

MA 402 Course Syllabus

MA 402 – Mathematics of Scientific Computing

Section 001

FALL 2017

3 Credit Hours

Course Description

This course will provide an overview of methods to solve quantitative problems and analyze data. The tools to be introduced are mathematical in nature and have links to Algebra, Analysis, Geometry, Graph Theory, Probability and Topology. Students will acquire an appreciation of (I) the fundamental role played by mathematics in countless applications and (II) the exciting challenges in mathematical research that lie ahead in the analysis of large data and uncertainties. Students will work on a project for each unit. While this is not a programming class, the students will do some programming through their projects.

Learning Outcomes

Overview of the mathematical aspects of methods of scientific computation.

Course Structure

Lectures

Course Policies

Distracting/annoying/rude behavior will not be tolerated.

Instructor

Pierre Gremaud – *Instructor*

Email: <mailto:gremaud@ncsu.edu>

Web Page: <http://www.math.ncsu.edu/~gremaud>

Office Location: Sas Hall 3214

Office Hours: Tu: 11:00-12:00, W: 11:00-12:00, or by appointment.

Lecture

Days: MW

Time: 1:30pm – 2:45pm

Campus: Main

Location: SAS 2106

This meeting is required.

Course Materials

Textbooks

1. Numerical Matrix Analysis: Linear Systems and Least Squares, Ilse Ipsen, <http://catalog.lib.ncsu.edu/record/NCSU2514760>

2. Spectral Methods in MATLAB, Lloyd N. Trefethen,
<http://catalog.lib.ncsu.edu/record/NCSU3109090>

3. Scientific Computing with Case Studies, Dianne P. O'Leary,
<http://catalog.lib.ncsu.edu/record/NCSU3551273>

4. The elements of statistical learning, Trevor Hastie, Robert Tibshirani, Jerome Friedman, <http://catalog.lib.ncsu.edu/record/NCSU2375350>

All of these texts have electronic versions that are available for free through the NCSU library, see the links above.

Expenses

None.

Materials

None.

Requisites and Restrictions

Prerequisites

(MA 341 or MA 405) and programming proficiency (MATLAB, C++, Java, Fortran, or other language)

Co-requisites

None.

Restrictions

None.

General Education Program (GEP) Information

GEP Category

This course does not fulfill a General Education Program category.

GEP Co-requisites

This course does not fulfill a General Education Program co-requisite.

Transportation

This course will not require students to provide their own transportation. Non-scheduled class time for field trips or out-of-class activities is NOT required for this class.

Safety & Risk Assumptions

None.

Grading

Grade Components

ComponentWeightDetails		
Projects	60	Work may be done individually or in groups of at most 3. Projects have to be turned in on time and written in a professional fashion (typesetting is strongly suggested but not required).
Quizzes	20	Given at the beginning of class each Wednesday, the questions will be based on homework problems.
Final exam	20	Closed book, comprehensive.

Letter Grades

This Course uses Standard NCSU Letter Grading:

97≤**A+** ≤100
 93≤**A** <97
 90≤**A-** <93
 87≤**B+** <90
 83≤**B** <87
 80≤**B-** <83
 77≤**C+** <80
 73≤**C** <77
 70≤**C-** <73
 67≤**D+** <70
 63≤**D** <67
 60≤**D-** <63
 0 ≤**F** <60

Requirements for Credit-Only (S/U) Grading

In order to receive a grade of S, students are required to take all exams and quizzes, complete all assignments, and earn a grade of C- or better. Conversion from letter grading to credit only (S/U) grading is subject to university deadlines. Refer to the Registration and Records calendar for deadlines related to grading. For more details refer to <http://policies.ncsu.edu/regulation/reg-02-20-15>.

Requirements for Auditors (AU)

Information about and requirements for auditing a course can be found at <http://policies.ncsu.edu/regulation/reg-02-20-04>.

Policies on Incomplete Grades

If an extended deadline is not authorized by the instructor or department, an unfinished incomplete grade will automatically change to an F after either (a) the end of the next regular semester in which the student is enrolled (not including summer sessions), or (b) the end of 12 months if the student is not enrolled, whichever is shorter. Incompletes that change to F will count as an attempted course on transcripts. The burden of fulfilling an incomplete grade is the responsibility of the student. The university policy on incomplete grades is located at <http://policies.ncsu.edu/regulation/reg-02-50-3>.

Late Assignments

Late work will be given a grade of 0.

Attendance Policy

For complete attendance and excused absence policies, please see <http://policies.ncsu.edu/regulation/reg-02-20-03>

Attendance Policy

Attendance is mandatory.

Absences Policy

To be discussed on case by case basis.

Makeup Work Policy

No make up for late work (and grade of 0).

Additional Excuses Policy

None.

Academic Integrity

Academic Integrity

Students are required to comply with the university policy on academic integrity found in the Code of Student Conduct found at <http://policies.ncsu.edu/policy/pol-11-35-01>

Academic Honesty

See <http://policies.ncsu.edu/policy/pol-11-35-01> for a detailed explanation of academic honesty.

Honor Pledge

Your signature on any test or assignment indicates "I have neither given nor received unauthorized aid on this test or assignment."

Electronically-Hosted Course Components

There are no electronically-hosted components for this course.

Accommodations for Disabilities

Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, student must register with the Disability Services Office (<http://www.ncsu.edu/dso>), 919-515-7653. For more information on NC State's policy on working with students with disabilities, please see the Academic Accommodations for Students with Disabilities Regulation at <http://policies.ncsu.edu/regulation/reg-02-20-01>.

Non-Discrimination Policy

NC State University provides equality of opportunity in education and employment for all students and employees. Accordingly, NC State affirms its commitment to maintain a work environment for all employees and an academic environment for all students that is free from all forms of discrimination. Discrimination based on race, color, religion, creed, sex, national origin, age, disability, veteran status, or sexual orientation is a violation of state and federal law and/or NC State University policy and will not be tolerated. Harassment of any person (either in the form of quid pro quo or creation of a hostile environment) based on race, color, religion, creed, sex,

national origin, age, disability, veteran status, or sexual orientation also is a violation of state and federal law and/or NC State University policy and will not be tolerated. Retaliation against any person who complains about discrimination is also prohibited. NC State's policies and regulations covering discrimination, harassment, and retaliation may be accessed at <http://policies.ncsu.edu/policy/pol-04-25-05> or http://www.ncsu.edu/equal_op/. Any person who feels that he or she has been the subject of prohibited discrimination, harassment, or retaliation should contact the Office for Equal Opportunity (OEO) at 919-515-3148.

Course Schedule

NOTE: The course schedule is subject to change.

Section 1: Floating Point Arithmetic (O'Leary)

Section 2: Monte Carlo Methods (O'Leary)

Section 3: Fourier Analysis (Trefethen)

Section 4: Singular Value Decomposition (Ipsen)

Section 5: Regression and Classification Trees (Hastie)

Section 6: Clustering (Hastie)