MANGALORE UNIVERSITY

DEPARTMENT OF MATHEMATICS

MSC MATHEMATICS

MTS 404	Numerical Analysis	4 Credits (48 hours)

Prerequisite: Knowledge of Mathematics at Under-Graduate Level.

Course Outcome: Students will have the knowledge and skills to explain the fundamental concepts ofNumerical analysis, area of mathematics and computer science that creates, analyzes, and implements algorithms for obtaining numerical solutions to problems involving continuous variables. Such problems arise throughout the natural sciences, social sciences, engineering, medicine and business.

Course Specific Outcome: At the end of the course students will have the knowledge and skills

- Obtain the solutions of Transcendental and Polynomial Equations.
- Solve by Direct methods and Iteration methods for solving system of equations.
- Apply Hermite Interpolation
- Solve problems using interpolation.
- Solve Ordinary Differential Equations using Numerical methods.

Unit I - Transcendental and Polynomial Equations:

Introduction, The bisection method, Iteration methods based on first degree equation, Iteration methods based on second degree equation, Rate of convergence, Rate of convergence of Secant and Newton-Raphson method. Iteration methods - First order method, Second order method, Higher order methods. Polynomial equations, Descartes' Rule of Signs, The Birge-Vieta method.

(12 Hours)

Unit II - System of Linear Equations and Eigenvalue problems: Introduction, Direct methods –Gauss elimination method, Gauss-Jordan method, Triangularization method, Cholesky method. Iteration methods - Jacobi iteration method, Gauss-Seidel iteration

method, Convergence analysis, Eigenvalues and eigenvectors. The power method.

(12 Hours)

Unit III - Interpolation and Approximation:

Introduction, Lagrange and Newton interpolations, Linear and Higher order interpolation, Finite difference operators, Interpolating polynomials using finite differences, Hermiteinterpolation, Approximations.

(12 Hours)

Unit IV

Numerical Differentiation: Introduction, Methods based on Interpolation, Methods based on finite differences, Methods based on undetermined coeffcients, Extrapolation methods. Numerical Integration: Methods based on Interpolation, Newton-Cotes methods, Composite Integration Methods.

(12 Hours)

References

[1] M. K. Jain, S. R. K. Iyengar, R. K. *Jain, Numerical Methods for Scientifc 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] A. Ralston and P. Rabinowitz, *A First Course in Numerical Analysis*, 2nd Ed., McGraw - Hill, New York, 1978.

[4] K. Atkinson, *Elementary Numerical Analysis*, 2nd Ed., John Wiley and Sons, Inc., 1994.

[5] P. Henrici, *Elements of Numerical Analysis*, John Wiley and Sons, Inc., New York, 1964.