EGM 6341 Numerical Methods of Engineering Analysis I

Spring 2020

Instructor: Dr. Siddharth Thakur
205B PERC Building
email: sst@ufl.edu
Ph: (352) 846-3555

Textbook: An Introduction to Numerical Analysis, 2nd Ed, Wiley,
by Kendall E. Atkinson ISBN 0471624896

References: An Introduction to Numerical Analysis, by F.B. Hildebrand
Numerical analysis using MATLAB and Excel, by S.T. Karris

Detailed lecture notes and worked out examples will be available on the website for each chapter.

Class Time: M, W, F 4th Period, 10:40 – 11:30 AM (NEB Room 100)

Instructor Office Hours: Monday & Wednesday – 11:30 AM to 1:00 PM

TA: TBA
Office: TBA
Office Hours: TBA
Email: TBA

COURSE CONTENTS

1. **Introduction**
   Math review (mean value theorems, Taylor series expansion, Fourier transform), Computer Arithmetic and Errors (roundoff error, truncation error, floating point arithmetic significant digits, absolute and relative errors, error propagation).

2. **Root finding**
   Bisection method, Newton's method, secant method, method of false position (regula falsi), successive iteration method, repeated roots.

3. **Solving sets of linear equations**
   Matrix review, norm, Gauss elimination and Gauss-Jordan method, L-U decomposition, Determinant and matrix inversion, condition number, iterative methods.

4. **Interpolation methods**
   Method of undetermined coefficient, Lagrangian interpolation, Newton's divided difference, finite difference, error detection in data, interpolation error, Hermite interpolation, cubic spline, least square method.

5. **Approximation of functions**
   Weierstrass theorem, minimax approximation, least square approximation, orthogonal polynomials, Gram-Schmidt theorem.

6. **Numerical integration and differentiation**
   Derivatives from difference tables, Newton-Cotes Integration Formulae (mid point rule, trapezoidal rule, Simpson's rules, Romberg integration, Richardson extrapolation, Gaussian quadrature, Gauss-Hermite quadrature, imperfect integral

7. **Numerical methods for initial value problems**
   Taylor series expansion for ODE, Euler & modified Euler methods, Runge-Kutta method and adaptive method, multi-step methods, systems of equations and high-order equations.

8. **Numerical methods for one-D boundary value problem**
   Shooting Method, finite fifference method, derivative boundary condition, collocation method, Galerkin Method

9. **Numerical methods for one-D unsteady heat equation & wave equation**
   KDV-Burgers equation and roles of convection, diffusion and dispersion; explicit and implicit finite difference method for parabolic equations; von Neumann stability analysis and growth factor; truncation error and accuracy; upwind difference scheme for wave equation; truncation error and modified PDEs;

Grading:

20%	Homework: problems will be assigned and collected regularly. Solutions will be posted after the graded papers are returned.
40%	Mid-term exam
40%	Final Exam

LETTER GRADE:

A: 90-100,	A-: 87-89;	
B+: 84-86,	B: 80-83,	B-: 77-79;
C+: 74-76,	C: 70-73,	C-: 67-69;
D+: 64-66;	D: 60-63,	D-: 55-59;
E: 0-54		

Academic Honesty:
All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a student at the University of Florida and to be honest in all work submitted and exams taken in this class and all others.

Accommodations for Disabilities:
Students with disabilities who are requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodations.