MA 510: Selected Topics (Mathematical Modeling)

Spring 2026 Course Syllabus

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Course Information

- **Instructor:** TBD
- **Email:** [Email me at TBD](#)
- **Office:** TBD
- **Office Hours:** TBD
- **Course Modality:** This course is an online, asynchronous Distance Education course.
- **Course website:** Find our course on [NC State Wolfware.](#)
- **Section:** 601

Course Description

(3 credit hours) Coverage of various topics in mathematics of concern to secondary teachers. Topics selected from areas such as mathematics of finance, probability, statistics, linear programming and theory of games, intuitive topology, recreational math, computers and applications of mathematics. Course may be taken for graduate credit for

certification renewal by secondary school teachers. Credit towards a graduate degree may be allowed only for students in mathematics education.

Prerequisite: Graduate standing

Learning Objectives

Upon completion of this course, students will be able to:

(CO1) Describe the mathematical modeling process and its applications.

(CO2) Identify and use mathematical theory and concepts to construct models.

(CO3) Select and implement an appropriate mathematical model given data.

(CO4) Analyze a mathematical model to make forecasts, predictions, and recommendations, and present the results in writing.

(CO5) Visualize data and models with numerical software.

Course Structure

This online course delivers all learning materials, activities, and assignments, through Moodle, a secure and easy-to-use online learning platform. The course is completely asynchronous, which means that students have no real-time class meeting requirements.

Learning activities include interactive video lectures, Moodle quizzes, a Piazza discussion forum, written homework assignments, coding exercises in MATLAB, and two examinations. In a typical week, this course will consist of three interactive video lectures per week with a weekly quiz.

Certain lecture activities (for example, those about MATLAB, and the activity on Pooled Testing) are self-paced explorations with shorter or no video. Each student works through the material with demonstrations and examples. Students must view the MATLAB activity lectures to gain completion for those tasks. The Pooled Testing assignment is counted towards the Homework score.

Lecture Materials

The lectures in this course are interactive, and you earn a score on each. At a minimum, each recorded lecture

- contains pop-up questions (look for the little open bubbles along the timeline), and

- concludes with summary statements (you choose the correct statement out of two).

These lectures scores are worth 5% of your grade. However, these are formative assessments, not summative assessments, and therefore scores are curved so that an 80%+ average in Moodle is a perfect score. My hope is that you will find that the questions highlight major concepts and improve your understanding–they were written to guide you, not to test you. Some of these questions pop-up automatically, while others must be clicked on (typically look for a purple indicator or open circle both on the slides and along the progress bar).

I recommend you only begin a lecture if you can fully commit your attention to it. Note that you can pause and return at a later time. You can also speed up the pace of the lecture up to 2x speed. If you start a lecture and finish it at a later time, correct answers for pop-up questions may erroneously be stored as 0 points when you submit your answers. However, you should only bring this to my attention if your score is less than 80% after completing the unit. The 20% buffer (anything between 80-100% is a perfect score) allows for some of these mishaps.

At the end of each lecture, you will go to the **Summary & submit** page to review your score and submit your grade to the gradebook. Each lecture has slides and bookmarks to allow you to quickly reach content you wish to review.

You may watch the videos directly in YouTube if you prefer. However, you must answer the pop-up questions in Moodle to get points towards your course grade. Thus you should not exclusively watch the course content in YouTube.

Communication and Getting Help

Forum

We will use **Piazza** for class discussion and homework questions. You are encouraged to use Piazza to discuss concepts and homework with discretion-hints and suggestions are okay, but full solutions will be deleted. You can post under your name or you may be anonymous to your classmates; however, the instructor will be able to see who you are. Please be respectful of your fellow classmates' ideas and attempts. If you have a math question you are not sure should be a public post, it is better to send me a direct message as a private post on Piazza.

Enroll in this class Piazza through the Piazza link near the top of Moodle.

Request: when asking a question about a specific item (like an item in Moodle), please include a direct link to that item (e.g. the Moodle url). It helps everyone answer your question a lot faster.

Email

Email may be used for confidential and private discussions about grades, scheduling office hours, etc. In general, I may not respond to email outside of business hours (M-F, 9am-5pm). It may take 24-72 hours for me to respond to an email. Please include MA 510 in the subject of the email. Math questions are best asked in office hours or on our on forum, not by email.

