



**INSTRUCTION DIVISION**  
**FIRST SEMESTER 2015-2016**  
**Course Handout (Part II)**

**Date: 03/08/2015**

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** DEVENDRA KUMAR

1. **Scope & 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, Patrick O. Wheatley Pearson education (7<sup>th</sup> Edition) 2003.*
3. **Reference Books**
  - i. Numerical Analysis, Burden and Faires, 7<sup>th</sup> ed., Thomson Learning, 2001.
  - ii. Numerical methods for engineers and scientists by J. D. Hoffman, 2<sup>nd</sup> ed. CRC 2010.
  - iii. A friendly introduction to Numerical Analysis by Brian Bradie, Pearson Education 2006.
  - iv. Elementary numerical Analysis, SD Conte & Carl de Boor 3<sup>rd</sup> ed., TMH 2006.
  - v. Introduction to Numerical Analysis 3<sup>rd</sup> ed., Devi Prasad, Narosa 2006.

4. Course Plan				
Lec. No.	Learner's Objective	Topic to be Covered	Ref. to Text /Ref. Ch./Sec	Prob.
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, avoiding loss of significant digits, Evaluation of polynomial.	0.1-0.6	All
4-9	To find roots of nonlinear equations and understand the relative strengths and weaknesses of each method for system of non-linear equations.	Bisection, secant, method of false –position, Newton's method, Fixed point iteration method. Order of convergence, multiple roots.	1.1-1.3, 1.5, 1.6	All





10-15	To solve a linear system using Gaussian elimination and iterative methods.  To compute inverse of a matrix and understand the relative strengths and weakness of each computational method.	The Elimination method, Gaussian Elimination, Other direct methods, Pathology in linear systems-singular matrices, Determinants and matrix inversions, Tri-diagonal systems, Thomas algorithm, Norms, condition numbers and errors in computed solutions. Jacobi's method, Gauss Seidel method, Newton's methods, fixed-point methods for non-linear systems	2.1-2.5, 1.7	All
16-21	What is an interpolating polynomial and how to efficiently evaluate it?	Existence and Uniqueness of interpolating polynomial, Lagrange polynomials, divided differences, evenly space points, error of interpolation, interpolation with repeated abscissa.	3.1, 3.2, 4.4(R5)	All
22-28	To compute numerical derivatives and integration using discrete data points and to know how to integrate functions containing singularities.	Derivatives from difference table, Higher order derivatives, Newton-Cotes Integration formulas, The Trapezoidal rule- a composite formula, Simpsons rule, Gaussian Quadrature,	5.1-5.3, 5.6	All
29-34	To compute numerical solutions of initial value problems	Taylor series method, Euler and Modified Euler's method, Runge-Kutta (RK) Methods Multistep methods: Milne's method, Adams-Moulton method, Predictor – corrector formulas System of equations and higher order equations.	6.1-6.5	All
35-37	To solve boundary value problems (BVP)	The shooting method, Finite difference method, solution through a set of equations, Derivatives boundary conditions.	6.7	All
38-39	Eigen values and eigenvectors of matrices	Power method, Inverse Power method of finding eigenvalues and eigenvectors of matrices.	6.8	All
40-42	How to deal with irregular boundaries using Finite Element Methods (FEM)?	The Rayleigh-Ritz method, The Collocation and Galerkin Methods.	9.1-9.2 12.1-12.3(R2)	All

#### 5. Evaluation Scheme

S. No.	Components	Duration	Marks	Date & Time	Remarks
ii.	Mid- Sem Test	90 min	70	10/10 4:00 - 5:30 PM	CB
iii.	Assignment/Quizzes	***	40	***	CB/OB
iv.	Comprehensive Exam	3 hrs	90	14/12 AN	CB/OB

\*\*\* To be announced later.

**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 by using **MATLAB** to get a better understanding of the subject.

**7. Only text book and hand written notes are allowed in open book exam.**

**8. Chamber Consultation Hours:** To be announced in the class.

**9. MAKE-UP:** Make-up for any component of evaluation will be given only in genuine cases of absence. **No makeup will be given for lab examination and quizzes.**

**10. Notices:** All notices related to this course will be put **only** on **Nalanda Website**.

**Instructor-in-Charge**  
**MATH F313**



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