

**QUAID-E-AWAM UNIVERSITY OF ENGINEERING, SCIENCE AND
TECHNOLOGY, NAWABSHAH**



DEPARTMENT OF MATHEMATICS AND STATISTICS

Title of Subject	: Numerical Analysis-I
Course Code	: MATH 303
Discipline	: First Semester Third Year
Effective	: 2017 Batch and onwards
Credit Hours	: 03 + 01
Minimum Contact Hours:	42
Total Marks	: 100 + 50

Prerequisites: Calculus I, Linear Algebra

Specific Objectives of course: This course is designed to teach the students about numerical methods and their theoretical bases. The course aims at inculcating in the students the skill to apply various techniques in the numerical analysis, understand the calculations about errors that can occur in the numerical methods moreover to understand and be able to use the basics of matrix analysis.

Course Outline:

Error analysis: Floating point arithmetic, approximations and errors.

Methods for the solution of nonlinear equations:

Bisection method, regula-falsi method, fixed point iteration method, Newton-Raphson method, secant method. The error analysis for the iterative methods and their applications.

Interpolation and polynomial approximation:

Lagrange interpolation, Newton's divided difference formula, forward, backward and centered difference formulae, interpolation with a cubic spline, Hermite interpolation, least squares approximation.

Numerical differentiation: Forward, backward and central difference formulae, Richardson's extrapolation.

Numerical integration: Rectangular rule, trapezoidal rule, Simpson's 1/3 and 3/8 rules, Boole's and Weddle's rules, Newton-Cotes formulae, Gaussian quadrature.

Numerical solution of a system of linear equations: Direct methods: Gaussian elimination method, Gauss-Jordan method; matrix inversion; LU-factorization; Doolittle's,

Crout's and Cholesky's methods, Iterative methods: Jacobi, Gauss-Seidel and SOR. The use of software packages/programming languages for above mentioned topics is recommended.

Recommended Books (Latest Editions):

1. C.F. Gerald and P.O. Wheatley, Applied Numerical Analysis, Pearson Education, Singapore.
2. R. L. Burden and J. D. Faires: Numerical Analysis, latest edition, PWS Pub. Co.
3. J.H. Mathews, Numerical Methods for Mathematics, latest Edition, Prentice Hall International.
4. S. C. Chapra and R. P. Canale: Numerical Methods for Engineers, 6th edition, McGraw Hill.
5. W. E. Boyce, R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, John Wiley & Sons, Inc.
6. L. Debnath, Nonlinear Partial Differential Equations for Scientists and Engineers, Birkhauser-Boston.
7. Alexander Komech, Andrew Komech, Principles of Partial Differential Equations, Springer-New York.
8. H. Richard, Elementary Applied Partial Differential Equations, Prentice-Hall International, Inc., London .
9. Weinberger, Hans F., A First Course in Partial Differential Equations with Complex Variables and Transform Methods, Dover Publications, Inc.
10. R. Kent Nagle, Edward B. Saff, Arthur David Snider, Fundamentals of Differential Equations, Addison Wesley Longman, Inc.