Homework

There are three types of homework in this class: Moodle quizzes (completed entirely in Moodle), MATLAB exercises (all due at the end of the semester), and written homework. Remark: You are responsible for keeping track of quiz, homework, and exam due dates. I will not necessarily send out due date reminders.

Quizzes

There are weekly ~45-minute quizzes on Moodle for each section in each module. Quizzes will require you to demonstrate knowledge of definitions and theorems. You may be asked to provide specific statements and will be evaluated based on correct and precise wording; using a computer is likely more convenient than using a phone for the quizzes. Although the quizzes are open notes/open book, your success in the course is closely linked to your familiarity with the terminology–heavy dependence during the quizzes on notes/books is discouraged.

On most quizzes you have two attempts per problem and one overall submission (so do not submit the entire quiz until you are done with each question). If your first attempt on a question is not correct, you can click on your answer and reattempt the question.

You can start a quiz, answer a few questions, close your browser, and resume later on a different device. You do not need to complete the quiz in one sitting. You also do not need to formally "submit" the quiz–Moodle will submit it on your behalf at the deadline.

MATLAB Exercises

In this class, we will learn to use some of the tools in the mathematical software MATLAB. This program will allow us to effectively visualize and analyze data and mathematical models. The goal is to pick up a new skill. Please do ask me for help if you are struggling with MATLAB! I am happy to help you become more comfortable with the program.

Written Homework

There are is a written homework set for each of Modules 1-3, and an extensive Moodle quiz for Module 4 (in lieu of a written assignment). For each homework, you will need to first choose a "group." However, you may work in a group of 1 if you wish. If you work with 2-3 other students, then only one person should submit the assignment.

Written homework assignments give you a chance to write-up full mathematical solutions. Your work will be assessed not only for the correctness of the final answer but also the supporting justification. All homework assignments are posted on Moodle and are due by 11pm (Eastern) on the posted due date. You may turn in homework early.

Homework should be submitted online as a single PDF file through the Assignment link posted on Moodle. You may typeset your homework in LATEX (and submit the PDF, not the tex file) or scan your homework and turn it into a PDF. You may find "Save as PDF" or "Print to PDF" useful. Let me know on Piazza if you need assistance converting your homework to a PDF file. Scans which are too large, rotated, or blurry may need to be re-submitted without penalty.

When your homework has been graded, you will receive a notification from Moodle. Go to the assignment on Moodle to see your score and feedback. After your assignment is graded, you will be able to see selected homework solutions posted underneath the assignment on Moodle.

Test Information

There are two take-home examinations, each covering two modules. The final may include earlier topics from the first two modules which the second two build upon.

Each examination is set up as a timed Moodle quiz consisting of some auto-graded questions and some free response questions. These tests are intended like "take-home" tests and will be self-proctored. Students are permitted to use their notes and class resources, but not the general internet or consult with others.

Test Dates

- Test 1: TBD
- Test 2: TBD
- Test 3: TBD
- Final Exam: TBD

Calculators

You may use graphing calculators on exams, provided they have no CAS (computer algebra system) capabilities and no internet access.

See the Moodle guide Calculator Guidelines for a list of appropriate calculators. If you are on-campus, you may rent a suitable calculator from the NC State Libraries: [Calculator rentals at NC State Libraries](#).

Classroom Expectations

1. **Course Structure:** This is an online class; you are responsible for your own learning and for pacing yourself within course guidelines.

   ◦ Watch the video lectures scheduled each week and follow the Course Calendar.
   ◦ Track all due dates in Moodle and on the Course Calendar.
   ◦ Complete all assignments in a timely fashion.
   ◦ Post your math questions in the course forum for discussions and Q&A.
   ◦ Optional: attend live sessions.

2. **Communication and announcements:** Please check your email, the course forum, and the Moodle site regularly. All announcements sent by email will also be saved under Announcements on Moodle. You are responsible for knowing the content of course emails.

3. **Respect and professionalism:** Treat everyone in class (students and instructor) with respect and courtesy. Be active and prepared in any live sessions. Come to office hours ready to ask questions and communicate with others.

