



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

NUMERICAL COMPUTATION LABORATORY								
III Semester: AE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEEE07	Core	0	0	2	1	40	60	100
Contact Classes: Nil		Tutorial Classes: Nil		Practical Classes: 36		Total Classes: 36		
Prerequisite: Matrices and Calculus & Ordinary Differential Equations and Vector Calculus								

I. COURSE OVERVIEW:

Numerical Methods using MATLAB involves the application of mathematical techniques to solve complex problems through numerical approximation. MATLAB, a powerful programming language and environment, is widely used for implementing and analyzing numerical methods. This approach is essential in fields such as engineering, physics, and finance, where analytical solutions may be challenging or impossible to obtain. The use of MATLAB facilitates efficient algorithm implementation, visualization of results, and quick prototyping of numerical solutions. Students and professionals benefit from learning and utilizing numerical methods in MATLAB to address real-world problems in a computational context.

II. COURSE OBJECTIVES:

The students will try to learn:

- I. The procedures, algorithms, and concepts require to solve specific problems.
- II. The concepts of algebra, calculus and numerical solutions using MATLAB software.
- III. The knowledge in MATLAB and can apply for project works.
- IV. The simple mathematical functions and operations thereon using plots/display.

III. COURSE OUTCOMES:

After successful completion of the course, students will be able to:

- CO1 Understand the numerical methods in MATLAB use for the accurate of solutions to mathematical problems that may lack analytical solutions or have complex expressions.
- CO2 Make use of MATLAB a user-friendly platform for implementing numerical algorithms efficiently, enabling the quick and reliable solution of mathematical problems.
- CO3 Utilize MATLAB's built-in plotting and visualization tools facilitate the interpretation and presentation of numerical results, aiding in a better understanding of the solution behavior.
- CO4 Apply Numerical methods often involve iterative processes, and MATLAB's programming capabilities make it easy to refine and optimize algorithms for improved convergence and accuracy.
- CO5 Make use of MATLAB's matrix-oriented approach is well-suited for handling large datasets, making it advantageous for numerical methods dealing with extensive data or complex systems of equations.
- CO6 Apply Numerical methods in MATLAB find applications in various disciplines, including engineering, physics, finance, and more, providing a versatile toolset for solving diverse computational challenges.

IV. COURSE CONTENT:

EXERCISE -1 BASIC FEATURES

- a) Features and uses.
- b) Local environment setup.

EXERCISE -2 ALGEBRA

- a) Solving basic algebraic equations.
- b) Solving system of equations.
- c) Two dimensional plots.

EXERCISE -3 CONTROL STRUCTURES

- a) For Loop.
- b) While Loop.
- c) If- elseif- else control structure.

EXERCISE -4 MATRICES

- a) Addition, subtraction and multiplication of matrices.
- b) Transpose of a matrix.
- c) Inverse of a matrix.

EXERCISE -5 SYSTEM OF LINEAR EQUATIONS

- a) Rank of a matrix.
- b) Gauss Jordan method.
- c) LU decomposition method.

EXERCISE -6 LINEAR TRANSFORMATION

- a) Characteristic equation.
- b) Eigen values.
- c) Eigen vectors.

EXERCISE -7 DIFFERENTIATION AND INTEGRATION

- a) Higher order differential equations.
- b) Double integrals.
- c) Triple integrals.

EXERCISE -8 NUMERICAL DIFFERENTIATION AND INTEGRATION

- a) Trapezoidal, Simpson's method.
- b) Euler method.
- c) Runge Kutta method

EXERCISE -9 3D PLOTTING

- a) Line plotting.
- b) Surface plotting.
- c) Volume plotting.

EXERCISE -10 DEFLECTION OF SIMPLY SUPPORTED BEAM

- a) Calculating vertical displacement with point load.
- b) Calculating vertical displacement with uniformly distributed load.
- c) Calculating vertical displacement with uniformly varying load.

EXERCISE -11 DEFLECTION OF CANTILEVER BEAM

- a) Calculating vertical displacement with point load.
- b) Calculating vertical displacement with uniformly distributed load.
- c) Calculating vertical displacement with uniformly varying load

Exercise -12 FORMULATION OF IDEAL AND REAL GAS EQUATIONS

- a) Calculating the pressure, temperature, density for Earth's atmospheric conditions at different altitudes.
- b) Calculating the pressure, temperature, density for other planets at different altitudes.

Exercise -13 SHEAR FORCE AND BENDING MOMENT DIAGRAMS- CANTILEVER BEAM

- a) Calculating shear force and bending moment for point load.
- b) Calculating shear force and bending moment for uniformly distributed load.
- c) Calculating shear force and bending moment for uniformly varying load

Exercise -14 SHEAR FORCE AND BENDING MOMENT DIAGRAMS- OVER HANGING BEAM

- a) Calculating shear force and bending moment for point load.
- b) Calculating shear force and bending moment for uniformly distributed load.
- c) Calculating shear force and bending moment for uniformly varying load calculating vertical displacement with uniformly distributed load.

V. TEXT BOOKS:

1. Cleve Moler, "Numerical Computing with MATLAB", SIAM, Philadelphia, 2nd edition, 2008.

VI. REFERENCE BOOKS:

1. Dean G. Duffy, "Advanced Engineering Mathematics with MATLAB", CRC Press, Taylor & Francis Group, 6th edition, 2015.
2. Delores M. Etter, David C. Kuncicky, Holly Moore, "Introduction to MATLAB 7", Pearson Education Inc, 1st edition, 2009.
3. Rao. V. Dukkipati, "MATLAB for ME Engineers", New Age Science, 1st edition, 2008.

VII. ELECTRONICS RESOURCES:

1. <http://www.tutorialspoint.com/matlab>

VIII. MATERIALS ONLINE

1. Course Outline Description
2. Lab manual