear transformations and Quadratic forms

14 Periods

Linear transformations, orthogonal transformations, vectors (linearly independent & dependent), eigen values, eigen vectors, properties of eigen values, Cayley - Hamilton theorem (without proof), reduction to diagonal form, reduction of Quadratic form to Canonical form, nature of the Quadratic form.

Learning outcome: At the end of this unit, student will be able to

- Identify the special properties of a matrix such as the eigen values, eigen vectors, diagonal form

and nature of the quadratic forms.

Unit - III: Single and Multivariable Calculus

12 Periods

Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem (All theorems without proof). Partial derivatives, total derivatives, chain rule, change of variables, Jacobians, Taylor's series expansion of two variable function, maxima and minima of function of two variables, method of Lagrange's multipliers.

Learning outcome: At the end of the unit, student will be able to

- Analyze the behavior of functions by using mean value theorems.
- Estimate the maxima and minima of multivariable functions.

Unit - IV: Multiple Integrals

14 Periods

Double integrals, change of order of integration, double integration in polar coordinates, areas enclosed by plane curves, evaluation of triple integrals, volumes of solids, change of variables between Cartesian cylindrical and spherical polar coordinates, calculation of mass, center of gravity.

Learning outcome: At the end of the unit, the student will be able to

- Evaluate double integrals of functions of several variables in two dimensions using Cartesian and polar coordinates.
- Apply double and triple integration techniques in evaluating areas and volumes bounded by a region.

Unit - V: Special functions

10 Periods

Beta and Gamma functions and their properties, relation between Beta and Gamma functions, evaluation of double and triple integrals by using Beta and Gamma functions, error function.

Learning outcome: At the end of this unit, the student will be able to

- conclude the use of special functions in multiple integrals.

Textbooks:

1. **B. S. Grewal**, "*Higher Engineering Mathematics*", 44/e, Khanna Publishers, 2017.
2. **Erwin Kreyszig**, "*Advanced Engineering Mathematics*", 10/e, John Wiley & Sons, 2011.

References:

1. **N. P. Bali**, "*Engineering Mathematics*", Lakshmi Publications.
2. **George B. Thomas, Maurice D. Weir and Joel Hass**, "*Thomas Calculus*", 13/e, Pearson Publishers, 2013.
3. **H. K. Dass**, "*Advanced Engineering Mathematics*", S. Chand and company Pvt. Ltd.
4. **Michael Greenberg**, "*Advanced Engineering Mathematics*", Pearson, Second Edition.