#### LINEAR ALGEBRA AND VECTOR CALCULUS

### **Course Objectives:**

- The course is designed to equip the students with the necessary mathematical skills and techniques that are essential for an engineering course.
- The skills derived from the course will help the student from a necessary base to develop analytic and design concepts.
- > Understand the most basic numerical methods to solve simultaneous linear equations.

#### **Course Outcomes**: At the end of the course student able to

- 1. Solve the linear system of equations using the concepts of rank, Gauss elimination, Gauss Jordan, and Gauss Seidel methods.
- 2. Solve Eigen values and eigenvectors of square matrices.
- 3. Appraise the Laplace transform technique and use it to solve various engineering problems.
- 4. Find the gradient and directional derivative of a scalar function and divergence, curl of a vector function.
- 5. Apply line, surface, and volume integrals to find work done by a force, flux and interpret vector integral theorems

# **UNIT I**: Solving systems of linear equations:

Rank of a matrix by echelon form and normal form – Solving system of homogeneous and non homogeneous equations– Gauss elimination for solving system of equations– Gauss Jordon-Gauss Jacobi and Gauss Seidal methods

### **UNIT II**: Eigen values - Eigen vectors and Quadratic forms:

Eigen values - Eigen vectors— Properties — Cayley-Hamilton theorem (without proof) - Inverse and powers of a matrix by using Cayley-Hamilton theorem- Diagonalization-Quadratic forms- Nature of the Quadratic forms - Reduction of quadratic form to canonical form and Orthogonal Transformations.

### **UNIT III**: Laplace transforms:

Laplace transforms of standard functions-Shifting theorems - Transforms of derivatives and integrals Unit step function -Dirac's delta function- Inverse Laplace transforms-Convolution theorem (without proof).

Applications: Solving ordinary differential equations (initial value problems) using Laplace transforms.

## **UNIT IV**: Vector Differentiation:

Gradient- Directional Derivative -Divergence- Curl – Scalar Potential -Vector identities.

## **UNIT V**: Vector Integration:

Line integral – Work done – Potential function – Area- Surface and volume integrals. Vector integral theorems: Greens, Stokes and Gauss Divergence theorems (without proof) and related problems.

#### **Text Books**:

- 1. B.S.Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
- 2. B. V Ramana, Higher Engineering Mathematics, 2007 Edition, Tata Mc.Graw Hill Education

#### **Reference Books:**

- 1. Greenberg, Advanced Engineering Mathematics, 2nd edition, Pearson edn
- 2. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley-India
- 3. Peter O'Neil, Advanced Engineering Mathematics,7th edition, Cengage Learning.
- 4. D.W. Jordan and T.Smith, Mathematical Techniques, Oxford University Press.
- 5. Srimanta Pal, Subodh C.Bhunia, Engineering Mathematics, Oxford University Press.
- 6. Dass H.K., Rajnish Verma. Er., Higher Engineering Mathematics, S. Chand Co. Pvt. Ltd, Delhi.
- 7. T.K.V.Iyengar, B.Krishna Gandhi, S.Ranganathan, M.V.S.S.N.Prasad, Engineering Mathematics (Volume-III), S Chand Publications.