BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI

FIRST SEMESTER 2020-2021

Course Handout (Part II)

17-08-2020

In addition to part I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

***Course No*.** **: MATH F313**
Course Title **: Numerical Analysis**
Instructor-in-charge **: A RAMU**
Instructors **: A RAMU and TSL Radhika**

1.Scope and Objective of the Course:

Enables one to devise algorithms for the numerical solutions of mathematical problems. Also discusses the error analysis of different algorithms.

2.Text Book: Applied Numerical Analysis by Curtis F. Gerald, Patrich O. Wheatley Pearson education (7^{th} Edition) 2003.

3. Reference Books: 1. Numerical Analysis, Burden and Faires, 7^{th} ed., Thomson Learning, 2001

2. Elementary numerical Analysis, SD Conte & Carl de Boor 3^{rd} ed., TMH 2006 (Reprint).

4. Course Plan:

Lec. No.	Learner's Objective	Topic to be Covered	Ref. to Text /Ref. Ch./Sec
1-3	To understand the potential pitfalls of numerical computing	Introduction, Using computer to do numerical analysis, Errors, Sources of errors, Floating point arithmetic, Arithmetic accuracy in computer, Significant digits, Relative error, Propagation of errors, how to avoid loss of significant digits, evaluation of polynomial, Parallel and distributed computing	0.1-0.7
4-9	To find roots of nonlinear equations and understand the relative strengths and Weaknesses of each Computation. Learn to apply.	Bisection, secant, false –position, Newton's method, Muller's method, Fixed point iteration method. Order of convergence, multiple roots.	1.1-1.6
10-15	To solve a linear system, using gaussian elimination and iterative methods and compute matrix inverse and understand the relative strengths and weakness of each computational method. Learn to apply.	The Elimination method, Gaussian Elimination, Other direct methods, Pathology in linear systems-singular matrices, Determinants and matrix inversions, Tridiagonal systems, Thomas algorithm, Norms, condition numbers and errors in computed solutions; Jacobi's method, Gauss Seidel method, SOR method , Newton's methods, fixed-point methods for non-linear systems	2.1-2.6, 1.7
16-21	What is an interpolating polynomial and how	Existence and Uniqueness of interpolating polynomial, Lagrange polynomials Divided differences, Evenly space points,	3.1, 3.2-3.3, 12.10(R1)

	to efficiently evaluate it. Learn to apply.	Error of interpolation, cubic spline, Inverse interpolation	
22-28	To compute numerical derivatives and integration using discrete data points and know how to integrate functions Learn to apply.	Derivatives from difference table, Higher order derivatives, Extrapolation techniques, Newton-Cotes Integration formulas, The Trapeziodal rule- a composite formula, Simpsons rule, Other ways to derive integration formulas, Gaussian Quadrature,	5.1-5.3, 5.6, 14.11-14.12(R1)
29-34	To compute numerical solutions of initial value problem Learn to apply. s.	The Taylor Series method, Euler and Modified Euler's method, Runge-kutta Methods Multistep methods : Milne's method, Adams-moulton method, Predictor – corrector formulas, system of equations and higher order equations,	6.1-6.6
35-37	Understand boundary value problems the solution methodology	The shooting method, Finite difference method, solution through a set of equations, Derivatives boundary conditions	6.7, 16.4(R1)
38-39	Learn the iterative way. Learn to apply.	Power method, Inverse Power method & QR methods of finding eigenvalues and eigenvectors of matrices	6.8
40-42	Introduction to Finite element Methods and some solutions methods.	The Rayleigh-Ritz method, The Collocation and Galerkin Methods, Finite Elements for Ordinary-Differential equations	9.1-9.2

5. **Evaluation Scheme:**

Evaluation Component	Duration	Weightage	Date & Time	Nature of Component
Test-1	30 min.	15%	September 10 –September 20 (During scheduled class hour)	Open book
Assignment-1		10%	To be announced	Open book
Test-2	30 min.	15%	October 09 –October 20 (During scheduled class hour)	Open book
Quiz		10%	To be announced	Open book
Test-3	30 min.	15%	November 10 – November 20 (During scheduled class hour)	Open book
Compre. Exam.	120 min.	35%	To be announced	Open book

6. Problems: Students are strongly advised to work out all the relevant problems in the text-book and do similar problems from the reference books. It is also recommended that the students should try out the algorithms on computers (Using MATLAB) to get a better understanding of the subject.

7. Chamber Consultation Hours: To be announced in the class.

8. Make-up: Make-up for any component of evaluation will be given only in genuine cases of absence.

9 Notices: All notices related to this course will be put only on the Mathematics Department Notice Board.

10. **Academic Honesty and Integrity Policy**: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable

Instructor-In-Charge MATH F313