MATH 340: Applied Numerical Methods
Spring 2025 Course Syllabus
==*Please also see the Math 340 Syllabus Introduction on the course canvas page*==

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.

Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at: NJIT Academic Integrity Code.

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university. If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu.

COURSE INFORMATION

Course Description: Introduction to numerical methods with emphasis on mathematical models. Implements and investigates numerical techniques for the solution of linear and nonlinear systems of equations, eigenvalue problems, interpolation and approximation, techniques of optimization, Monte Carlo methods, and applications to ordinary differential equations and integration.

Number of Credits:

Prerequisites: MATH 211 with a grade of C or better or MATH 213 with a grade of C or better, and CS 100 with a grade of C or better or CS 101 with a grade of C or better or CS 113 with a grade of C or better or CS 115 with a grade of C or better or MATH 240 with a grade of C or better.

Course-Section and Instructors:

Course-Section	Instructor
Math 340-002	Professor B. Bukiet
Math 340-004	Professor B. Bukiet

Class meetings	Mondays in ME 224 and Wednesdays in Weston LH 2 1:00 pm–2:20 pm Lab: Fridays 10:00-11:20 am (GITC 2400) or 1:00 pm – 2:20 pm (in MALL PC40)
Professor contact information:	Bruce Bukiet Office: Cullimore Hall 603 Phone: 973-596-8392 Email: bukiet@njit.edu Office Hours: Monday 2:30-4:00 pm; Wednesday 11:30 am - 1:00 pm and by appointment

Office Hours for All Math Instructors: Spring 2025 Office Hours and Emails

Required Textbook:

Title	*Numerical Analysis*
Author	Timothy Sauer
Edition	3rd
Publisher	Pearson
ISBN #	978-0134696454
Website(s)	http://web.njit.edu/~bukiet See course Canvas page for course learning objects Resource: http://web.njit.edu/~bukiet/M611/M611.html

University-wide Withdrawal Date: The last day to withdraw with a **W** is **Monday, April 7, 2025**. It will be strictly enforced.

COURSE GOALS

Course Outcomes

Students will demonstrate the ability to:

- Analyze errors arising in numerical computation of solutions to mathematical and applied problems.
- Apply numerical techniques to compute approximate solutions of nonlinear equations and differential equations and analyze error issues.
- Apply numerical techniques for interpolation, differentiation and quadrature problems and analyze error issues.
- Communicate advantages and disadvantages of various numerical techniques and select appropriate numerical methods to solve specific problems.
- Translate numerical problems and methods into computational algorithms, apply the algorithms and develop

conclusions from the output.
- Articulate connections among course material, their other courses, their majors and/or their prospective careers

Course Assessment: The assessment of outcomes will be achieved through homework, MATLAB assignments, quizzes, and exams.

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, Quizzes, Lab, (optional) Project, and Class Participation	25%
Midterm Exams (4)	30% - 60%
Final Exam	15% - 45%
Project (for Honors) see project ideas at: **https://web.njit.edu/~bukiet/M611/M611_proj.html**	25% (total out of 125%)

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

A	90 - 100	**C**	70 - 75
B+	86 - 89	**D**	60 - 69
B	80 - 85	**F**	59 and below
C+	76 - 79		

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. This policy will be strictly enforced.

Religious Observance: Please be aware of the NJIT Policy on on Student Absences for Religious Observances: https://www.njit.edu/registrar/njit-policy-student-absences-religious-observances

NJIT does not cancel classes for non-federally recognized religious holidays. Students observing such holidays must follow this policy to receive academic accommodations. The policy ensures that students absent due to religious observances are excused without penalty. Faculty are required to provide students an academically reasonable timeframe to make up missed assignments, exams, projects, quizzes, or other academic work.

Students must notify their professors in writing of any conflicts between course requirements and religious observances. Faculty must include a reminder on the course syllabus about this notification process. Students expecting to miss classes or exams due to religious observances must submit a written list of dates to their instructors, ideally by the end of the second week of class, but no later than two weeks before the anticipated absence.

Faculty are expected to make academically appropriate accommodations for missed work, including exams, quizzes, and assignments, due to religious observances. Once notified in writing, professors must ensure that students are not penalized for missed work, as long as it is completed by a new deadline set by the professor,

which must fall within the academic term. If the student fails to meet this deadline, the professor will assign an appropriate grade. Missed work may include homework, projects, exams, quizzes, lab work, or out-of-class activities scheduled during the observance.

This policy applies only to absences for religious observances. For other excused absences, students should refer to the policies from the Dean of Students.

For any questions or concerns regarding this policy, please contact the Office of Inclusive Excellence at inclusiveexcellence@njit.edu.

Homework: Homework assignments REQUIRE use of MATLAB software.

