

## MATH 340: Applied Numerical Methods

### *Spring 2019 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:** 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:** 3

**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 340-004	Professor B. Bukiet
Math 340-006	Professor B. Bukiet

**Office Hours for All Math Instructors:** [Spring 2019 Office Hours and Emails](#)

#### Required Textbook:

<b>Title</b>	<i>Numerical Analysis</i>
<b>Author</b>	Sauer
<b>Edition</b>	1st or 2nd
<b>Publisher</b>	Pearson
<b>ISBN #</b>	978-0321783677
<b>Website</b>	<a href="http://web.njit.edu/~bukiet">http://web.njit.edu/~bukiet</a> See course moodle page for course learning objects
<b>Resource</b>	<a href="http://web.njit.edu/~bukiet/M611/M611.html">http://web.njit.edu/~bukiet/M611/M611.html</a>

**University-wide Withdrawal Date:** The last day to withdraw with a **W** is **Monday, April 8, 2019**. It will be strictly enforced.

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## COURSE GOALS

### Learning Outcomes

Students succeeding in this course will be able 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.
- Apply numerical techniques for interpolation, differentiation and quadrature problems.
- Communicate advantages and disadvantages of various numerical techniques and select appropriate numerical methods for specific problems.
- Students will demonstrate the ability to translate these numerical problems into a computational algorithm.
- Student will articulate connections among course material, their other course, their majors and/or their prospective careers

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

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## 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, and Class Participation	25 points
Midterm Exams (4)	30 - 60 points
Final Exam	15 - 45 points
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 Policy:** Homework assignments require use of MATLAB software. Tutors are available in accordance with a posted schedule.

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

Midterm Exam I	February 20, 2019
Midterm Exam II	March 13, 2019

Midterm Exam III	April 8, 2019
Midterm Exam IV	May 1, 2019
Final Exam Period	May 10 - 16, 2019

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: [Spring 2019 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](#).

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

**Accommodation of Disabilities:** Disability Support Services (DSS) 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 Chantonette Lyles, Associate Director of Disability Support Services at [973-596-5417](tel:973-596-5417) or via email at [lyles@njit.edu](mailto:lyles@njit.edu). The office is located in Fenster Hall Room 260. A Letter of Accommodation Eligibility from the Disability Support 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 Disability Support Services (DSS) website at:

- <http://www5.njit.edu/studentssuccess/disability-support-services/>

**Important Dates** (See: [Spring 2019 Academic Calendar, Registrar](#))

Date	Day	Event
January 22, 2019	T	First Day of Classes
February 1, 2019	F	Last Day to Add/Drop Classes
March 17 - 24, 2019	Su - Su	Spring Recess - No Classes, NJIT Open
April 8, 2019	M	Last Day to Withdraw
April 19, 2019	F	Good Friday - No Classes, NJIT Closed
May 7, 2019	T	Friday Classes Meet/ Last Day of Classes
May 8 & 9, 2019	W & R	Reading Days

## Course Outline

Date	Lecture	Sections	Topic
1/23	1		Matlab Introduction and Introduction to the Course
1/28	2	0.1 and 0.4	Numerical Methods Foundations
1/30	3	0.5	Calculus Review: IVT, MVT, Taylor Series etc.
2/4	4	1.1	Rootfinding for nonlinear equations - Bisection
2/6	5	1.2	Rootfinding for nonlinear equations - Fixed Point Iteration
2/11	6	1.3	Rootfinding for nonlinear equations - Error considerations
2/13	7	1.4-1.5	Rootfinding for nonlinear equations - Newton's Method and Secant Method
2/18	8	3.1	Review for Exam 1 and Polynomial Interpolation
2/20	9	3.1	<b>EXAM 1</b> and Polynomial Interpolation
2/25	10	3.1	Polynomial Interpolation
2/27	11	3.2	Polynomial Interpolation Error
3/4	12	3.3	Chebyshev Polynomials
3/6	13	3.4	Cubic Splines
3/11	14	5.1	Review for Exam 2 and Numerical Differentiation
3/13	15	5.1	<b>EXAM 2</b> and Numerical Differentiation
3/25	16	5.2	Numerical Integration
3/27	17	5.3	Romberg Integration and Richardson Extrapolation
4/1	18	5.5	Gaussian Quadrature
4/3	19	6.1	Review for Exam 3 and Ordinary Differential Equations - Basics, Direction Fields
4/8	20	6.1-6.2	<b>EXAM 3</b> and Ordinary Differential Equations - Euler's Method and its Error Analysis
4/10	21	6.2	Ordinary Differential Equations - Taylor Series Methods
4/15	22	6.3	Ordinary Differential Equations - Systems of ODEs
4/17	23	6.4	Ordinary Differential Equations - Runge Kutta Methods
4/22	24	6.6	Ordinary Differential Equations - Stiff Equations, Stability and Implicit Methods
4/24	25	6.7	Ordinary Differential Equations - Multi-Step Methods and Stability
4/29	26	7.1	Review for Exam 4 and ODE-Boundary Value Problems - Shooting Method
5/1	27	7.2	Exam 4 and BVP Finite Differences
5/6	28		Review for Final Exam and Miscellaneous Topics
5/10-5/17			<b>FINAL EXAM WEEK</b>