

Lecture Plan		
Name of the College: Government College of Arts, Science and Commerce, Sanquelim-Goa		
Name of Faculty: Aaron Philip Alphonso	Subject: Mathematics	
Paper code: MAT-6402 Numerical Methods	Program: M.Sc. (Mathematics)	Division: -
Academic year: 2026-27	Semester: III	Total Lectures: 15 (Theory) + 30 (Practical)
Course Objectives: 1. To introduce the foundational concepts of Numerical Methods, fostering a strong theoretical understanding of their definitions and properties. 2. To develop the learner's ability to construct and understand rigorous mathematical proofs related to key Numerical Methods concepts and theorems. 3. To equip learners with the skills necessary to identify and apply appropriate Numerical methods and techniques to solve structured problems. 4. To encourage analytical thinking and creativity in solving unfamiliar problems in Numerical Methods, enabling learners to construct logically sound and precise mathematical arguments.		
Expected Course Outcome: 1) Display familiarity and knowledge of Numerical Methods and associated concepts. 2) Demonstrate proofs to establish truths related to Numerical Methods and associated concepts. 3) Choose the appropriate procedures, modify them if needed, and apply them to solve method-based problems in Numerical Methods. 4) Analyze and solve unseen problems in Numerical Methods and create mathematically precise arguments to justify their solutions. 5) Prove various results in Riemann integration. 6) Analyze and compare various number theoretic functions. 7) Examine the convergence of improper integrals.		

Student Learning Outcome: Student will be able to 1) Implement and analyze numerical methods for linear systems, eigenvalue problems, and nonlinear equations. 2) Apply interpolation, approximation, numerical integration, and methods for ODEs/BVPs to solve computational problems, including software implementation. 3) Apply the theory of Riemann integration in evaluating integrals.							
Month	Lecture From	Lecture To	No. of lectures allotted	Topic, Subtopic to be covered	Exercise/ Assignment	ICT Tools	Reference books
June	22/06/2026	27/06/2026	1	Principles of floating point computations and rounding errors		Smart Board	K. E. Atkinson, An Introduction to Numerical Analysis, Wiley, 1989.
	29/06/2026	04/07/2026	1	Systems of linear equations: factorization methods, pivoting and scaling		Smart Board	K. E. Atkinson, An Introduction to Numerical Analysis, Wiley, 1989.
	06/07/2026	11/07/2026	1	Residual error correction method		Smart Board	K. E. Atkinson, An Introduction to Numerical Analysis, Wiley, 1989.
July	13/07/2026	18/07/2026	1	Iterative methods: Jacobi and Gauss–Seidel methods with convergence analysis; conjugate gradient methods		Smart Board	K. E. Atkinson, An Introduction to Numerical Analysis, Wiley, 1989.
	20/07/2026	25/07/2026	1	Eigenvalue problems: implementation issues		Smart Board	K. E. Atkinson, An Introduction to Numerical Analysis, Wiley, 1989.

Jul/Aug	27/07/2026	01/08/2026	1	Nonlinear systems: Newton and Newton-like methods; unconstrained optimization		Smart Board	K. E. Atkinson, An Introduction to Numerical Analysis, Wiley, 1989.
August	03/08/2026	08/08/2026	1	Interpolation: review of Lagrange interpolation techniques		Smart Board	K. E. Atkinson, An Introduction to Numerical Analysis, Wiley, 1989.
	10/08/2026	15/08/2026	1	Piecewise linear and cubic splines; error estimates		Smart Board	K. E. Atkinson, An Introduction to Numerical Analysis, Wiley, 1989.
	17/08/2026	22/08/2026	1	Approximation: uniform approximation by polynomials; data fitting and least squares approximation		Smart Board	K. E. Atkinson, An Introduction to Numerical Analysis, Wiley, 1989.
	24/08/2026	29/08/2026	1	Numerical integration: integration by interpolation		Smart Board	K. E. Atkinson, An Introduction to Numerical Analysis, Wiley, 1989.
August/Sep t	31/08/2026	05/09/2026	1	Adaptive quadratures and Gauss methods		Smart Board	K. E. Atkinson, An Introduction to Numerical Analysis, Wiley, 1989.
Sep	07/09/2026	12/09/2026	1	Initial value problems for ODEs: Runge–Kutta methods; multi-step methods		Smart Board	K. E. Atkinson, An Introduction to Numerical Analysis, Wiley, 1989.