4. **Accountability:** You are responsible for resolving any confusion about assignments, due dates, exams, accommodations, etc., in a prompt manner.

5. **Academic integrity:** Do not submit work that is not yours. It is understood that your name on any assignment indicates your adherence to the NC State Honor Pledge: "I have neither given nor received unauthorized aid on this test or assignment."

6. **Exam device policy:** Review the permitted items before each exam. Keep phones and other forbidden devices powered off and stored away during exams to avoid accidental use.

Student Success

Student well-being is important to success at NC State. Every student, faculty member, and staff member enriches the community through varied perspectives, knowledge, and experience. Our classroom should be a space where every student is respected and heard.

In an effort to affirm and respect the identities of all students in the classroom and beyond, please contact me if you wish to be referred to using a name and/or pronouns other than those listed in the student directory.

I welcome any suggestions you have for making our classroom more welcoming.

Grading

Grade Weighting and Numerical Conversion

Your grade will be determined by the following breakdown:

- Lectures[1], 5%
- Written Homework, 20%
- Quizzes, 25%
- Test 1, 25%
- Test 2, 25%

[1] *Due to Moodle incorrectly storing some lecture activity scores, lecture scores are scaled so that getting 80%+ is a perfect score.*

Grades are tracked in real-time in the Moodle **Gradebook**.

Conversion from Numerical Grade to Letter Grade

A student's numerical average will be converted to a letter grade as follows (do not expect any additional rounding, extra credit, or curves):

Standard Conversion Table

Grade	Range
A+	97-100
A	93-96.99
A-	90-92.99
B+	87-89.99

Grade	Range
B	83-86.99
B-	80-82.99
C+	77-79.99
C	73-76.99
C-	70-72.99
D+	67-69.99
D	63-66.99
D-	60-62.99
F	0-59

Requirements for Credit-Only (S/U) Grading

In order to receive a grade of S, students are required to take all exams, 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 REG 02.20.15 - Credit-Only Courses.

It is the student's responsibility to check if an S grade gives progress towards their degree(s).

Requirements for Auditors (AU)

Information about and requirements for auditing a course can be found at REG 02.20.04 - Audits.

Policies on Incomplete Grades

NC State Policy

At the discretion of the instructor, students may be given an IN grade for work not completed because of a serious interruption in their work not caused by their own negligence. An IN must not be used, however, as a substitute for an F when the student's performance in the course is deserving of failing. An IN is only appropriate when the student's record in the course is such that the successful completion of particular assignments, projects, or tests missed as a result of a documented serious event would enable that student to pass the course.

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. See the university policy on incomplete grades: [REG 02.50.03 - Grades and Grade Point Average.](#)

Course Schedule

The course schedule is tentative and subject to change. Adjustments may be made to accommodate the pace of the class and unforeseen circumstances. All major changes will be announced in class and posted on Moodle.

- [Course Calendar (HTML)](#)
- [Course Calendar (PDF)](#)

Important Dates

For holidays and other university closures, please consult [the general NC State Academic Calendar.](#)

Your final exam schedule is already determined; find it here: [NC State Final Exam Calendar.](#) You are responsible for reviewing your final exam sessions to arrange a suitable time for this course.

List of Topics

Here are the major topics of MA 510, with the approximate regular-semester time allocated to each:

- Module 1: Introduction to Modeling. Major topics include building and comparing simple models (especially exponential and logistic growth), interpreting real-world data, and using basic Matlab/Octave tools to create plots and fit curves. *(approximately 3.5 weeks)*
- Module 2: Methods in Modeling. Major topics include least squares curve fitting, proportionality, dimensional analysis, and discrete-time models based on difference equations. *(approximately 3 weeks)*
- Module 3: Modeling with Calculus (First-Order Differential Equations). Major topics include first-order differential equations, equilibrium solutions, stability, and the way parameters change qualitative behavior in applied models. *(approximately 3 weeks)*

- Module 4: Modeling Interactions. Major topics include systems of differential equations (such as predator–prey and epidemic models), transition matrices, Markov chains, and applications like pooled testing and PageRank-style processes. *(approximately 3 weeks)*

Additional Information

Student Expenses

Late Assignments

Generally no late assignments are accepted in this course. Please plan your work carefully and submit assignments by their stated deadlines. Extensions may be occasionally granted by the instructor for extenuating circumstances, which are best documented with [NC State Absence Verification.](#)

For longer-term, recurring, or more serious illness or other interruptions to your participation in this class, you should reach out to your instructor as soon as you can.

