COURSECONTENT

NUMERICAL ANALYSIS LABORATORY								
II Semester: SE								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
2522073	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		0	1	2	2	40	60	100
Contact Classes: Nil	**Tutorial Classes: 15**	**Practical Classes: 30**				**TotalClasses:45**		
Prerequisites: NIL								

Course Overview:

This course provides practical exposure to numerical methods and their implementation using MATLAB for solving engineering problems. It covers matrix operations, solution of linear and non-linear equations, and numerical techniques such as Gauss elimination, Gauss-Seidel, and Newton-Raphson methods. The course emphasizes applications in structural analysis, including beams, frames, and multistory buildings. Students will also learn eigenvalue analysis, numerical integration, and solving differential equations. Additionally, it develops skills in data visualization through 2D and 3D plotting.

Course Objectives:

1. To develop proficiency in using MATLAB for matrix operations and solving systems of linear and nonlinear equations related to structural engineering problems.
2. To apply numerical methods such as Gauss elimination, Gauss–Seidel iteration, and Newton–Raphson for analysis of determinate and indeterminate structures.
3. To compute eigenvalues and eigenvectors for dynamic analysis of multistory buildings, including determination of time periods and mode shapes.
4. To perform numerical integration and differential equation solving using tools like trapezoidal rule, Simpson's rule, and Runge – Kutta methods for engineering applications.
5. To visualize engineering data and results through basic 2D and 3D plotting techniques in MATLAB.

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

1. Perform basic matrix operations and implement numerical techniques using MATLAB for solving engineering problems.
2. Analyze structural systems using methods for solving linear equations like Gauss Elimination, Gauss-Seidel, and Gauss-Jordan.
3. Analyze structural systems using methods for solving linear equations like Gauss Elimination, Gauss-Seidel, and Gauss-Jordan.
4. Apply curve fitting and numerical integration techniques to model data and compute areas or volumes.
5. Implement numerical methods for solving ordinary differential equations such as Euler's and Runge-Kutta methods.

List of Experiments:

1. Overview of MATLAB, Matrix operations (Addition, Subtraction, Multiplication, Transpose)
2. Solution of simultaneous equations using matrix inversion – Resolution of forces and moments and finding the reactions on a beam.
3. Solution of system of linear equations using Gauss Elimination method – Application to the analysis of indeterminate beams.
4. Solution of system of linear equations using Gauss Seidel iteration Method – Application to the analysis of portal frames.
5. Finding the roots of non-linear equations using Newton–Raphson Method – Application for finding the slopes and deflections in indeterminate beams.
6. Solve the system of linear equations using Gauss-Jordan Method.
7. Finding the solution of an Eigen value problem – Application to a multistory RC building for determining the time periods and mode shapes.
8. Numerical Integration using Trapezoidal & Simpson's Rule – Application for finding the areas and volumes of a given plot.
9. Numerical solution of second and higher order differential equations.
10. Plotting simple graphs, basic 2D plots, and 3D plots.

REFERENCESES:

1. Bansal & Goel – *MATLAB and Its Applications in Engineering*

MATERIALS ON LINE:

1. Virtual labs
2. Content beyond syllabus