### EC/EE/ME-107

#### CALCULUS AND NUMERICAL METHODS

- COURSE OBJECTIVES:
- 1. Finding the Eigen values and Eigen vectors and inverse of a matrix and getting familiarity with diagonalization and quadratic forms.
- 2. To give basic knowledge on evaluation of double, triple integrals, area and volume.
- 3. To provide sufficient theoretical and analytical background of differentiation and integration of vector functions.
- 4. To provide basic knowledge of numerical methods including solving systems of linear equations.
- 5. To provide knowledge on numerical differentiation and integration.

# COURSE OUTCOMES:

### After successful completion of the course, the students are able to

- 1. demonstrate the basic linear algebraic concepts, Double and Triple integrals, Vector Calculus, Solving System of equations, Numerical Techniques.
- 2. find eigen values, eigen vectors of a matrix, area by double integrals and volume by triple integrals.
- 3. evaluate double integrals and triple integrals.
- 4. find the polynomial from the given tabular values.
- 5. Evaluate definite integrals using numerical methods.

### UNIT I

**Matrices :** Characteristic equation - Eigen values and Eigen vectors of a real matrix - Properties of Eigen values (without proofs) - Cayley - Hamilton theorem (without proof). Reduction to diagonal form.

Reduction to diagonal form. Reduction of quadratic form to canonical form by orthogonal transformations, Nature of a quadratic form.

### UNIT II

**Multiple Integrals :** Double integration in Cartesian and polar coordinates - Change of order of integration - Area as a double integral.

Triple integration in Cartesian coordinates - Change of variables in double integrals from Cartesian to polar - Volume as a Triple Integral.

### UNIT III

**Vector Calculus :** Gradient, Directional derivatives, divergence, curl - Solenoidal and irrotational fields - Vector identities (without proof).

Line, surface and volume integrals - Green's theorem in the plane, Stoke's theorem and Gauss divergence theorem (without proofs).

### UNIT IV

### Numerical Solution of Equations and Interpolation :

Newton - Raphson method - Gauss Seidel method. Forward and backward differences - Differences of a polynomial.

Interpolation - Newton-Gregory Forward and Backward Interpolation formulae (without proof), Lagrange's Interpolation formula (without proof) - Inverse interpolation.

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## UNIT V

#### Numerical differentiation and Integration :

Newton's forward and backward differences formulae to compute first and second order derivatives.

Trapezoidal rule - Simpson's one third rule.

#### LEARNING RESOURCES:

#### TEXT BOOK(s):

B.S.Grewal - Higher Engineering Mathematics, Khanna publishers, 40th edition, 2007.

#### **REFERENCE BOOK(s):**

Erwin Kreyszig - Advanced Engineering Mathematics, 8th edition, New Age International (P) Ltd., 2007.

#### WEB RESOURCES:

http://nptel.iitm.ac.in/courses/

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