


NUMERICAL METHODS

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INTENDED AUDIENCE: UG students of technical universities/colleges.

INDUSTRY SUPPORT: TCS, Intel, General Electric, General Motors, ABB, Nuclear Industries, etc.

COURSE OUTLINE :

This course is a basic course offered to UG student of Engineering/Science background. It contains solution of system of linear equations, roots of non-linear equations, interpolation, numerical differentiation and integration. It plays an important role for solving various engineering sciences problems. Therefore, it has tremendous applications in diverse fields in engineering sciences.

ABOUT INSTRUCTOR :

Prof. Ameeya Kumar Nayak is Associate Professor in Department of Mathematics at IIT Roorkee and actively involved in teaching and research in the direction of numerical modeling of fluid flow problems for last ten years. His research interests are in the fundamental understanding of species transport in macro and micro-scale confinements with applications in biomedical devices and micro electro mechanical systems. He has authored and co-authored more than 32 peer-reviewed journal papers, which includes publications in Springer,ASME, American Chemical Society and Elsevier journals. He is also active in writing book chapter with reputed international publication house.

Prof. Sanjeev Kumar is working as an associate professor with Department of Mathematics, IIT Roorkee. Earlier, he worked as a postdoctoral fellow with Department of Mathematics and Computer Science, University of Udine, Italy and assistant professor with IIT Roorkee. He is actively involved in teaching and research in the area of computational algorithms, inverse problems and image processing. He has published more than 55 papers in various international journals conferences of repute. He has completed a couple of sponsored research projects and written several chapters in reputed books published with Springer and CRC press.

COURSE PLAN :

Week 01 : Introduction to significant digits and errors, Solution of system of linear Equations (direct methods, Iterative methods, Ill-conditioned systems)

Week 02 : Roots of Nonlinear Equations (Bisection method, Regula-Falsi method, Newton-Raphson method, Fixed point iteration method, convergence criteria)

Week 03 : Eigenvalues and Eigenvectors, Gerschgorin circle theorem , Jacobi method, Power methods

Week 04 : Interpolation (Finite difference operators, difference tables, Newton's Forward/Backward difference)

Week 05 : Interpolation (Central difference formula's i.e. Bessel and Stirling's interpolation formulae, Divided differences, Lagrange interpolation and Newton's divided difference interpolation)

Week 06 : Numerical Differentiation (Using Forward/ Backward/central difference formula)

Week 07 : Integration (Trapezoidal and Simpson's rules for integration)

Week 08 : Solution of first order and second order ordinary differential equations (Euler method, Euler modified method, Runge-Kutta methods, Milne PC method)