APPLIED NUMERICAL METHODS

PROF. MALAY K. DAS
Department of Mechanical Engineering
IIT Kanpur

INTENDED AUDIENCE: 3rd, 4th year UG students and PG students in any branch of engineering

PREREQUISITES: Undergraduate engineering mathematics Knowledge of a programming language (preferable)

INDUSTRY SUPPORT: BARC, DRDO, GE, ANSYS, CSIR laboratories

COURSE OUTLINE:
Objective: - To approximately solve problems of algebra and calculus, using repetitive calculations, implemented in a computer
Learning Outcome: At the end of the course the students should be able to
- write the algorithms for numerical solution of basic problems of algebra and calculus, such as solution of algebraic and differential equations, optimization using gradient descent, prediction using regression,
- implement the above algorithms in a computer writing their own programs from scratch,
- write the limitations of the above algorithms, and
- solve complex problems combining multiple algorithms.

ABOUT INSTRCTOR:
Prof.Malay K. Das is a professor in the Department of Mechanical Engineering at the Indian Institute of Technology Kanpur. He has completed his PhD in Mechanical Engineering from Pennsylvania State University, USA. He has also worked in thermal power industry for ten years. His research interests include computational and experimental thermo-fluid sciences covering multiphase reacting system.

COURSE PLAN:

Week 1: Course introduction, algorithm development, root finding, role/examples of numerical methods in practical problem solving

Week 2: Minimalistic introduction to computer programming

Week 3: System of linear/non-linear Equations

Week 4: Eigenvalue problem

Week 5: Interpolation, finite difference, numerical differentiation

Week 6: Numerical integration, Ordinary differential equations

Week 7: Ordinary differential equations

Week 8: Partial differential equations

Week 9: Case studies: modeling, nondimensionalization, solution, validation

Week 10: Regression and related techniques

Week 11: Optimization methods, gradient descent

Week 12: Artificial neural network