

## MATH 614: Numerical Methods I

### *Spring 2023 Course Syllabus*

**NJIT Academic Integrity Code:** All Students should be aware that the Department of Mathematical Sciences takes the University Code on Academic Integrity at NJIT very seriously and enforces it strictly. This means that there must not be any forms of plagiarism, i.e., copying of homework, class projects, or lab assignments, or any form of cheating in quizzes and exams. Under the University Code on Academic Integrity, students are obligated to report any such activities to the Instructor.

### COURSE INFORMATION

**Course Description:** Theory and techniques of scientific computation, with more emphasis on accuracy and rigor than Math 611. Machine arithmetic. Numerical solution of a linear system and pivoting. Interpolation and quadrature. Iterative solution of nonlinear systems. Computation of eigenvalues and eigenvectors. Numerical solution of initial- and boundary-value problems for systems of ODEs. Applications. The class includes examples requiring student use of a computer.

**Number of Credits:** 3

**Prerequisites:** [Math 222](#), [Math 337](#), [Math 340](#), and proficiency in a computer language (MATLAB, FORTRAN, C, or C++), or departmental approval.

**Course-Section and Instructors:**

Course-Section	Instructor
Math 614-002	Professor R. Goodman

**Office Hours for All Math Instructors:** [Spring 2023 Office Hours and Emails](#)

**Required Textbook:**

<b>Title</b>	<i>A First Course in Numerical Methods</i>
<b>Author</b>	Uri Ascher and Chen Greif
<b>Links</b>	<a href="https://www.cs.ubc.ca/~greif/ag_errata.pdf">https://www.cs.ubc.ca/~greif/ag_errata.pdf</a> , <a href="#">MATLAB Programmng Examples</a>
<b>Edition</b>	2011
<b>Publisher</b>	SIAM
<b>ISBN #</b>	978-0-898719-97-0

**University-wide Withdrawal Date:** The last day to withdraw with a W is **Monday, April 3, 2023**. It will be strictly enforced.

## COURSE GOALS

### Course Objectives

Students will gain experience in developing, analyzing, and implementing common numerical methods for a range of mathematical problems.

### Course Outcomes

- Students should gain an understanding of common numerical methods.
- Students should know how to apply numerical methods to various mathematical problems.
- Students should have an improved ability to derive and program numerical methods.

**Course Assessment:** Outcomes are assessed through homework assignments, a midterm exam, and a comprehensive final exam.

## POLICIES

**DMS Course Policies:** All DMS students must familiarize themselves with, and adhere to, the **Department of Mathematical Sciences Course Policies**, in addition to official **university-wide policies**. DMS takes these policies very seriously and enforces them strictly.

**Grading Policy:** The final grade in this course will be determined as follows:

Homework	40%
Midterm Exam	30%
Final Exam	30%

Your final letter grade will be based on the following tentative curve.

A	90 - 100	C +	75 - 79
B+	86 - 89	C	70 - 75
B	80 - 85	F	0 - 69

**Attendance Policy:** Attendance at all classes will be recorded and is **mandatory**. Please make sure you read and fully understand the **Math Department's Attendance Policy**.

**Homework:** Homework assignments/projects will be given frequently; some will involve writing computer programs in a computer language such as MATLAB, C, or Python. The textbook and lectures contain examples written in MATLAB, so this will be the default. **The purpose of homework is not simply to “get the right answer” or write a working computer program. It is also to learn how to communicate results clearly. I can only grade your work based on the communication of results.** This means that I don't just want to see your scrawled answer, but an actual prepared document explaining what you have done and possibly skipping straightforward steps. I do not demand work typed up in LaTeX but readability is important. Finally, the

results of computer programs must be displayed in meaningful and well-formatted graphs and tables. [MATLAB Live Scripts](#) are a great way of incorporating computer code, formatted text, and outputs into a readable document and their use is highly encouraged.

Assignments will be posted, turned in, and graded on the [course Canvas page](#).

In order to provide timely, high-quality feedback, I may not always grade all problems in a homework. Instead, I will focus our grading efforts on providing feedback on a few key points. I will provide written solutions so that you can evaluate yourself for problems that I do not grade in detail.

