EC/EE/ME-107 CALCULUS AND NUMERICAL METHODS

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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 **(12)**

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 **(12)**

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 **(12)**

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 **(12)**

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.

UNIT V **(12)**

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/