College of Engineering Pune
(An Autonomous Institute of Government of Maharashtra, Pune-411005)
Department of Mathematics
Computational Methods in Engineering
(MAT-15001, IPI-15001, CGE-15001)

F.Y. M. Tech. Semester I

(Automotive (Mech),Geotech (Civil),Process instrumentation (Instru.))

Teaching Scheme	Examination Scheme
Lectures : 3 hrs / week	Internal Test 1: 20 marks
Tutorial : 1 hr / week	Internal Test 2: 20 marks
	End Sem. Exam: 60 marks

Unit I : Roots of Equations

Bracketing methods, open methods and case studies. **[06 Hrs]**

Unit II : Linear Algebraic Equations

Gauss Elimination, LU decomposition and matrix inversion, special matrices and Gauss-Seidel method, case studies. **[08 Hrs]**

Unit III : Numerical Differentiation and Integration

Newton-Cotes integration formulas, integration of equations, numerical differentiation, case studies. **[08 Hrs]**

Unit IV : Ordinary Differential Equations

Runge-Kutta methods, stiffness and multistep methods, boundary value and eigen value problems, case studies. **[09 Hrs]**

Unit V : Partial Differential Equations

Finite difference methods for elliptic and parabolic equations, case studies. **[09 Hrs]**

Text Book :

- Numerical Methods for Engineers by Steven C. Chapra, Raymond P. Canale, McGraw-Hill (special Indian edition), 5th edition 2010.

Reference Books :

- Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, Inc., 8th edition 2010.
- Higher Engineering Mathematics by H K Dass, S Chand & Co. Ltd.,15th edition 2006.
- Higher Engineering Mathematics by Dr B S Grewal, Khanna Publication, 40th edition 2007.
- Introductory methods in Numerical Analysis by S S Sastry,PHI,Latest Edition.
- Applied Numerical Methods using MATLAB for Engineers and Scientists by Steven C. Chapra McGraw-Hill (Indian edition), 3rd edition 2012.
- Computed Oriented Numerical Methods, (5th edition) by R.S. Salaria, Khanna Publishing Company Private Limited, New Delhi.

Outcomes : Students will be able to

1. **know** and **recall** the core knowledge of computational methods.
2. **understand** the concept of roots of equations, linear algebraic equations, numerical differentiation and integration.
3. **diagnose** a problem and **apply** the appropriate concepts to solve differential equations.
4. **outline** proofs, **give reasoning** to topics such as roots of equations, linear algebraic equations, numerical differentiation and integration.
5. **apply** core concepts to new application oriented Engineering problems in different fields.

Note 1 :

- To measure CO1, questions may be of the type- define, identify, state, match, list, name etc.

- To measure CO2, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.
- To measure CO3, questions will be based on applications of core concepts.
- To measure CO4, questions may be of the type- true/false with justification, theoretical fill in the blanks, theoretical problems, prove implications or corollaries of theorems, etc.
- To measure CO5, some questions may be based on self-study topics and also comprehension of unseen passages.

Note 2 :

All the Course outcomes 1 to 3 will be judged by 75% of the questions and outcomes 4 and 5 will be judged by 25 % of questions.