

## **MATH 340: Applied Numerical Methods** *Fall 2020 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.

**DMS Online Exam Policy Fall 2020:** Exams will be proctored using both Respondus LockDown Browser+Monitor and Webex. Students will be required to join a Webex meeting from their phone with their cameras on, and to access the exam through LockDown Browser on a Mac or Windows PC with webcam. Students must follow all instructions related to environment checks and camera positioning.

Please be sure you read and fully understand our [DMS Online Exam Policy](#).

### **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 340-001	Professor S. Jiang
Math 340-003	Professor Y. N. Young

**Office Hours for All Math Instructors:** [Fall 2020 Office Hours and Emails](#)

#### **Required Textbook:**

<b>Title</b>	<i>Numerical Analysis</i>
<b>Author</b>	Timothy Sauer
<b>Edition</b>	3rd
<b>Publisher</b>	Pearson

**University-wide Withdrawal Date:** The last day to withdraw with a **W** is **Monday, November 9, 2020**. It will be strictly enforced.

## 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 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 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.

## 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, Labwork, and Class Participation	30%
Exam I	20%
Exam II	20%
Final Exam	30%

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 2 midterm exams held in class during the semester and one final exam. Exams are held on the following times:

Exam I	September 29, 2020
Exam IV	November 3, 2020
Final Exam Period	December 15 - 21, 2020

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 2020 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.

See course Canvas page for course learning objects Resource:

<http://web.njit.edu/~bukiet/M611/M611.html>

**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 Chantonette Lyles, Associate Director of Disability Support Services at **973-596-5417** or via email at [lyles@njit.edu](mailto:lyles@njit.edu). The office is located in Kupfrian Hall, Room 201. 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:

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

**Important Dates** (See: **Fall 2020 Academic Calendar, Registrar**)

Date	Day	Event
September 1, 2020	T	First Day of Classes
September 5, 2020	S	Saturday Classes Begin
September 7, 2020	M	Labor Day
September 8, 2020	T	Monday Classes Meet
September 8, 2020	T	Last Day to Add/Drop Classes

November 9, 2020	M	Last Day to Withdraw
November 25, 2020	W	Friday Classes Meet
November 26-29, 2020	R - Su	Thanksgiving Recess - University Closed
December 10, 2020	R	Last Day of Classes
December 11 & 14, 2020	F & M	Reading Days
December 15 - 21, 2020	T - M	Final Exam Period

## Course Outline

Date	Week	Section	Topic
09/01	1		MatlabIntroduction and Introduction to the Course
09/03	1	0.1 and 0.4	Numerical Methods Foundations
09/08	2	0.5	Calculus Review: IVT, MVT, Taylor Series etc.
09/10	2	1.1	Rootfinding for nonlinear equations - Bisection
09/15	3	1.2	Rootfinding for nonlinear equations - Fixed Point Iteration
09/17	3	1.3	Rootfinding for nonlinear equations - Error considerations
09/22	4	1.4-1.5	Rootfinding for nonlinear equations - Newton's Method and Secant Method
09/24	4	3.1	Review for Exam 1 and Polynomial Interpolation
09/29	5		Exam 1
10/01	5	3.1	Polynomial Interpolation
10/6	6	3.2	Polynomial Interpolation Error
10/8	6	3.3	Chebyshev Polynomials
10/13	7	3.4	Cubic Splines
10/15	7	5.1	Numerical Differentiation
10/20	8	5.2	Numerical Integration
10/22	8	5.3	Romberg Integration and Richardson Extrapolation
10/27	9	5.5	Gaussian Quadrature
10/29	9		Review for Exam 2
11/3	10		Exam 2
11/5	10	6.1	Ordinary Differential Equations - Basics, Direction Fields
11/10	11	6.1-6.2	Ordinary Differential Equations - Euler's Method and its Error Analysis
11/12	11	6.2	Ordinary Differential Equations - Taylor Series Methods
11/17	12	6.3	Ordinary Differential Equations - Systems of ODEs
11/19	12	6.4	Ordinary Differential Equations - Runge Kutta Methods
11/24	13	6.6	Ordinary Differential Equations - Stiff Equations, Stability and Implicit Methods
12/1	14	6.7	Ordinary Differential Equations - Multi-Step Methods and Stability
12/3	14	7.1	ODE-Boundary Value Problems - Shooting Method

12/8	15	7.2	BVP Finite Differences
12/10	15		Review for Final Exam and Miscellaneous Topics
Finals	FINAL EXAM WEEK: 12/15 to 12/21		

*Updated by Professor S. Jiang and Y.N. Young - 9/1/2020  
Department of Mathematical Sciences Course Syllabus, Fall 2020*

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