

Course No.: ENR 172  
 Course title: **Applied numerical methods (thru MATLAB)**  
 Number of credits: 4 (3-1-0)  
 Number of lectures-tutorial-practical: 42-14-0  
 Course coordinator: Dr Priyanka Kaushal

### Course outline

The course is aimed to provide elementary knowledge of numerical methods and statistical techniques and enable students to apply various tools and techniques to solve problems in engineering and science.

### Evaluation procedure

- Two Minor tests: 30%
- Assignments/Tutorials: 20%
- Major test: 50%

### Details of course contents and allotted time

Unit	Topic	Lecture (hours)	Tutorial (hours)
1	Introduction Mathematical modelling, modelling approaches: deterministic – analytical (closed-form) and numerical; and stochastic.	1	
2	High speed computing and error analysis Computer arithmetic, Errors: significant figures, accuracy and precision, round-off errors, truncation errors, Taylor series, error propagation, total numerical error, blunders, formulation errors and data uncertainty.	2	
3	Roots Bracketing methods and open methods, roots of polynomials	4	2
4	Linear algebraic equations and matrices Gauss elimination, LU-factorization, matrix inverse and condition, iterative methods, eigen value problems	7	2
5	Interpolation Polynomial, spline and piecewise interpolation	4	2
6	Numerical differentiation and integration Numerical differentiation: high-accuracy differentiation formulas, derivatives of unequally spaced data, derivatives for data with errors, partial derivatives Numerical integration: numerical integration formulas, numerical integration of functions, integrals for data with errors	10	4
7	Ordinary differential equations Initial-value problems, adaptive methods and stiff systems, boundary-value problems	8	2

8	Partial differential equations Finite difference: elliptic and parabolic equations,	6	2
	<b>Total</b>	<b>42</b>	<b>14</b>

The course is reviewed by the following experts.

Dr Neela Natraj, Associate Professor, Department of Mathematics, Indian Institute of Technology, Bombay.

Dr Pravin Chandra, Reader, School of Information Technology, GGS Indraprastha University, Delhi.

### **Suggested readings**

1. Chapra, S.C. (2007). *Applied Numerical Methods with MATLAB*. Tata McGraw Hill, New Delhi.
2. Chapra, S.C. and Canale, R.P. (2007). *Numerical methods for Engineers*. Tata McGraw Hill, New Delhi.
3. Jain, M.K., Iyenger, S.R.K. and Jian, R.K. (2008). *Numerical Methods for Scientific and Engineering Computation*. New Age International ltd, New Delhi.
4. Kreyszig, E. (1999). *Advanced Engineering Mathematics*. John Wiley & Sons, Inc, India