	14/09/2026	19/09/2026	0	Ganesh Chaturthi Break (14–19 Sep)			K. E. Atkinson, An Introduction to Numerical Analysis, Wiley, 1989.
	21/09/2026	26/09/2026	1	Predictor and corrector scheme; stability and convergence analysis		Smart Board	K. E. Atkinson, An Introduction to Numerical Analysis, Wiley, 1989.
Sep/Oct	28/09/2026	03/10/2026	1	Two-point boundary value problems: finite difference methods		Smart Board	K. E. Atkinson, An Introduction to Numerical Analysis, Wiley, 1989.
Oct	05/10/2026	10/10/2026	1	Convergence results for finite difference methods; review and problem solving		Smart Board	K. E. Atkinson, An Introduction to Numerical Analysis, Wiley, 1989.
Practical Component (30 Hours)							
Month	Lecture From	Lecture To	No. of lectures allotted	Topic, Subtopic to be covered	Exercise/ Assignment	ICT Tools	Reference books
June/July	22/06/2026	27/06/2026	3	Practical 1 – Floating Point & Linear Systems: floating-point error analysis; LU factorization with pivoting, scaling and residual error correction		Computer Lab	K. E. Atkinson, An Introduction to Numerical Analysis, Wiley, 1989.
June/July	29/06/2026	04/07/2026	3	Practical 2 – Iterative Methods: Jacobi, Gauss–Seidel and Conjugate Gradient methods; convergence behaviour		Computer Lab	K. E. Atkinson, An Introduction to Numerical Analysis, Wiley, 1989.
July	06/07/2026	11/07/2026	3	Practical 3 – Eigenvalue Problems: power method and inverse power method for dominant/smallest eigenvalues		Computer Lab	K. E. Atkinson, An Introduction to Numerical Analysis, Wiley, 1989.

July	13/07/2026	18/07/2026	3	Practical 4 – Nonlinear Systems & Optimization: Newton and Newton-like methods; gradient-based unconstrained optimization		Computer Lab	K. E. Atkinson, An Introduction to Numerical Analysis, Wiley, 1989.
July	20/07/2026	25/07/2026	3	Practical 5 – Interpolation: Lagrange, piecewise linear and cubic spline interpolation; interpolation error estimation		Computer Lab	K. E. Atkinson, An Introduction to Numerical Analysis, Wiley, 1989.
Aug	27/07/2026	01/08/2026	3	Practical 6 – Approximation: uniform polynomial approximation and least squares curve fitting for a given dataset		Computer Lab	K. E. Atkinson, An Introduction to Numerical Analysis, Wiley, 1989.
Aug	03/08/2026	08/08/2026	3	Practical 7 – Numerical Integration: Newton–Cotes formulas, adaptive quadrature and Gauss quadrature methods		Computer Lab	K. E. Atkinson, An Introduction to Numerical Analysis, Wiley, 1989.
Aug	10/08/2026	15/08/2026	3	Practical 8 – Initial Value Problems (ODEs): Runge–Kutta and multi-step predictor–corrector methods; stability and convergence		Computer Lab	K. E. Atkinson, An Introduction to Numerical Analysis, Wiley, 1989.
Aug	17/08/2026	22/08/2026	3	Practical 9 – Two-Point Boundary Value Problems: finite difference methods; numerical verification of convergence		Computer Lab	K. E. Atkinson, An Introduction to Numerical Analysis, Wiley, 1989.
Aug	24/08/2026	29/08/2026	3	Practical 10 – Lab Component: implementation of algorithms and exposure to public-domain packages like LINPACK and ODEPACK		Computer Lab	K. E. Atkinson, An Introduction to Numerical Analysis, Wiley, 1989.

* Assessment Rubrics

Component	Max Marks
ISA 1	10
ISA 2	10
Practical	20
Project	Nil
Semester End Exam	60