Exams: There will be four exams during the semester and a final exam during the final exam week. The tentative dates are:

Midterm Exam I	2/17/25
Midterm Exam II	3/12/25
Midterm Exam III	4/14/25
Midterm Exam IV	4/30/25
Final Exam Period	May 10 - May 16, 2025

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 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. As one may make up up to two exams on the final, if one exam is missed, the student will make it up through the final exam. If more than one exam is missed during the semester (with a valid excuse), please work with the professor to implement an appropriate process. (In rare situations in which multiple students have legitimate reasons to miss and exam or in the case of religious observance, make-ups may be allowed).

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

ADDITIONAL RESOURCES

Math Tutoring Center: Located in the Central King Building, Lower Level, Rm. G11 (See: Spring 2025 Hours)

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 If you need an accommodation due to a disability please contact the Office of Accessibility Resources and Services at oars@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 2025 Academic Calendar, Registrar)

Date	Day	Event
January 21, 2025	Tuesday	First Day of Classes
January 27, 2025	Monday	Last Day to Add/Drop Classes
March 16, 2025	Sunday	Spring Recess Begins
March 22, 2025	Saturday	Spring Recess Ends
April 3, 2025	Thursday	Wellness day
April 7, 2025	Monday	Last Day to Withdraw
April 18, 2025	Friday	Good Friday - No Classes
April 20, 2025	Sunday	Easter Sunday - No Classes Scheduled
May 6, 2025	Tuesday	Thursday Classes Meet
May 7, 2025	Wednesday	Friday Classes Meet
May 7, 2025	Wednesday	Last Day of Classes
May 8, 2025	Thursday	Reading Day 1
May 9, 2025	Friday	Reading Day 2
May 10 - May 16, 2025	Friday to Thursday	Final Exam Period

Course Outline
Tutors are available in accordance with the Math department's posted schedule.

Date	Lecture	Sections	Topic
1/22	1		Introduction to the Course, Class Dynamics, Guidelines for Success

1/24	Lab 1		Lab session 1: MATLAB basics; Series
1/27	2	1.1	Bisection Method (prior knowledge IVT, MVT)
1/29	3	1.3, 1.5	Forward and Backward Error and Secant Method / Regula Falsi
1/31	Lab 2		Lab session 2: Bisection and/or Secant Method
2/3	4	1.4	Newton's Method and Error
2/5	5	1.2	Fixed Point Iteration: Fixed Point Error considerations (prior knowledge: Taylor Series)
2/7	Lab 3		Lab session 3: Newton's Method and Fixed point iteration
2/10	6	notes	Higher order iteration and Accelerating convergence
2/12	7	4.1-4.2	Review for Exam 1 and start Least Squares
2/14	Lab 4		Lab 4: Accelerating convergence and Higher order iteration
2/17	8		Exam 1
2/19	9	4.1-4.2	Least Squares
2/21	Lab 5		Lab session 5: Least Squares
2/24	10	3.1-3.2	Polynomial Interpolation; Lagrange Polynomials and error
2/26	11	3.3	Chebyshev Polynomials

2/28	Lab 6		Lab session 6: Lagrange and Chebyshev Polynomials
3/3	12	3.4	Cubic Splines
3/5	13	3.4	More Cubic Splines
3/7	Lab 7		Lab session 7: Cubic Splines
3/10	14		Review for Exam 2
3/12	15		Exam 2
3/14	Lab 8		Make-up lab
3/24	16	5.1	Numerical Differentiation
3/26	17	5.2	Numerical Integration
3/28	Lab 9		Lab 9: Numerical Differentiation
3/31	18	5.3	Romberg Integration and Richardson Extrapolation
4/2	19	5.5	Gaussian Quadrature
4/4	Lab 10		Lab session 10: Numerical Integration and Richardson Extrapolation
4/7	20	6.1, 6.2	Ordinary Differential Equations - Euler's Method; Taylor Series Methods
4/9	21		Review for Exam 3;

4/11	Lab 11		Lab session 11: Gaussian Quadrature
4/14	22		Exam 3: Passover Day 2
4/16	23	6.2, 6.4	ODEs – Taylor Series Methods, Runge Kutta Methods
4/18			No Lab Good Friday
4/21	24	6.3, 6.4	Ordinary Differential Equations – Systems of ODEs
4/23	25	6.6-6.7	Ordinary Differential Equations –Stability of One Step Methods including Implicit Methods; Multi-Step Methods and Stability
4/25	Lab 11		Lab session 12: Runge Kutta Methods
4/28	26	6.7	Review for Exam 4
4/30	27		Exam 4
5/2	Lab 13		Lab session 13: Systems of ODEs or Implicit Methods, Multistep methods and Stabilit
5/5	28		Review for Final Exam and Miscellaneous Topics
			FINAL EXAM TBD