

# 19HS105 ENGINEERING MATHEMATICS I (E)

## LINEAR ALGEBRA & VECTOR CALCULUS

Hours Per Week :

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 2 | 4 |

Total Hours :

| L  | T | P  | WA/RA | SSH/SHS | CS | SA | S | BS |
|----|---|----|-------|---------|----|----|---|----|
| 45 | - | 30 | 20    | 45      |    | 10 | - | 5  |



Source: <https://www.google.co.in/>

### COURSE DESCRIPTION AND OBJECTIVES:

To acquaint students with principles of mathematics through matrices, vector calculus, differential equations that serves as an essential tool in several Engineering applications.

### COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

| COs | Course Outcomes  | POs  |
|-----|--|------|
| 1   | Compute the solutions of differential equations using analytical techniques.                             | 1, 2 |
| 2   | Appreciate the use of Cayley-Hamilton theorem.   | 1, 2 |
| 3   | Perform vector differentiation and integration and applications.   | 1, 2 |
| 4   | Determine rank, Eigen values and Eigen vectors of a matrix and solution of a system of linear equations. | 1, 2 |
| 5   | Use software tools to obtain and verify the solutions  | 5    |

### SKILLS:

- ✓ Find the rank of matrix by different methods.
- ✓ Solve the system of linear equations.
- ✓ Compute Eigen values and Eigen vectors of a matrix.
- ✓ Convert the matrix into diagonal form by suitable method.
- ✓ Compute gradient, divergence and curl.
- ✓ Evaluate surface and volume integrals through vector integral theorems.
- ✓ Solve first order ordinary differential equations by various methods.

**ACTIVITIES:**

- o Compute the rank of the matrix
- o Solve the system of simultaneous equations, Eigen values and Eigen vectors with any software like MATLAB.
- o Compute the power of matrix and inverse of matrix by Cayley – Hamilton Theorem with any software like MATLAB.
- o Evaluate surface and volume integrals through vector integral theorems.
- o Compute exact solutions of first order differential equations by various methods.

**UNIT – I****L–9**

**MATRICES** : Rank of a matrix, Normal form, Triangular form, Echelon form; Consistency of system of linear equations, Gauss-Jordan method, Gauss elimination method, Gauss-Seidel method.

**UNIT – II****L–9**

**EIGEN VALUES AND EIGEN VECTORS** : Eigen values, Eigen vectors, Properties (without proofs); Cayley-Hamilton theorem (without proof), Power of a matrix, Diagonalisation of a matrix.

**UNIT – III****L–9**

**VECTOR DIFFERENTIATION** : Review of Vector Algebra (Not for testing).

Vector function, Differentiation, Scalar and Vector point functions, Gradient, Normal vector, Directional Derivate, Divergence, Curl, Vector identities.

**UNIT – IV****L–9**

**VECTOR INTEGRATION** : Line integral, Surface integral, Volume integral, Vector Integral Theorems : Green's theorem for plane, Gauss divergence theorem, Stokes' theorem (without proofs)

**UNIT – V****L–9**

**FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS** : Basic Definitions, Variable separable and homogeneous differential equations, Linear differential equations, Bernoulli's differential equations, Exact and non-exact differential equations.

**LABORATORY EXPERIMENTS****LIST OF EXPERIMENTS****TOTAL HOURS: 30**

1. Mathematical Preliminaries.
2. Algebra of Matrixes.
3. To find Rank of a Matrix.
4. To find Triangular & Echelon form of a Matrix.
5. Solving system of equations using Cramer's rule.
6. Solving system of equations using Matrix inversion method.
7. Solving system of equations using Gauss-Jordan method, Gauss elimination method.
8. To find Eigenvalues, Eigenvectors of a Matrix.
9. Cayley-Hamilton theorem for a square Matrix.
10. Algebra of Vectors.

**TEXT BOOKS:**

1. H. K. Dass and Er. Rajanish Verma, "Higher Engineering Mathematics", S. Chand & Co., 3<sup>rd</sup> edition, 2015.
2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 44<sup>th</sup> edition, 2018.

**REFERENCE BOOKS:**

1. John Bird, "Higher Engineering Mathematics", Routledge (Taylor & Francis Group), 2018.
2. Srimanta Pal and Subodh C. Bhunia, "Engineering Mathematics", Oxford Publications, 2015.
3. B. V. Ramana, "Advanced Engineering Mathematics", TMH Publishers, 2008.
4. N. P. Bali and K. L. Sai Prasad, "A Textbook of Engineering Mathematics I, II, III", Universal Science Press, 2018.
5. T. K.V. Iyengar et al., "Engineering Mathematics, I, II, III", S. Chand & Co., 2018.