MATH 340: Applied Numerical Methods
Spring 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 340-002	Professor B. Bukiet
Math 340-004	Professor B. Bukiet

Class meetings	Mondays in FMH 408 and Wednesdays in Weston LH 2 1:00 pm–2:20 pm Lab: Fridays 10:00-11:20 am (in PC40) or 1:00 pm – 2:20 pm (in PC 39)
Professor contact information:	Bruce Bukiet Office: Cullimore Hall 603 or 206 C Phone: 973-596-8392 Email: bukiet@njit.edu

	Office Hours: Monday 10:00-11:30 am; Wednesday 2:30 pm - 4:00 pm and by appointment

Office Hours for All Math Instructors: Spring 2024 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 1, 2024**. 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.

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	
Midterm Exam II	
Midterm Exam III	
Midterm Exam IV	
Final Exam Period	May 3 - May 9, 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: Spring 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 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 2024 Academic Calendar, Registrar)

Date	Day	Event
January 16, 2024	Tuesday	First Day of Classes
January 22, 2024	Monday	Last Day to Add/Drop Classes
March 10, 2024	Sunday	Spring Recess Begins
March 16, 2024	Saturday	Spring Recess Ends
March 29, 2024	Friday	Good Friday - No Classes
April 1, 2024	Monday	Last Day to Withdraw
April 30, 2024	Tuesday	Friday Classes Meet
April 30, 2024	Tuesday	Last Day of Classes
May 1, 2024	Wednesday	Reading Day 1
May 2, 2024	Thursday	Reading Day 2
May 3 - May 9, 2024	Friday to Thursday	Final Exam Period

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

Date	Lecture	Sections	Topic

1/17	1		Introduction to the Course, Class Dynamics, Guidelines for Success
1/19	Lab 1		Lab session 1: MATLAB basics; Series
1/22	2	1.1	Bisection Method (prior knowledge IVT, MVT)
1/24	3	1.3, 1.5	Forward and Backward Error and Secant Method / Regula Falsi
1/26	Lab 2		Lab session 2: Bisection and/or Secant Method
1/29	4	1.4	Newton's Method and Error
1/31	5	1.2	Fixed Point Iteration: Fixed Point Error considerations (prior knowledge: Taylor Series)
2/2	Lab 3		Lab session 3: Newton's Method and Fixed point iteration
2/5	6	notes	Higher order iteration and Accelerating convergence
2/7	7	4.1-4.2	Review for Exam 1 and start Least Squares
2/9	Lab 4		Lab 4: Accelerating convergence and Higher order iteration
2/12	8		Exam 1
2/14	9	4.1-4.2	Least Squares
2/16	Lab 5		Lab session 5: Least Squares
2/19	10	3.1-3.2	Polynomial Interpolation; Lagrange Polynomials and error
2/21	11	3.3	Chebyshev Polynomials
2/23	Lab 6		Lab session 6: Lagrange and Chebyshev Polynomials
2/26	12	3.4	Cubic Splines
2/28	13		Review for Exam 2

3/1	Lab 7		Lab session 7: Cubic Splines
3/4	14		Exam 2
3/6	15	5.1	Numerical Differentiation
3/8	Lab 8		Lab session 8: Numerical Differentiation
3/18	16	5.2	Numerical Integration
3/20	17	5.3	Romberg Integration and Richardson Extrapolation
3/22	Lab 9		Lab session 9: Numerical Integration and Richardson Extrapolation
3/25	18	5.5	Gaussian Quadrature
3/27	19	6.1	Review for Exam 3; Ordinary Differential Equations - Euler's Method
3/29	No Lab		Good Friday
4/1	20		Exam 3
4/3	21	6.2	Taylor Series Methods
4/5	Lab 10		Lab session 10: Euler's Method and Taylor Series Methods
4/8	22	6.4	Ordinary Differential Equations – Runge Kutta Methods
4/10	23	6.3	Ordinary Differential Equations – Systems of ODEs
4/12	Lab 11		Lab session 11: Runge Kutta Methods and Systems of ODEs
4/15	24	6.6	Ordinary Differential Equations –Stability of One Step Methods including Implicit Methods
4/17	25	6.7	Ordinary Differential Equations – Multi-Step Methods and Stability
4/19	Lab 12		Lab session 12: Implicit Methods, Multistep methods and Stability

4/22	26		Review for Exam 4 and Miscellaneous Topics
4/24 Passover	27		Exam 4
4/26	Lab 13		Lab session 13: Lab combining some earlier methods
4/29 Passover	28		Review for Final Exam and Miscellaneous Topics
4/30	Lab 14		Friday Schedule – Last day of class - Makeup or Extra Credit Lab
5/3 - 5/9			FINAL EXAM WEEK

Updated by Professor B. Bukiet - 12/20/2023
Department of Mathematical Sciences Course Syllabus, Spring 2024