College of Engineering Pune
(An Autonomous Institute of Government of Maharashtra, Pune-411005)
Department of Mathematics
(AS-09004) Numerical Methods with C / C++
T.Y. B.Tech. Semester VI (Production)

Teaching Scheme
Lecture : 1 hr / week
Lab : 2 hrs / week

Examination Scheme
Internal Test 1: 20 marks
Internal Test 2: 20 marks
Term Work: 30 marks
ESE Pract./Oral: 30 marks

Unit I : Numerical integration: Trapezoidal Rule, Simpson $1/3^{rd}$ and $3/8^{th}$ Rule, Weddle's Rule, Gauss Quadrature - Two and Three Point Formula, Double Integration, Applications. Curve Fitting: least square criteria- 1^{st} and 2^{nd} Degree, Applications. **[04 Hrs]**

Unit II : Numerical Solution of Ordinary Differential Equation: Taylor Series Method, Euler Method, Modified Euler Method, Runge Kutta 2^{nd} and 4^{th} order method, Simultaneous Differential Equations and Second Order Differential Equations, Applications. **[03 Hrs]**

Unit III : Interpolation: Langrange's Interpolation, Newton's forward, backward and central difference method, divided difference method, Inverse Interpolation, Applications. Numerical Differentiation: Forward, Backward and Central Difference Methods, Applications. **[03 Hrs]**

Unit IV : Numerical Solution of Algebraic and Transcendental equations: Bisection Method, Secant Method, Regula-Falsi Method, Newton-Raphson Method, Successive Approximation Method, Applications. Solution of linear simultaneous equations: Homogeneous/Non-homogeneous systems, Gauss Elimination, Gauss Jordon, Gauss-Seidel Methods, LU-Decomposition, Cholesky Method, Applications. **[04 Hrs]**

Lab Sessions : **[26 Hrs]**

The term work shall consist of record of following exercises using C/C++ language.

- Numerical integration
- Curve Fitting
- Ordinary Differential Equation
- Interpolation
- Numerical Differentiation
- Algebraic and Transcendental equations
- Linear simultaneous equations

Text Book :

- Chapra, S.C. & Canal, R. P., Numerical Methods for Engineers, 5th Ed., Tata McGraw Hill Pubication.

Reference Books :

- Balagurusamy, E., Numerical Methods, Tata McGraw Hill Publication.
- Rajaraman, V., Computer Oriented Numerical Methods, Prentice Hall of India Ltd.
- Sastry, S. S., Introductory Methods of Numerical Analysis, Prentice Hall of India Ltd.
- Jain, M.K., Iyengar, S.R.K. and Jain, R.K., Numerical Methods for Scientific and Engineering Computations, 5th Ed., New Age International Ltd.
- Rajasekaran, S., Numerical Methods in Science and Engineering – A practical Approach, S. Chand and Co. Ltd.
- Rao, S.S., Optimization Theory and Applications, New Age International Ltd.
- Computed Oriented Numerical Methods, (5^{th} edition) by R.S. Salaria, Khanna Publishing Company Private Limited, New Delhi.

Outcomes : Students will be able to

1. **remember** basics of numerical methods.
2. **understand** basic concepts of numerical differentiation and integration, interpolation.
3. **find** numerical solutions to ordinary differential equations, algebraic and transcendental equations.
4. **Compare** numerical solutions obtained by analytical methods with solutions obtained by C++ programs.
5. **write** C++ program and run it in the laboratory for the given data.

Note :

- 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.