

MATH 340: Applied Numerical Methods *Fall 2021 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
Math 340-003	Professor B. Bukiet

Office Hours for All Math Instructors: [Fall 2021 Office Hours and Emails](#)

Required Textbook:

Title	<i>Numerical Analysis</i>
Author	Timothy Sauer
Edition	3rd
Publisher	978-0134696454
ISBN #	Pearson

University-wide Withdrawal Date: The last day to withdraw with a **W** is **Wednesday, November 10, 2021**. 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)	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	September 28, 2021
Midterm Exam II	October 21, 2021
Midterm Exam III	November 9, 2021
Midterm Exam IV	December 7, 2021
Final Exam Period	December 15 - 21, 2021

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 2021 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 contact Scott Janz, Associate Director of Disability Support Services at **973-596-5417** or via email at **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/studentsuccess/accessibility/>

Important Dates (See: **Fall 2021 Academic Calendar, Registrar**)

Date	Day	Event
September 1, 2021	Wednesday	First Day of Classes
September 4, 2021	Saturday	Saturday Classes Begin
September 6, 2021	Monday	Labor Day
September 8, 2021	Wednesday	Monday Classes Meet
September 8, 2021	Wednesday	Last Day to Add/Drop Classes
November 10, 2021	Wednesday	Last Day to Withdraw
November 25 to November 28, 2021	Thursday to Sunday	Thanksgiving Recess - Closed
December 10, 2021	Friday	Last Day of Classes
December 13 and December 14, 2021	Monday and Tuesday	Reading Days
December 15 to December 21, 2021	Wednesday to Tuesday	Final Exam Period

Course Outline

(Tentative)

Date	Lecture	Sections	Topic
9/2	1		Introduction to the Course, Class Dynamics, Guidelines for Success
9/3			Lab session 1: MATLAB basics
9/7	2*	0.1-0.5	Numerical Methods Foundations: Taylor Series, Error
9/9	3	1.1	Rootfinding for nonlinear equations - Bisection Method (IVT, MVT)
9/10			Lab session 2: Series
9/14	4	1.2	Rootfinding for nonlinear equations - Fixed Point Iteration
9/16	5*	1.3	Rootfinding for nonlinear equations - Error considerations
9/17			Lab session 3; Bisection Method
9/21	6*	1.4-1.5	Rootfinding for nonlinear equations - Newton's Method and Secant Method
9/23	7	3.1	Review for Exam 1 and Polynomial Interpolation
9/24			Lab session 4: Fixed point methods
9/28	8*		Exam 1
9/30	9	3.1	Polynomial Interpolation
10/1			Lab session 5: Lagrange Polynomials
10/5	10	3.2	Polynomial Interpolation Error
10/7	11	3.3	Chebyshev Polynomials
10/8			Lab session 6: Chebyshev Polynomials
10/12	12	3.3	More Chebyshev Polynomials
10/14	13	3.4	Cubic Splines
10/15			Lab session 7: Cubic Splines

10/19	14	5.1	Review for Exam 2 and Numerical Differentiation
10/21	15	5.1	Exam 2 and Numerical Differentiation
10/22			Lab session 8: Numerical Differentiation
10/26	16	5.2	Numerical Integration
10/28	17	5.3	Romberg Integration and Richardson Extrapolation
10/29			Lab session 9: Numerical Integration
11/2	18	5.5	Gaussian Quadrature
11/4	19	6.1	Review for Exam 3 and Ordinary Differential Equations - Basics, Direction Fields
11/5			Lab session 10: Richardson Extrapolation
11/9	20	6.1-6.2	Exam 3 and Ordinary Differential Equations - Euler's Method and its Error Analysis
11/11	21	6.2	Ordinary Differential Equations - Taylor Series Methods
11/12			Lab session 11: Euler's Method
11/16	22	6.3	Ordinary Differential Equations - Systems of ODEs
11/18	23	6.4	Ordinary Differential Equations - Runge Kutta Methods
11/19			Lab session 12: Runge Kutta Methods
11/23	24	6.6	Ordinary Differential Equations - Stiff Equations, Stability and Implicit Methods
11/30	25	6.7	Ordinary Differential Equations - Multi-Step Methods and Stability
12/2	26	7.1	Review for Exam 4 and ODE-Boundary Value Problems - Shooting Method
12/3			Lab session 13: Stability
12/7	27	7.2	Exam 4 and BVP Finite Differences
12/9	28		Review for Final Exam and Miscellaneous Topics
12/10			Lab session 14: Make up or Independent project
12/15-12/21			FINAL EXAM WEEK
	*		Order of sessions may be adjusted that week due to calendar issues

*Updated by Professor B. Bukiet - 8/13/2021
Department of Mathematical Sciences Course Syllabus, Fall 2021*