Late Examinations

Excused absense. If an exam is missed with an excused absence (that is, for a university-approved reason with supporting documentation), then a make-up test will be scheduled individually. The make-up test may contain different questions and be assessed differently than the regular test. Documentation for an excused absence must be provided within 1 week of the missed class. All absences that require a make-up exam or other special accommodations must go through the NC State University absence verification process. Here is the link to that office: [NC State Absence Verification.](#)

Failure to schedule. You must schedule exams in a timely fashion to guarantee that you will be able to take them. It is the instructor's discretion whether a make-up exam will be allowed if you are not able to schedule an exam appointment within the selected time frame. If the instructor approves a make-up exam, there may be a 10% penalty on that exam. The make-up test may contain different questions and be assessed differently than the regular test.

Other absences. If an exam is missed for an unexcused absence, that exam will be given a score of 0.

Attendance

Since this course is an asynchronous online course, there is no daily attendance. Instead, each student's participation in Moodle is tracked to check for regular activity. For complete attendance and excused absence policies, please see Attendance Regulations (NCSU REG 02.20.03).

Academic Integrity

Students are required to comply with the university policy on academic integrity found in the Code of Student Conduct (NCSU POL11.35.01). Your submission of any exam indicates "I have neither given nor received unauthorized aid on this test or assignment." Violations of academic integrity will be handled in accordance with the Student Discipline Procedures (NCSU REG 11.35.02).

Posting any course material to websites like Chegg, ChatGPT, and Course Hero is a violation of copyright law and course policy and is strictly prohibited. Violations of this policy will be reported to the Office of Student Conduct.

- Tests: Proctored tests are closed book assessments. You may not consult any internet resources nor receive help from anyone else. Do not share information about the content on the exams with anyone else in the class. See the calculator policy in the Test Information section of this syllabus.
- Homework: You may consult your notes, the textbook, each other, or online resources.
- Forum discussion boards: You are encouraged to discuss mathematical concepts and problems with your classmates. However, you must arrive at your own solutions with your own work. Do not seek nor state final answers on the forum; focus on understanding the concepts.

Disability Resources

Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, students must register with the Disability Resource Office at Holmes Hall, Suite 304, 2751 Cates Avenue, Campus Box 7509, 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 (NCSU REG 02.20.01).

Digital Course Components

Because of the way our course is structured, students need internet connectivity in order to read course materials and complete assignments. NC State's Online and Distance

Education provides [technology requirements and recommendations](#) for computer hardware.

For access to computing hardware, please see the NC State University Libraries [Technology Lending](#) and the general [Library Computing resources](#). There are several computers available for use around campus, including in the [Mathematics Tutoring Center](#).

Digitally hosted course components will include but are not limited to Moodle and Zoom.

Software

There are several resources available to assist students with technical or computer issues. Please consult [Office of Information Technology - NC State University](#).

Here are some of the primary applications commonly used in online mathematics courses:

- [Moodle and Wolfware](#): Our course is hosted online on Moodle, where you can find the course content, a link to this syllabus, and the gradebook.

    ◦ [Moodle Accessibility Statement](#)
    ◦ [Moodle Privacy Notice](#)
    ◦ [NC State WolfWare Privacy Statement](#)

- [Panopto](#): NC State uses Panopto for video hosting.

    ◦ [Panopto Accessibility Features](#)
    ◦ [Panopto Privacy Policy](#)
    ◦ [Panopto Support](#)

- [Piazza](#): this site hosts our class forum. You will use **Piazza** to ask questions regarding the lecture or homework.

    ◦ [Piazza Accessibility Statement](#)
    ◦ [Piazza Privacy Policy](#)
    ◦ [Piazza Support Center](#)

- [Google Meet](#): when needed.

