MATH 3510-002

Numerical Analysis (I)[1]

Instructor: Dr. George Yin, Mont 425, gyin@uconn.edu

Term: 2026 Fall

Lectures: Tuesdays and Thursdays, Tu Th 3:30 pm - 4:45 pm, MONT 419

Office Hours: Tuesdays and Thursdays 1:05 pm -1:50 pm [Mont 425], 3:15 pm-3:30 pm [Mont 419], or by appointment.

Text: *Fundamentals of Numerical Computation*, T.A. Driscoll and R.J. Braun

Online Content

https://fncbook.com/
https://github.com/tobydriscoll/fnc-extras

Course Learning Objectives

By the end of the course, students will be able to:

1. Floating point and error analysis: Quantify rounding error and truncation error. Distinguish forward vs backward error and relate them to conditioning.
2. Linear systems: Implement and analyze Gaussian elimination with pivoting. Compute and interpret condition numbers. Solve least squares problems via QR factorization.
3. Nonlinear equations: Analyze convergence of fixed-point iterations. Implement and compare bisection, Newton, and secant methods. Determine order of convergence empirically.
4. Approximation and interpolation: Construct polynomial and spline interpolants. Diagnose instability. Use piecewise methods (splines) for stable approximation.
5. Numerical integration: Apply quadratures. Derive and interpret error bounds.
6. ODE initial value problems: Implement Euler and Runge–Kutta methods. Analyze stability regions and step-size effects.
7. Computational practice: Translate mathematical algorithms into working code. Produce reproducible numerical experiments with error analysis.

Homework: you will be asked to carry out some numerical experiments. A few computation projects will be assigned. (Here and hereafter, project and homework will be used interchangeably.)

Methods of Evaluation and Grading scale: There will be homework and four midterm exams (3 in-class exams and 1 take-home exam). Performance on the homework

[1] This syllabus provides a general plan for the course; some modifications and derivations may be needed.

and exams is the primary basis for the course grade. The weights of the homework and exams are as given in the table.

Homework	100	20%
Exam 1	100	20%
Exam 2	100	20%
Exam 3	100	20%
Exam 4	100	20%
Total	500	100%

Important Dates:

- First day of class: 9/1
- Last of class: 12/10
- Exam 1: 9/17
- Exam 2: 10/15
- Exam 3: 11/12
- Exam 4: 12/10 (take-home due)

Computer programming:

Homework projects require writing simple computer programs. Matlab is a preferred programming language for MATH3510.

Course Plan:

Floating point number and error analysis;

Square linear systems of equations;

Over-determined linear systems;

Solution of nonlinear equations;

Piecewise interpolation; Numerical differentiation and integration;

Initial value problems for ODEs

Computer programming: Homework projects require writing simple computer programs. Matlab is used as a programming language for teaching in MATH3510 (as well as the followup course MATH3511). The latest release of Matlab is installed on UConn Anyware and available for installation on students personal computers.

Policy on Makeup Exams: I plan to give no makeups.

Policy on Late Homework: It is important to observe the due date of the homework (project). A late homework will result in a reduction of 25% of the points for each day delayed.

Grader: Xiaohang Ma: xiaohang.ma@uconn.edu

A Few Words About the Projects:

The numerical experiment is an important part of the course work. It will consist of applications of various numerical methods. Normally, you will need to write computer program to do the calculation. After the completion of the computation, you need to write a report, which should contain:

1. a list of the program and its input,
2. its output,
3. a careful summary.

The summary should include (but not be limited to) any special considerations in the choice of algorithm, the expected accuracy of the results, the observed accuracy of the results, if this can be determined, and any reasons why the algorithm might not have behaved as theoretically predicted. Good exposition is expected. Keep in your mind that clarity and brevity will raise your grade, while unclear explanations and unnecessary material will lower it. The discussion should be typed, or legibly handwritten. Illegible documents will be returned without grading.

Keep your programs at least until after your work has been graded and returned. In some cases you may be asked to provide a copy of your program if we have questions about your work.

You are free to talk to classmates about your work and are free to use any other references and books etc., as long as you acknowledge any help or ideas that are not your own. (e.g., "To integrate Eq. (4), we use the method introduced in Kahaner, Moler and Nash's book". or "To integrate Eq. (4), we use the idea of John Doe".) If identical work from different people with no acknowledgements were received, we may ask each person involved to explain their work. If it is determined that ideas have been borrowed without acknowledgement, 0 point will be given on that project.