DEPARTMENT OF MATHEMATICS,

UNIVERSITY OF KARACHI,

Course Outline

MATH 505: NUMERICAL ANALYSIS – I   (2 + 1)

Course contents:

Errors Analysis: relative and absolute errors, percentage error, propagation. Root Finding Methods: Non-linear equations in one unknown; Newton's method, Secant method, Bisection method, Fixed Point Iteration method, Regula-False Method. Polynomial Equations; Quotient Difference algorithm, Horner's method Bairstow's method. Systems of Equations: Linear Systems; Gaussian Elimination, Gauss-Jacobi and Gauss-Seidel iterative methods for diagonally dominant systems. III conditioned systems, Norms, condition numbers and errors in solution. Newton's method for systems of Non-Linear equations. Interpolation and Curve fitting: Development of polynomials for a given set of points. Lagrange polynomials, Newton's Divided Difference Interpolation Polynomial for unevenly spaced data, Newton's Forward Difference Interpolating Polynomial for evenly space data. Algorithm for developing a Cubic Spline. Least Square Approximations for fitting first, second and nth degree polynomials for a given set of data. Introduction to Bezier Curves and B-Spline Curves. Numerical Differentiation: Differentiation using divided difference and forward difference Tables. Higher order derivatives, central difference formulas for derivatives of different order. Numerical Integration: Newton-Cotes techniques for Numerical Integration and its use for developing Trapezoidal Rule, Simpson's 1/3 and 3/8 rules. Gaussian Quadrature and Adaptive Integration.

Books Recommended:

1. Allen, III, M .B. and Isaacson, E. L., Numerical Analysis for Applied Sciences (Pure and Applied Mathematics A. Willy-interscience series texts), John Wiley and Sons Inc. N.Y. 1998
2. Jain, M. K., Iyengar, S. R. K. and Jain R. K., Computational methods for Partial Differential Equations. Wiley Eastern Limited, New Delhi, 1991.
3. Jain, M. K., Iyengar, S. R. K. and Jain, R. K.: Numerical Methods for Scientific and Engineering Computations. Wiley Eastern Limited, New Delhi, 1991.
4. Atkinson, K. E., An Introduction to Numerical Analysis, John Wiley and Sons, N.Y., 1989.
5. Hager, W. W., Applied Numerical Linear Algebra, Prentice Hall International Inc. Toronto, Canada, 1995.

6. Chapra, S. C. and Canale, R. P., Numerical Methods for Engineers, Mc Graw Hill Book Co. Toronto, 2000.
7. Mathews, J. H. Numerical Methods for Mathematics, Science and Engineering, Pentice Hall International Inc, N.J., 1984.
8. Gerald, C. F. and Patric, O.W., Applied Numerical Analysis, Addison Wesley Pub. Com., 1984.
9. King, J. T., Introduction to Numerical Computation, Mc Graw Hill, N. Y., 1984.
10. Vendergraft, J. S., Introduction to Numerical Computation, Academic Press, New York, 1983.
11. Sharma, J. N., Numerical Methods for Engineers and Scientists, Second Edition, Narosa Publishing House, New Delhi, 2007.
12. Jain, R. K. and Iyengar, S.R.K., Advanced Engineering Mathematics, Third Edition, Narosa Publishing House, New Delhi, 2007.
13. Griffiths, D. V. and Smith, I. M., Numerical Methods for Engineers, Second Edition, Chapman and Hall/CRC, New York, 2006.
14. Chapra, S. C., Applied Numerical Method, with MATLAB: For Engineers and Scientist, Second Edition, Tufts University, McGraw Hill, 2007.
15. Karris S. T., Numerical Analysis using MATLAB and Excel, Third Edition, Orchant Pub., 2007.
16. Patil P. B., and Verma U. P., Numerical Computational Methods, Narosa Publication House, 2006.