    ◦ [Google Meet Accessibility features](#)
    ◦ [Google Meet Security and Privacy](#)
    ◦ [Google Meet Help](#)

- [Zoom](#): when needed.

    ◦ [Zoom Accessibility Statement](#)

- ◦ [Zoom Privacy Policy](#)
- ◦ [Zoom Support](#)

- • [Gradescope](#): We will use Gradescope for collecting and returning written work.

  - ◦ [Gradescope Accessibility Information](#)
  - ◦ [Gradescope Privacy Policy](#)
  - ◦ [Gradescope Help Center](#)

- • [MathWorks](#): We will use MathWorks MATLAB for programming assignments.

  - ◦ [MATLAB Accessibility Statement](#)
  - ◦ [MATLAB Privacy Policy](#)
  - ◦ [MATLAB Support](#)

You must address the accessibility of these websites for yourself during the course drop/ add period. The instructor is not responsible for ensuring privacy or accessibility of electronic materials that are not required components of the course (e.g., links to supplemental information that is not part of the required reading list). However, the instructor will judiciously consider the privacy, copyright, and accessibility of supplemental links provided to students and warn them of any known issues or concerns in this regard. See Online Course Material Host Requirements ([NCSU REG 08.00.11](#)).

Electronically Hosted Components

Please be advised that live meetings for this course may be recorded for current and potential future educational purposes. By your continued participation in this recorded course, you are providing your permission to be recorded. If you would like for your likeness to be edited out of a recorded video, please contact me and I will edit the video accordingly.

Required Statement

Students may be required to disclose personally identifiable information to other students in the course, via digital tools, such as email or web-postings, where relevant to the course. Examples include online discussions of class topics, and posting of student coursework. All students are expected to respect the privacy of each other by not sharing or using such information outside the course.

Additional NC State Rules and Regulations

Your rights and responsibilities

Students are responsible for reviewing the NC State University Policies, Rules, and Regulations (PRRs) which pertain to their course rights and responsibilities, including those referenced both below and above in this syllabus:

- Equal Opportunity and Non-Discrimination Policy Statement, [POL 04.25.05 - Equal Opportunity and Nondiscrimination Policy](#)
  with additional references at [NC State Office of Equal Opportunity](#)
- Code of Student Conduct, [POL 11.35.01 - Student Conduct](#)
- Grades and Grade Point Average, [REG 02.50.03 - Grades and Grade Point Average](#)
- Credit-Only Courses, [REG 02.20.15 - Credit-Only Courses](#)
- Audits, [REG 02.20.04 - Audits](#)

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

[POL 04.25.05 - Equal Opportunity and Nondiscrimination Policy](#) or [the Office of Equal Opportunity](#)

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.

Support

Everyone is encouraged to take care of themselves and their peers. If you need additional support, there are many resources on campus to help you:

1. [Counseling Center](#)
2. [Health Center](#)
3. [Share a Concern](#)
4. [Pack Essentials](#)

Course Evaluations

ClassEval is the end-of-semester survey for students to evaluate instruction of all university classes. The current survey is administered online and includes 12 closed-ended questions and 3 open-ended questions. Deans, department heads, and instructors may add a limited number of their own questions to these 15 common-core questions.

Each semester students' responses are compiled into a ClassEval report for every instructor and class. Instructors use the evaluations to improve instruction and include them in their promotion and tenure dossiers, while department heads use them in annual reviews. The reports are included in instructors' personnel files and are considered confidential.

Online class evaluations will be available for students to complete during the last two weeks of the semester for full semester courses and the last week of shorter sessions. Students will receive an email directing them to a website to complete class evaluations. These become unavailable at 8am on the first day of finals.

- [Contact ClassEval Help Desk](#)
- [ClassEval website](#)
- [Information about ClassEval and how the information is used](#)

Syllabus Modification Statement

Our syllabus represents a flexible agreement. It outlines the topics we will cover and the order we will cover them in. Minor changes in the syllabus can occur if we need to slow down or speed up the pace of instruction.

This syllabus was designed by Bevin Maultsby to meet the standards in REG 02.20.07 (Last Revised: May 27, 2020), found at [NC State REG 02.20.07 - Course Syllabus](#) according to the May 27, 2020 revision.

Department of Mathematics · NC State University