MANGALORE UNIVERSITY

DEPARTMENT OF MATHEMATICS

MSC MATHEMATICS

MTS 505	Advanced Numerical Analysis	4 Credits (48 hours)

Prerequisite: Knowledge of syllabus prescribed for the course MTS 404 (Numerical Analysis).

Course Outcome: Students will have the knowledge and skills of Numerical Integration, Numerical solutions of Ordinary Differential Equations, Solving systems of Linear Differential Equations.

Course Specific Outcome: At the end of the course Students will have the knowledge and skills to understand, explain in depth and apply in various situations the concepts -

- To use different quadrature rules for computing the approximate value of definite integrals
- To use different numerical techniques to solve ordinary differential equations with initial and boundary conditions.
- To use different methods to find numerical solution of second order partial differential equations.

Unit I - Numerical Integration:

Recapitulation of the methods based on interpolation, Methods based on undetermined coefficients. Romberg integration, Gauss-Legendre integration methods, Gauss-Chebyshev integration methods, Gauss-Laguerre integration methods, Gauss-Hermite integrationmethods. Double integration, Trapezoidal rule, Simpson's rule.

(15 Hours)

Unit II - Ordinary Differential Equations:

Introduction, Numerical methods, Euler method, Backward Euler method, Mid-point method, Single step methods, Taylor series method, Runge-Kutta methods, Multistep methods, Determination of a_j and b_j, Predictor-corrector methods, Boundary value problems, Finite difference methods, Trapezoidal, Dahlquist and Numerov methods.

(15 Hours)

Unit III - Systems of Linear Differential Equations:

Introduction, Difference methods, Parabolic equations in one space dimension, Schmidt formula, Du Fort-Frankel scheme, Crank-Nicolson and Crandall schemes, Solution of hyperbolic equation in one dimension by explicit schemes, The CFL condition, Elliptic equations, Dirichlet problem,Neumann problem, Mixed problem.

(18 Hours)

References

[1] M. K. Jain, S. R. K. Iyengar, P. K. Jain, *Numerical Methods for Scientific and Engineering Computation*, 6th Ed., New Age International, 2012.

[2] C. F. Gerald and P. O. Wheatly, *Applied Numerical Analysis*, Pearson Education, Inc., 1999.

[3] M. K. Jain, *Numerical Solution of Differential Equations*, 2nd Ed., New Age International (P) Ltd., New Delhi, 1984.

A. R. Mitchell, *Computational Methods in Partial Differential Equations*, John Wiley and Sons, Inc., 1969.