NJIT New Jersey's Science & Technology University

THE COLLEGE OF SCIENCE AND LIBERAL ARTS

THE DEPARTMENT OF MATHEMATICAL SCIENCES

# MATH 614: Numerical Methods I
## *Spring 2016 Graduate 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**: Theory and techniques of scientific computation, with more emphasis on accuracy and rigor than Math 611. Machine arithmetic. Numerical solution of a linear system and pivoting. Interpolation and quadrature. Iterative solution of nonlinear systems. Computation of eigenvalues and eigenvectors. Numerical solution of initial- and boundary-value problems for systems of ODEs. Applications. The class includes examples requiring student use of a computer.

**Number of Credits**: 3

**Prerequisites**: Math 222, Math 337, Math 340, and proficiency in a computer language (FORTRAN, C, or C++), or departmental approval.

**Course-Section and Instructors**

| Course-Section | Instructor |
|---|---|
| Math 614-002 | Professor B. Froese |

**Required Textbooks**:

| | |
|---|---|
| **Title** | *An Introduction to Numerical Analysis* |
| **Author** | Atkinson |
| **Edition** | 2nd |
| **Publisher** | John Wiley & Sons, Inc. |
| **ISBN #** | 0-471-62489-6 |

**University-wide Withdrawal Date**: Please note that the last day to withdraw with a **W** is **March 28, 2016**. It will be strictly enforced.

## COURSE GOALS

**Course Objectives**: Students will gain experience in developing, analyzing, and implementing common

numerical methods for a range of mathematical problems.

**Course Outcomes**

- Students should gain an understanding of common numerical methods.
- Students should know how to apply numerical methods to various mathematical problems.
- Students should have an improved ability to derive and program numerical methods.

**Course Assessment**: Outcomes are assessed through homework assignments, a midterm exam, and a comprehensive final exam.

## 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** | 40% |
| **Midterm Exam** | 30% |
| **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** | 0 - 59 |
| **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/projects will be given frequently; some will involve writing computer programs in a computer language such as C, FORTRAN, or Matlab. Each assignment must be handed in at the beginning of class. Late assignments are NOT accepted.

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

| | |
|---|---|
| Midterm Exam | March 11, 2016 |
| Final Exam | May 6 - 12, 2016 |

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**: To properly report their absence during a midterm or final exam, please review the required steps under the DMS Examination Policy found here:

- http://math.njit.edu/students/policies_exam.php

**Cellular Phones**: All cellular phones and other electronic devices must be switched off during all class times.

## ADDITIONAL RESOURCES

**Accommodation of Disabilities**: NJIT is committed to providing students with documented disabilities equal access to programs and activities. If you have, or believe that you may have, a physical, medical, psychological, or learning disability that may require accommodations, please contact the Coordinator of Student Disability Services located in the Center for Counseling and Psychological Services, in Campbell Hall, Room 205, (973) 596-3414. Further information on disability services related to the self-identification, documentation and accommodation processes can be found on the webpage at:

- http://www.njit.edu/counseling/services/disabilities.php

**Important Dates** (See: Spring 2016 Academic Calendar, Registrar)

| Date | Day | Event |
|---|---|---|
| January 19, 2016 | T | First Day of Classes |
| January 25, 2016 | M | Last Day to Add/Drop Classes |
| March 13 - 20, 2016 | Su - Su | Spring Recess - No Classes, University Open |
| March 25, 2016 | F | Good Friday - No Classes, University Closed |
| May 3, 2016 | T | Friday Classes Meet/ Last Day of Classes |
| May 4 & 5, 2016 | W & R | Reading Days |
| May 6 - 12, 2016 | F - R | Final Exam Period |

# Course Outline

| Week | Chapter | Topic |
|---|---|---|
| Week 1 | Chapter 1: | Taylor Theorem and Errors |
| Week 2 | Chapter 2: | Rootfinding for Nonlinear Equations |
| Week 3 | Chapters 3 & 4: | Interpolation Theory and Approximation of Functions |
| Week 4 | Chapters 3 & 4: | Interpolation Theory and Approximation of Functions (cont.) |
| Week 5 | Chapters 3 & 4: | Interpolation Theory and Approximation of Functions (cont.) |
| Week 6 | Chapter 5: | Numerical Integration |
| Week 7 | Chapter 5: | Numerical Integration (cont.) |
| Week 8 | └▶ | **REVIEW FOR MIDTERM EXAM** |
| | └▶ | **MIDTERM EXAM: MARCH 11, 2016** |
| Week 9 | └▶ | **SPRING RECESS: MARCH 13 - 20, 2016** |
| Week 10 | Chapter 6: | Numerical ODE |
| Week 11 | Chapter 6: | Numerical ODE (cont.) |
| Week 12 | Chapter 6: | Numerical ODE (cont.) |
| Week 13 | Chapters 8 & 9: | Numerical Linear Algebra |
| Week 14 | Chapters 8 & 9: | Numerical Linear Algebra (cont.) |
| Week 15 | Chapters 8 & 9: | Numerical Linear Algebra (cont.) |