

19HS104 ENGINEERING MATHEMATICS - I(D)

LINEAR ALGEBRA & NUMERICAL METHODS

Hours Per Week :

L	T	P	C
3	1	2	5

Total Hours :

L	T	P	WA/RA	SSH/HSH	CS	SA	S	BS
45	15	30	20	45		10	-	5

COURSE DESCRIPTION AND OBJECTIVES:

To acquaint students with principles of mathematics through matrices, numerical methods, vector calculus 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	Determine rank, Eigen values and Eigen vectors of a matrix and solution of a system of linear equations.	1, 2
2	Appreciate the use of Cayley-Hamilton theorem.	1, 2
3	Demonstrate the techniques of numerical methods.	1, 2
4	Illustrate the concepts of gradient, divergence and curl of a given function.	1, 2
5	Use software tools to obtain and verify the solutions.	5

SKILLS:

- ✓ Find the consistency of System of linear equations with iterative methods.
- ✓ Compute the numerical solutions of differential equations and integrate functions using relevant methods.
- ✓ Determine the divergence, curl, gradient and directional derivative of vector equations.



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ACTIVITIES:

- o Differentiate method to solve the numerical equation.
- o Compute the numerical solutions of differential equations.
- o Compare the solutions of differential equations obtained by different 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-Siedal 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, Inverse of a matrix, Diagonalisation of a matrix.

UNIT – III**L-9****NUMERICAL METHODS – I**

Solutions of Algebraic and Transcendental Equations : Introduction, Bisection method, Regula-Falsi method, Iteration method, Newton-Raphson method.

Numerical integration : Trapezoidal rule, Simpson's 1/3 and 3/8 rules, Boole's rule, Weddle's rule.

UNIT – IV**L-9**

NUMERICAL METHODS – II : Introduction, Finite differences, Forward differences, Backward differences, Differences of a polynomial, Newton's formulae for interpolation, Gauss forward and backward interpolation formulae; Interpolation with unevenly spaced points, Lagrange's interpolation formula.

UNIT – V**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.

LABORATORY EXPERIMENTS

LIST OF EXPERIMENTS

TOTAL HOURS:30

1. Mathematical Preliminaries.
2. Algebra of Matrixs.
3. Determine Rank, Triangular & Echelon form of a matrix.
4. Solving system of equations using Direct Method.
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 Eigen values, Eigen vectors of a Matrix.
9. Cayley-Hamilton Theorem for a square Matrix.
10. Modal Matrix, Diagonalization of a given Matrix.
11. Algebra of Vectors.
12. Gradient, Divergence & Curl of Scalar and Vector functions.

TEXT BOOKS :

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