**Exams:** There will be one midterm exam held in class during the semester and one comprehensive final exam. Exams are held on the following days:

Midterm Exam	March 9, 2023
Final Exam Period	May 5 - May 11, 2023

The final exam will test your knowledge of all the course material taught in the entire course. Make sure you read and fully understand the [Math Department's Examination Policy](#). This policy will be strictly enforced.

**Makeup Exam Policy:** There will be **NO MAKE-UP QUIZZES OR EXAMS** during the semester. In the event an exam is not taken under rare circumstances where the student has a legitimate reason for missing the exam, the student should contact the Dean of Students office and present written verifiable proof of the reason for missing the exam, e.g., a doctor's note, police report, court notice, etc. clearly stating the date AND time of the mitigating problem. The student must also notify the Math Department Office/Instructor that the exam will be missed.

**Cellular Phones:** All cellular phones and other electronic devices must be switched off during all class times.

## ADDITIONAL RESOURCES

**Further Assistance:** For further questions, students should contact their instructor. All instructors have regular office hours during the week. These office hours are listed on the Math Department's webpage for [Instructor Office Hours and Emails](#).

**Accommodation of Disabilities:** The Office of Accessibility Resources and Services (OARS) offers long term and temporary accommodations for undergraduate, graduate and visiting students at NJIT.

If you are in need of accommodations due to a disability please contact Scott Janz, Associate Director of Disability Support Services at [973-596-5417](tel:973-596-5417) or via email at [scott.p.janz@njit.edu](mailto:scott.p.janz@njit.edu). The office is located in Kupfrian Hall, Room 201. A Letter of Accommodation Eligibility from the Office of Accessibility Resources and Services office authorizing your accommodations will be required.

For further information regarding self identification, the submission of medical documentation and additional support services provided please visit the Office of Accessibility Resources and Services (OARS) website at:

<https://www.njit.edu/accessibility/>

**Important Dates** (See: [Spring 2023 Academic Calendar, Registrar](#))

Date	Day	Event
January 17, 2023	Tuesday	First Day of Classes
January 23, 2023	Monday	Last Day to Add/Drop Classes
March 13, 2023	Monday	Spring Recess Begins
March 18, 2023	Saturday	Spring Recess Ends
April 3, 2023	Monday	Last Day to Withdraw
April 7, 2023	Friday	Good Friday - No Classes
May 2, 2023	Tuesday	Friday Classes Meet
May 2, 2023	Tuesday	Last Day of Classes
May 3 - May 4, 2023	Wednesday and Thursday	Reading Days
May 5 - May 11, 2023	Friday to Thursday	Final Exam Period

## Course Outline

Week	Topics	Sections
1/16-1/20	Introduction	1.1, 1.2, 1.3
1/23-1/27	Roundoff Errors Nonlinear equations in one variable	2.1, parts of 2.2, 2.3 3.1, 3.2
1/30-2/3	Nonlinear equations in one variable Linear algebra background	3.3, 3.4, extra proofs 4.1 (review on your own <i>before class</i> ), 4.2, 4.3,
2/6-2/10	Linear algebra background Direct methods for linear systems	4.5 5.1, 5.2, 5.3
2/13-2/17	Direct methods for linear systems Iterative methods for linear systems	5.4, 5.5, 5.8 7.1, 7.2
2/20-2/24	Iterative methods for linear systems Nonlinear systems of equations	7.3, 7.4 9.1
2/27-3/3	Polynomial interpolation	10.1-10.6
3/6-3/10	MIDTERM (MARCH 9)	
***	Spring Recess	
3/20-3/24	Piecewise Polynomial interpolation Best Approximation	11.1, 11.2, 11.3 12.1, 12.2
3/27-3/31	Best Approximation Numerical Differentiation	12.3, 12.4 14.1, 14.2, 14.4

4/3-4/7	Numerical Integration	15.1-15.5
4/10-4/14	Numerical ODE	Chapter 16 and supplements
4/17-4/21	Numerical ODE	Chapter 16 and supplements
4/24-4/28	Numerical ODE	Chapter 16 and supplements
5/1	No class Tuesday 5/2, but office hours held	

*Updated by Professor R. H. Goodman - 1/20/2023  
Department of Mathematical Sciences Course Syllabus, Spring 2023*