

GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Computer Application

Subject Name : Computer Oriented Numerical Methods

Subject Code : 620005

Objectives:

With the current deployment of computer technology and tools, it is very important to develop efficient algorithms for solving problems in science, engineering, technology, insurance & 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 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 the 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:

1. Computer Arithmetic

2. Iterative Methods for finding roots:

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

(a) Polynomial interpolation : Lagrange, forward difference, backward difference, divided difference interpolation, Error Estimates, Cubic Spline interpolation , Inverse interpolation.

(b) 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

Differentiation

Integration - Trapezoidal, Simpson's 1/3 & 3/8 rules, Gauss Quadrature formulas

5.

- 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 & Adam's Moulton method

Main Reference Books :

- 1. Numerical Methods for Engineers by Steven C Chapra & Raymond P Canale, Fifth Edition, Tata McGraw Hill Publication, Special Indian Edition.
- 2. Computer Oriented Numerical Methods by Dr. N Datta, Vikas Publication.

Suggested Additional Reading :

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

Chapter wise Coverage from the main reference books :

1 : From Book # 1 → Chp. 2 , Chp. 3 section 3.3 & section 3.4

2 : From Book # 1 → Chp. 4 , Chp. 5 upto subsection 5.3.2, Chp. 7 only section 7.1

(Case study)

From Book # 2 → Chp. 5 pages 118 – 123 (also refer suggested reading Bk # 1)

3: From Book # 1 → Chp. 12 section 12.1 except subsection 12.1.3, section 12.2,
Chp. 13 only section 13.1 except 13.1.4, section 13.2,
subsection 13.6.3 & subsection 13.6.4, Chp. 14 only section 1

From Book # 2 → Chp. 2 pages 17 – 23, 28 – 31 & 3

4 : From Book # 1 → Chp. 16 upto subsection 16.2.4, Chp. 17 section 17.3 except
subsection 17.3.3, Chp. 18 only section 18.3

From Book # 2 → Chp. 3 pages 53 – 62

5: From Book # 1 → Chp. 8 upto section 8.4, Chp. 10 only section 10.2
Chp. 20 section 20.1 & section 20.3 upto 20.3.3
Chp. 21 only section 21.2.4

From Book # 2 → Chp. 6 pages 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