

COURSE CODE	COURSE TITLE	L	T	P	C
1151AE213	NUMERICAL METHODS USING MATLAB	2	0	2	3

Course Category:

Programme core

a. Preamble:

The course focuses on some of the most important numerical methods to solve Aerospace engineering. The numerical software package MATLAB is introduced and used throughout the course.

b. Prerequisite Courses:

- Transforms and Partial differential equations

c. Related Courses:

- Finite element methods
- Approximate Methods in Structural Mechanics
- Computational fluid dynamics

d. Course Educational Objectives:

- To develop the mathematical skills of the students in the area of numerical methods.
- To teach theory and applications of numerical methods in a large number of engineering subjects which require solutions of linear systems, finding eigenvalues, eigenvectors, interpolation and applications, solving ODEs, PDEs and dealing with statistical problems like testing of hypotheses

e. Course Outcomes:

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

CO Nos.	Course Outcomes	Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	Apply numerical methods to solve algebraic equations using different methods under different conditions, and to analyze the numerical solution of system of algebraic equations.	K3
CO2	Apply various interpolation methods and finite difference concepts.	K3
CO3	Work out numerical differentiation and integration whenever and wherever routine methods are not applicable.	K4
CO4	Work numerically on the ordinary differential equations using different methods through the theory of finite differences	K3
CO5	Work numerically on the partial differential equations using different methods through the theory of finite differences	K3

f. Correlation of COs with POs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H			H			H	H	L	M		
CO2	H			H			H	H	L	M		
CO3	H			H			H	H	L	M		
CO4	H			H			H	H	L	M		
CO5	H			H			H	H	L	M		

H- High; M-Medium; L-Low

g. Course Contents:

UNIT-I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS L-6 P-6

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method- Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Matrix Inversion by Gauss Jordan method - Eigenvalues of a matrix by Power method. MATLAB based problems

UNIT-II INTERPOLATION AND APPROXIMATION L-6 P-6

Interpolation with unequal intervals - Lagrange's interpolation – Newton's divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton's forward and backward difference formulae. MATLAB based problems

UNIT-III NUMERICAL DIFFERENTIATION AND INTEGRATION L-6 P-6

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 rule – Romberg's method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules. MATLAB based problems

UNIT-IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS L-6 P-6

Single Step methods - Taylor's series method - Euler's method - Modified Euler's method –Fourth order Runge-Kutta method for solving first order equations - Multi step methods - Milne's and Adams-Bashforth predictor corrector methods for solving first order equations. MATLAB based problems

UNIT-V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS L-6 P-6

Finite difference methods for solving two-point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods –One dimensional wave equation by explicit method. MATLAB based problems

Total Periods: 30 + 30 = 60

h. Learning Resources

i. Text Books:

1. Grewal. B.S., and Grewal. J.S., " Numerical methods in Engineering and Science", Khanna Publishers, New Delhi, 9th Edition, 2007
2. Chapra. S.C., and Canale.R.P., "Numerical Methods for Engineers, 5th Edition, Tata McGraw - Hill, New Delhi, 2007

ii. Reference Books:

1. Brian Bradie. "A friendly introduction to Numerical analysis", Pearson Education, Asia, New Delhi, 2007.
2. Sankara Rao. K., "Numerical methods for Scientists and Engineers", 3rd Edition, Prentice Hall of India Private Ltd., New Delhi, 2007.