ME 501 Advanced Engineering Mathematics (3-0-2-8)

Vector and Tensor Analysis in Cartesian system, effect of rotation of coordinate systems. Review of ODEs; Laplace & Fourier methods, series solutions, and orthogonal polynomials. Sturm-Liouville problem. Review of 1st and 2nd order PDEs. Linear systems of algebraic equations. Gauss elimination, LU decomposition etc., Matrix inversion, ill-conditioned systems. Numerical eigen solution techniques (Power, Householder, QR methods etc.). Numerical solution of systems of nonlinear algebraic equations; Newton-Raphson method. Numerical integration: Newton-Cotes methods, error estimates, Gaussian quadrature. Numerical solution of ODEs: Euler, Adams, Runge-Kutta methods, and predictor-corrector procedures; stability of solutions; solution of stiff equations. Solution of PDEs: finite difference techniques. Probability and Statistics – Probability Distribution, Bays Theorem, Parameter Estimation, Testing of Hypothesis, Goodness of Fit. Laboratory: Basics of programming. Numerical experiments with the algorithms covered in class.

Texts/References:

[1] E. Kreyzig, Advanced Engineering Mathematics, New Age International, 1996.

[2] D. S. Watkins, Fundamentals of Matrix Computations, John Wiley, 1992.

[3] M. K. Jain, S. R. K. Iyengar, and R. K. Jain, Numerical Methods for Scientific and Engineering Computation, 3rd Ed., New Age International, 1993

[4] D.S. Chandrashekaraiah and L. Debnath, Continuum Mechanics, Academic Press, 1994.

[5] M.K. Jain, S.R.K. Iyenger and R.K. Jain, Computational Methods for Partial Differential Equations, New Age International, 1994

[6] R. Courant and D. Hilbert, Methods of Mathematical Physics, Wiley, 1989.

[7] P.V. O'Neil, Advanced Engineering Mathematics, Cengage Learning, 2007

[8] G. B. Arfken, H. J. Weber and F.Harris, Mathematical Methods for Physicists, 5th Ed., Academic Press,