

## Schedule

Lectures – MWF 11:00 to 11:50 am; L-18    Tutorials – Th 11-11:50 am (Room mentioned below)

## Instructor

Rajesh Srivastava, Department of Civil Engineering    Office: FB 318, Tel.: 7755 (e-mail: rajeshs)

## Tutors

Section 1, L2: Dr. Sanjeev Garg, Department of Chemical Engineering, Tel.: 7736 (sgarg)  
Section 2, L5: Dr. Indranil Saha Dalal, Department of Chemical Engineering, Tel.: 6072 (indrasd)  
Section 3, L6: Dr. Vishal Agarwal, Department of Chemical Engineering, Tel.: 6895 (vagarwal)  
Section 4, L8: Dr. Anubha Goel, Department of Civil Engineering, Tel.: 7027 (anubha)  
Section 5, L10: Dr. S N Tripathi, Department of Civil Engineering, Tel.: 7845 (snt)  
Section 6, L13: Dr. P S Ghoshdastidar, Department of Mechanical Engineering, Tel.: 7019 (psg)  
Section 7, T201: Ms. Garima Mishra, Roll No. 14202262, Department of Chemical Engineering (mishrag)  
Section 8, T203: Mr. Suman Roy, Roll No. 13103172, Department of Civil Engineering (sumanroy)  
Section 9, WL226: Mr. Abhijeet Swain, Roll No. 13103161, Department of Civil Engineering (abswain)

## Text Book

Guha, S. and Srivastava, R. (2010). Numerical Method for Engineering and Science, 1st Edition, Oxford University Press.

Corrections to the 1st Edition at: <http://home.iitk.ac.in/~rajeshs/ErrorsInFirstEditionNM.pdf>

## Reference Books

Chapra, S. C., and Canale, R. P. (2012). Numerical Methods for Engineers, 6<sup>th</sup> Edition, McGraw-Hill Education (India).

Atkinson, K. E. (2008). An Introduction to Numerical Analysis, 2<sup>nd</sup> Edition, John Wiley & Sons.

## Course Website

<http://home.iitk.ac.in/~rajeshs/ESO208>

## Course Outline

**Introduction:** Engineering problems and computational methods

**Error Analysis:** Round-off and Truncation errors; Backward and Forward error analysis

**Roots of Nonlinear Equations:** Bisection method, **Method of False Position**, Secant method, **fixed-point method**, Newton-Raphson method, **Muller and Bairstow methods**; Roots of system of non-linear equations

**Solution of System of Linear Equations:** Direct methods (Gauss Elimination, Gauss-Jordan, LU decomposition, **Choleski decomposition**, Thomas Algorithm); Iterative methods (**Gauss-Jacobi**, Gauss-Seidel)

**Approximation of functions:** Approximation using polynomials (Least squares estimation, orthogonal basis functions); Interpolation (Newton's divided difference and Lagrange interpolating polynomials, Spline interpolation); Regression

**Eigen values and Eigen vectors:** Power and inverse power methods, and QR decomposition

**Numerical Integration and Differentiation:** Newton-Cotes integration formula, Romberg integration and Gauss-Legendre quadrature; Finite difference approximation, Richardson's extrapolation

**Ordinary Differential Equations (Initial Value Problems):** Euler's method, Multi-step methods, Runge-Kutta methods, System of IVPs, Stiff problems and Gear's method

**Ordinary Differential Equations (Boundary Value Problems):** Shooting and direct methods

**Partial Differential Equations:** Introduction to solution of PDEs, Parabolic (diffusion equation and advection-diffusion equation), Elliptic (Laplace equation) and Hyperbolic (Wave equation) equations

**Weightage:**

Final Exam	45%
Mid Semester Exam	30%
Quiz (2 No.)	15%
Programming Assignment	10%
Tutorial	5% (bonus)

**Notes:**

1. Bring calculators in all tutorial classes.
2. Quizzes are scheduled for Saturdays, Aug. 26 and Oct. 21.
3. Programmable calculators are NOT allowed in Quizzes and Exams.
4. No books/notes/formula sheets allowed in Quizzes and Exams. The paper will provide formulae, some of which would be useful in answering the questions.