MATH 340: Applied Numerical Methods
Fall 2024 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.

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 340-001	Professor B. Bukiet

Office Hours for All Math Instructors: Fall 2024 Office Hours and Emails

Recommended Textbook:

Title	*Numerical Analysis*
Author	Timothy Sauer
Edition	3rd
Publisher	978-0134696454
ISBN #	Pearson

University-wide Withdrawal Date: The last day to withdraw with a **W** is **Monday, November 11, 2024**. It will

be strictly enforced.

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)	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.

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	TBA
Midterm Exam II	TBA
Midterm Exam III	TBA
Midterm Exam IV	TBA
Final Exam Period	December 15 - December 21, 2024

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

Math Tutoring Center: Located in the Central King Building, Lower Level, Rm. G11 (See: Fall 2024 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 need an accommodation due to a disability, please contact the Office of Accessibility Resources and Services at oars@njit.edu, or visit Kupfrian Hall 201 to discuss your specific needs. A Letter of Accommodation Eligibility from the office authorizing student accommodations is 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: Fall 2024 Academic Calendar, Registrar)

Date	Day	Event
September 2, 2024	Monday	Labor Day
September 3, 2024	Tuesday	First Day of Classes

September 9, 2024	Monday	Last Day to Add/Drop Classes	
November 11, 2024	Monday	Last Day to Withdraw	
November 26, 2024	Tuesday	Thursday Classes Meet	
November 27, 2024	Wednesday	Friday Classes Meet	
November 28 to December 1, 2024	Thursday and Sunday	Thanksgiving Recess - Closed	
December 11, 2024	Wednesday	Last Day of Classes	
December 12, 2024	Thursday	Reading Day 1	
December 13, 2024	Friday	Reading Day 2	
December 15 to December 21, 2024	Sunday to Saturday	Final Exam Period	

Course Outline
(Tentative)

Homework assignments REQUIRE use of MATLAB software.
Tutors are available in accordance with the Math department's posted schedule.

Date	Lecture	Section(s)	Topic
9/3	1		Introduction to the Course, Class Dynamics, Guidelines for Success
9/5	2	1.1	Bisection Method (prior knowledge IVT, MVT)
9/6	Lab 1		Lab session 1: MATLAB basics; Bisection
9/10	3	1.3, 1.5	Forward and Backward Error and Secant Method / Regula Falsi
9/12	4	1.4	Newton's Method and Error
9/13	Lab 2		Lab session 2: Secant and Newton
9/17	5	1.2	Fixed Point Iteration: Fixed Point Error considerations (prior knowledge: Taylor Series)
9/19	6	notes	Higher order iteration and Accelerating convergence
9/20	Lab 3		Lab session 3: Fixed point
9/24	7	4.1-4.2	Review for Exam 1 and start Least Squares
9/26	8		Exam 1
9/27	Lab 4		Lab 4: Higher order iteration or Accelerating convergence
10/1	9	4.1-4.2	Least Squares
10/3 (RH)	10	3.1-3.2	Polynomial Interpolation; Lagrange Polynomials and error
10/4 (RH)	Lab 5		Lab session 5: Least Squares
10/8	11	3.3	Chebyshev Polynomials
10/10	12	3.4	Cubic Splines
10/11	Lab 6		Lab session 6: Lagrange and Chebyshev Polynomials
10/15	13		Review for Exam 2
10/17 (Sukkot)	14		Exam 2
10/18 (Sukkot)	Lab 7		Lab session 7: Cubic Splines
10/22	15	5.1	Numerical Differentiation

10/24 (Shmini Atzeret)	16	5.2	Numerical Integration
10/25 (Simchat Torah)	Lab 8		Lab session 8: Numerical Differentiation
10/29	17	5.2	Numerical Integration
10/31	18	5.3	Romberg Integration and Richardson Extrapolation
11/1	Lab 9		Lab session 9: Numerical Integration and Richardson Extrapolation
11/5	19	5.5	Gaussian Quadrature
11/7	20	6.1	Ordinary Differential Equations - Euler's Method
11/8	Lab 10		Lab session 10: Gaussian Quadrature or Euler's Method
11/12	21	6.2	Taylor Series Methods
11/14	22	6.4	Ordinary Differential Equations – Runge Kutta Methods
11/15	Lab 11		Lab session 11: Runge Kutta Methods
11/19	23	6.3	Ordinary Differential Equations – Systems of ODEs
11/21	24	6.6	Ordinary Differential Equations –Stability of One Step Methods including Implicit Methods
11/22	Lab 12		Lab session 12: Systems of ODEs
11/26	25	6.7	Ordinary Differential Equations – Multi-Step Methods and Stability
11/27 (Friday schedule)	Lab 13		Lab session 13: Multistep methods or Stability
12/3	26		Review for Exams 3 & 4 and Miscellaneous Topics
12/5	27		Exam 3 & 4
12/6	Lab 14		Makeup or Extra Credit Lab
12/10	28		Review for Final Exam and Miscellaneous Topics
12/15-12/21			FINAL EXAM WEEK