

Gujarat Technological University

Master of Computer Applications

Semester-II

Subject Name: **Computer Oriented Numerical Methods (CONM)**
Subject Code: **2620004**

Learning Objectives:

With the current deployment of computer technology and tools, it is very important to develop efficient algorithms for solving in science, engineering, technology, insurance and banking. Thus, the objective of this course is to enable students to obtain an intuitive and working understanding of numerical methods for the basic problems of numerical analysis and gain an experience in the implementation of numerical methods using a computer. They would also gain an appreciation of the concept of error in these methods and need to analyze and predict it.

Prerequisites:

Basic knowledge of functions, logarithmic, trigonometric and exponential functions, graph of a function, polynomials, and roots of a polynomial, differentiation and integration, differential equations, simultaneous equations.

Contents:* indicates algorithms/pseudocode to be included for the said methods

1 : Computer Arithmetic [3 Lectures]

2 : Iterative Methods for finding roots [6 Lectures]

Bisection*	}	Discuss convergence only without derivation
False Position*		
Secant Method*		
Newton Raphson*		
Successive Approximation*		
Birge Vieta Method*		
Descarte's rule of sign		

3: Interpolation and Approximation [15 Lectures]

- Polynomial interpolation** : Lagrange*, Newton's Forward Difference Interpolation*, Newton's Backward Difference Interpolation*, Newton's Divided Difference Interpolation*, Error Estimates, Cubic Spline Interpolation, Inverse Interpolation
- Approximation** : Least Square Curve Fitting, Linear Regression and Non linear Regression, Approximation of Functions by Taylor Series, Chebyshev Approximation, Chebyshev Economization

4: Numerical Differentiation & Integration [11 Lectures]

- a. **Differentiation*** : Using Newton's Forward Difference, Newton's Backward Difference, Newton's Divided Difference for both tabulated and untabulated points (First and Second Order Differentiation only)
- b. **Integration** : Trapezoidal*, Simpson's 1/3* & 3/8* rules, 2-point Gauss Quadrature formulas

5: Matrix and Solution of Simultaneous Linear & Differential Equations [15 Lectures]

- a. **Matrix** : Introduction to Matrix, Types of Matrices, Transpose of a Matrix, Matrix Multiplication, Eigen Values and Eigen Vectors, Power Method
- b. **Solution of Simultaneous Linear Equations** : Naïve Gauss Elimination*, Gauss Elimination with Pivoting, Gauss-Seidel Method*
- c. **Solution of Ordinary Differential Equations** : Taylor Series*, Runge-Kutta* 2nd Order, 3rd Order, 4th Order, Predictor-Corrector Methods* : Milne Simpson and Adam's Moulton

Text Books:

1. Steven C Chapra, Raymond P Canale, "Numerical Methods for Engineers", 5th Edition, Tata McGraw Hill Publication, Special Indian Edition
2. Dr. N Datta, "Computer Oriented Numerical Methods", Vikas Publication

Reference Books:

1. T Veerarajan, T Ramachandran, "Numerical Methods with Programs in C", 2nd Edition, Tata McGraw Hill Publication
2. V. Rajaraman, "Numerical Methods", 3rd Edition, Prentice-Hall India Pvt. Ltd.
3. R M Somasundaram, R M Chandrasekaran, "Numerical Methods with C++ Programming", Prentice-Hall India Pvt. Ltd.
4. C F Gerald, P O Wheatley, "Applied Numerical Analysis", 7th Edition, Pearson Education Asia, New Delhi
5. Atkinson, Han, "Elementary Numerical Analysis", Wiley India Edition
6. Dr. V N Vedamurthy, Dr. N. Ch. S N Iyengar, "Numerical Methods", Vikas Publication
7. Richard L Burden, J Douglas Faires, "Numerical Analysis", Cengage Publication
8. Srimanta Pal, "Numerical Methods", Oxford University Press

Chapter wise Coverage from the Text book (s):

Unit #	Book #	Chapter(s)
1	1	2, 3 (sections 3.3 and 3.4)
2	1	4, 5(upto subsection 5.3.2), 7 (only section 7.1 – Case Study)
	2	5 (pgs. 118 – 123) – also refer Reference Book # 1
3	1	12 (section 12.1 except subsection 12.1.3, section 12.2), 13 (only section 13.1 except 13.1.4, section 13.2, subsection 13.6.3 & subsection 13.6.4), 14 (only section 14.1)
	2	2 (pgs. 17 – 23, 28 – 31 & 33)

4	1	16 (upto subsection 16.2.4), 17 (section 17.3 except subsection 17.3.3), 18 (only section 18.3)
	2	3 (pgs. 53 – 62)
5	1	8 (upto section 8.4), 10 (only section 10.2), 20 (section 20.1 & section 20.3 upto 20.3.3), 21 (only section 21.2.4)
	2	6 (pgs. 127 – 130 & 144 – 149)

Accomplishments of the student after completing the course:

- Solve linear and non-linear algebraic equations, perform operations of calculus, fit curves, and solve differential equations using a computer.
- Appreciate problems due to rounding errors and convergence.