Gujarat University

K. S. School of Business Management and Information Technology
[Five Years' (Full – Time) M.Sc. (CA&IT) Integrated Degree Course]
Second Year M.Sc. (CA&IT) (Semester - III)

Course Name: Computer Oriented Numerical Methods-Theory

Course Code: IDC-IMSCIT-234T

Course Credit: 2

Objective:

With the current trend in computer science and technology, it is very important to develop time efficient and accurate algorithms for solving problems in various sectors like science, engineering, banking etc. The objective of this course is to enable students to gain a working understanding of Numerical Methods for the basic problems of Numerical Analysis. They would also be able to appreciate the problems due to rounding errors and convergence. It is expected that the student have knowledge of computer representation of numbers in memory, functions, graphs along with basics of matrices and calculus.

Course Outcomes:
Upon successful completion of this practical course, students will be:

- Able to calculate solution of system of linear equation and solve non-linear equations
- Able to calculate area under the curve using numerical integration techniques
- Able to calculate solutions of initial value problem

Contents:

Unit No.	Course Content	Hours	Credits
1	**Mathematics in the Vedas and Sulva Sutras (IKS):** Mathematical references in Vedas. The extant Sulbasutra texts & their commentaries. The meaning of the word Sulbasutra. Qualities of a Sulbasutra. Solving System of Simultaneous Linear equations: Gauss Elimination with partial pivoting, Gauss Jacobi Method, Gauss Seidel Method; Ill conditioned system of equations Methods for solving Non-linear Equations: Bisection Method, False Position Method, Secant Method, Newton Raphson Method; Geometric Interpretation of Bisection, RegulaFalsi and Newton Raphson Method;	15	1
2	**Interpolation:** Operators and relation among operators, Lagrange's Interpolation, Newton's forward and Backward Interpolation, Newton's Divided Difference Interpolation, Error Propagation in Difference Tables Geometric Interpretation and deriving formula of all the above methods Numerical Integration: Trapezoidal Rule, Simpson's $1/3^{rd}$ rule and Simpson's $3/8^{th}$ rule; 2 point Gauss Quadrature method Numerical solution of Ordinary Differential Equations**:** Euler's Method, Modified Euler's Method, RungeKutta's 2^{nd} order and 4^{th} order Methods	15	1

Reference Books:

1. Numerical Methods for Engineering and Science, Oxford Higher Education by SaumyenGuha and Rajesh Srivastava
2. Plofker, K. (2009). Mathematics in India. Princeton University Press.
3. Numerical Methods for Engineers, 5th edition, Tata McGraw Hill Publications. by Steven C Chapra and Raymond P Canale
4. Numerical Methods with C++ Programming, PHI New Delhi. by Nita H. Shah
5. Computer Oriented Numerical Methods, 3rd edition, PHI. by V. Rajaraman
6. Computer Oriented Numerical Methods, Vikas Publications. by N. Datta
7. Applied Numerical Analysis, 7th edition, Pearson Education Asia, New Delhi. by C.F. Gerald and P.O. Wheatley
8. Numerical Methods, Vikas Publications by Dr. V.N. Vedamurthy& Dr. N.Ch.S.NIyenger
9. Numerical Methods with C++ Programming, Prentice Hall India Pvt. Ltd. by RM Somasundaram& RM Chandrasekaran
10. Numerical Methods using MATLAB, 4th edition, Pearson Education. by John H. Mathews and Kurtis D. Fink

Accomplishments of the student after completing the Course:

After completion of this course Student would be able to

- Gain a thorough understanding of various numerical techniques used for solving mathematical problems that are difficult or impossible to solve analytically.
- Analyze and quantify errors associated with numerical methods. This includes understanding sources of error such as round-off error and truncation error, and methods for minimizing them.
- Apply numerical methods to solve a variety of mathematical problems including but not limited to: solving equations (linear and nonlinear), numerical integration, numerical differentiation, solving differential equations (ordinary and partial), optimization problems, etc.
- Study in numerical analysis or related fields, or for careers where numerical methods are commonly employed, such as scientific computing, engineering, finance, and data science.