**College of Engineering, Pune-5**

**Department of Mathematics**

**( MA - ) Numerical Methods with C++**

T.Y. B.Tech. (Production)

Teaching Scheme Examination Scheme

Lectures : 1 hr / week Internal Test 1: 20 marks

Lab: 2 hrs / week Internal Test 2: 20 marks

Term Work: 30 marks

ESE Pract./Oral: 30 marks

**Objectives :**  At the end of the course, students will demonstrate the ability to:

1. Apply numerical methods to solve various engineering application problems using discrete data obtained through experiments.
2. Write C++ program for the above mentioned methods and run it in laboratory.

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**Unit I:** Numerical integration: Trapezoidal Rule, Simpson 1/3rd and 3/8th Rule, Weddle‘s Rule, Gauss Quadrature - Two and Three Point Formula, Double Integration, Applications. Curve Fitting: least square criteria- 1st and 2nd Degree, Applications. **[4 Hrs]**

**Unit II:** Numerical Solution of Ordinary Differential Equation: Taylor Series Method, Euler Method, Modified Euler Method, Runge Kutta 2nd and 4th order method, Simultaneous Differential Equations and Second Order Differential Equations, Applications. **[3 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. **[3 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. **[4 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.

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**Outcomes :** Students will be able to

1. know and recall core knowledge of the syllabus. ( To measure this outcome, questions may be of the type- define, identify, state, match, list, name etc.)
2. understand basic concepts. ( To measure this outcome, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.)
3. analyze the problem and apply the appropriate concept. ( To measure this outcome, questions will be based on applications of core concepts)
4. give reasoning. ( To measure this outcome, questions may be of the type- true/false with justification, theoretical fill in the blanks, theoretical problems, prove implications or corollaries of theorems, etc.)
5. write C++ program and run it in the laboratory for the given data.