GURU TEGH BAHADUR

INSTITUTE OF TECHNOLOGY

NEW DELHI

COMPUTATIONAL METHODS

ES-201

Lecture Plan
Course: COMPUTATIONAL METHODS (CM)
B.Tech.: CSE, IT, ECE
Semester: 3
Subject Code: ES-201
Credit: 4, Period: 4

Unit	Topic	Lectures
1	Review of Taylor Series, Rolle 's Theorem and Mean Value Theorem.	01
	Approximations and Errors in numerical computations.	01
	Data representation and computer arithmetic.	01
	Loss of significance in computation.	01
	Location of roots of equation: Bisection method (convergence analysis and implementation), Newton Method (convergence analysis and implementation) and Secant Method (convergence analysis and implementation).	2+2+2
	Unconstrained one variable function minimization by Fibonacci search, Golden Section Search and Newton's method.	02
	Multivariate function minimization by the method of steepest descent and Nelder- Mead Algorithm.	02
2	Interpolation: Assumptions for interpolation and errors in polynomial interpolation.	01
	Finite differences, Gregory-Newton's Forward Interpolation and Gregory-Newton's backward Interpolation.	02
	Lagrange's Interpolation.	01
	Newton's divided difference interpolation.	01
	Numerical Integration: Definite Integral and Newton-Cote's Quadrature formula.	01
	Numerical Integration: Trapezoidal Rule, Simpson's one-third rule and Simpson's three-eighth rule.	03
	Errors in Quadrature formulae.	01
	Romberg's Algorithm and Gaussian Quadrature formula.	02
3	System of Linear Algebraic Equations: Existence of solution.	01

		Gauss Elimination method and its computational effort.	01
		Concept of Pivoting, Gauss Jordan method and its Computational effort.	02
		Triangular Matrix factorization methods: Dolittle algorithm, Crout's Algorithm and Cholesky method.	03
		Eigen value problem: Power method.	01
		Approximation by Spline Function: First-Degree and second degree Splines.	01
		Natural Cubic Splines.	01
		Interpolation and Approximation	01
4		Numerical solution of ordinary Differential Equations: Picard's method.	01
		Numerical solution of ordinary Differential Equations: Taylor's series method.	01
		Numerical solution of ordinary Differential Equations: Euler's and Runge-Kutta method.	02
		Numerical solution of ordinary Differential Equations: Predictor-corrector methods: Modified Euler's, Adams-Bashforth and Milne's method.	03
		Numerical solution of Partial Differential Equations: Parabolic, Hyperbolic, and elliptic equations.	04

Textbook:

[T1] E. Ward Cheney & David R. Kincaid, "Numerical Mathematics and Computing" Cengage; 7th ed (2013).

References:

[R1] R. L. Burden and J. D. Faires, "Numerical Analysis", CENGAGE Learning Custom Publishing; 10" Edition (2015).

[R2] S. D. Conte and C. de Boor, "Elementary Numerical Analysis: An Algorithmic Approach", McGraw Hill, 3rd ed. (2005).

[R3] H. M. Antia, "Numerical Methods for Scientists & Engineers", Hindustan Book Agency. (2002).

[R4] E Balagurusamy "Numerical Methods" McGraw Hill Education (2017)