MATH385 / MATH685, Numerical Methods I
Spring 2024

Instructor: SA Kwon
Resources: Numerical Analysis, 2nd Ed (Tim Sauer, Pearson Education, 2012); Various.

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#*	Lecture Topic
01	00 Introduction: Syllabus, Coursework Expectations. 00 Review of Basics: Polynomials, Base 2, Floating Point.
02	00 Review of Basics: Floating Point (continued), Error, Basic Analysis.
03	01 Rootfinding: Bisection, Fixed-Point Iteration.
04	01 Rootfinding: Newton's Method, Secant Method.
05	02 Systems of Equations: Gauss Elimination, LU Factorization, PA-LU Factorization.
06	02 Systems of Equations: Iterative, Symmetric-Positive Definite Matrices, Newton's Multivariate.
07	03 Interpolation: Polynomial Interpolation, Interpolation Error.
08	03 Interpolation: Chebyshev, Cubic Splines, Bezier Curves.
09	04 Least Squares: LSQ, Models.
10	04 Least Squares: QR Factorization, GMRES, Non-Linear.
11	05 Differentiation & Integration: Differentiation.
12	05 Differentiation & Integration: Newton-Cotes, Romberg.
13	99 Special Lecture 1: Uniform Random Number Generation (wrt Integration). 05 Differentiation & Integration: Adaptive Quadrature, Gaussian Quadrature, *Advanced Extra Credit*.
14	06 ODEs: Initival Value Problems, Solvers.
15	06 ODEs: Systems, Runge-Kutta Family, *Advanced Extra Credit*.
16	06 ODEs: Variable Step; Implicit; Multi-Step.
17	07 Boundary Value Problems: Shooting Method, Finite Difference Method.
18	07 Boundary Value Problems: Collocation & Finite Element Method.
19	08 PDEs (2D): Parabolic, Hyperbolic.
20	08 PDEs (2D): Elliptic, Non-Linear.
21	99 Special Lecture 2: Hyperplane Separation & Analysis 99 Special Lecture 3: Perceptrons
22-24	99 Special Lecture 4: Introduction to Neural Networks

*Lecture number and order does not include class time devoted to review of course material or recitation-style code demonstrations.

This course provides an introduction to Numerical Methods. The later topics may be more of an overview, less in-depth than earlier topics. That will depend on the overall profiency of all students enrolled this semester. Coursework requires coding; however, a programming language is not a prerequisite. Python is supported but a limited number of other languages will be accepted.

There is no required textbook but lecture notes will be provided and other resources as relevant.

Weekly homework and weekly quizzes will be 70% of the grade; attendance of Math & Statistics Department Special Lectures will be 5% of the grade; the final will be the remainder. Extra credit will be available throughout the course.

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The Dolciani Math Learning Center, located on the 7th floor HE in the Library, has tutoring - both onsite and virtual - as well as multi-media materials, drill and practice sheets, textbooks, workshops and review sessions. The Center is generally open six days per week with day and evening hours. More information can be found on their website, www.hunter.cuny.edu/dolciani.