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MA 405-601 Spring 2026

Introduction to Linear Algebra Course Syllabus

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Course Information

- **Instructor:** Ian Bunner
- **Email:** [Email me at ikbunner@ncsu.edu](mailto:ikbunner@ncsu.edu)
- **Office:** SAS 3145/Zoom
- **Office Hours:** TBD
- **Course Modality:** This course is an online, asynchronous Distance Education course.
- **Course website:** Find our course on [NC State Wolfware](#).

Course Description

(3 credit hours) This course offers a rigorous treatment of linear algebra, including systems of linear equations, matrices, determinants, abstract vector spaces, bases, linear independence, spanning sets, linear transformations, eigenvalues and eigenvectors, similarity, inner product spaces, orthogonality and orthogonal bases, factorization of matrices. Compared with MA 305 Introductory Linear Algebra, more emphasis is placed on theory and proofs. MA 225 is recommended as a prerequisite. Credit is not allowed for both MA 305 and MA 405.

Prerequisite: MA 241 (MA 225 recommended); Corequisite: MA 341 is recommended.

Learning Objectives

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

1. **Use Mathematical Notation and Terminology** The students will demonstrate mastery in using the mathematical notation and terminology of linear algebra. Students will read, interpret, and use the vocabulary, symbolism and basic definitions.
 2. **Understand and Describe the Fundamental Concepts of Linear Algebra** Students will identify and apply the theorems about abstract vector spaces and linear transformations; will gain a clear understanding of the basic concepts of linear algebra, such as linear independence of vectors, spanning sets, basis, similarity, eigenvalues and eigenvectors.
 3. **Identify and Utilize Linear Algebra Tools** The students will be able to apply course material along with techniques and procedures covered in this course to solve problems. Students will master techniques for solving linear systems by various matrix methods, compute the determinant and the inverse of a square matrix, compute various factorizations of matrices, apply the Gram-Schmidt process, calculate and analyze the characteristic equation of a matrix to determine its eigenvalues and eigenvectors. Moreover, students will apply properties and theorems about vector spaces to specific mathematical structures that satisfy the vector space axioms, will analyze the differences and similarities between spanning sets, bases, and orthogonal bases and will use the knowledge gained in this course to determine appropriate methods of proof for specific problems.
 4. **Develop Cognitive Skills** Students will demonstrate the ability to reason with abstract linear algebra concepts, to read and comprehend mathematical arguments utilizing direct and indirect proof, case analysis, and mathematical induction. Students will develop familiarity with axiomatic approaches in mathematics through the study of vector spaces and linear transformations. They will acquire a level of proficiency in manipulating linear algebra concepts, in analyzing and evaluating their applicability in their future studies, including graduate work, in academic areas requiring linear algebra as a prerequisite for work in occupational fields requiring a background in linear algebra.
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Course Structure

Lecture Materials

Linear algebra provides one of the cornerstones for much of modern mathematics and has important applications in physics, engineering, and economics. The main purpose of this

course is to introduce the basic concepts from linear algebra, explain the underlying theory, the computational techniques, and study how these concepts and results can be productively used in other areas of mathematics and physical sciences, especially in applied mathematics where multivariable models are involved. Among the topics covered in this course will be: solving systems of linear equations using Gauss elimination, row echelon form, determinants, vector spaces, linear independence, bases, dimension, linear transformations, orthogonality, eigenvalues, and reduction of matrices to diagonal forms.

The subject involves a mixture of both the practical and the theoretical and will provide in particular a good introduction to mathematical proofs. For this reason, the course is considered to be a difficult one in undergraduate mathematics, and the student should be prepared to invest a considerable amount of time in understanding the class material and doing homework.

Course lectures were prepared and recorded specifically for this section of MA 405 by Dr. Alina Duca. They are hosted on Panopto, and students should access them through the course Moodle page. Note that Safari sometimes does not allow this, whereas Chrome and Firefox are more user friendly.

In this online asynchronous course, the video content is designed to approximate the 150 minutes of weekly contact time typical of a regular semester course. However, please note that the duration of video content may vary from week to week. Some weeks may feature more than 150 minutes of videos, while others may have less.

You may shift your viewing schedule each week to accommodate your own schedule. However, please keep in mind that this online, distance-education course is fast-paced, and it may become difficult to catch up if you fall behind.

Live sessions

TBD

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

Contact me for confidential and private discussions about grades, scheduling office hours, etc. Please include MA 405 in the subject line. In general, I may not respond to messages outside of business hours (M-F, 9am-5pm), and it may take 24-72 hours for me to respond to an message. Math questions are generally best asked in office hours or on our forum, not by email.

Tutoring Centers

During the regular school year, there is free help available on campus for MA 405. See the following links:

- [Math Tutoring Center \(MTC\)](#) in SAS 2105. This room has many computers available so that you can work on your assignments. The room is a low-stress environment: you may work quietly in the room without engaging a tutor, or you may ask questions of the graduate tutors when they are available.
- [Academic Success Center \(ASC\)](#) in D.H. Hill Library has a few options:
 - [ASC Drop-In Tutoring](#)
 - [ASC Appointment Tutoring](#)
 - [ASC Weekly Group Tutoring](#)

For Drop-In Tutoring hours, notice the MTC is open during the day, and the ASC is open in the evening.

Textbook and other resources

There is no required textbook for this course. However, several textbooks available through the NC State Libraries are good resources, and specific chapters will be recommended for each course unit. You can also find links to these resources on Moodle.

Recommended Textbooks

1. Most recommended:

Axler, S. (2015). *Linear Algebra Done Right*. Springer. [Library resource](#)

2. Olver, P. J., & Shakiban, C. (2018). *Applied Linear Algebra*. Undergraduate Texts in Mathematics. Springer. [Library resource](#)

3. Nair, M. T., & Singh, A. (2018). *Linear Algebra*. Springer. [Library resource](#)

4. Said-Houari, B. (2017). *Linear Algebra*. Compact Textbooks in Mathematics. Birkhäuser. [Library resource](#)
5. Chahal, J. S. (2019). *Fundamentals of Linear Algebra*. CRC Press, Taylor & Francis Group. [Library resource](#)

LaTeX Resources

LaTeX resources

The links below provide learning materials and software for LaTeX. Additional resources are located in Moodle.

- [Learning LaTeX — Griffiths & Higham \(NCSU library\)](#) — Library record for the book "Learning LaTeX".
- [LaTeX Project — software and documentation](#) — Official LaTeX distribution and documentation.
- [LaTeX Wikibook — comprehensive guide](#) — Community-maintained LaTeX reference and examples.
- [Getting started with LaTeX — primer \(Trinity College Dublin\)](#) — Introductory tutorial and examples.
- [MiKTeX — easy-to-install LaTeX for Windows](#) — Windows installer and documentation for MiKTeX.
- [Using TeX notation in Moodle forums](#) — Moodle documentation for inserting math with TeX.

Homework

There are two types of homework in this class: written assignments in Gradescope and computer-based assignments in WebWork. The links to all homework assignments are available in Moodle and grades will appear in the Moodle Gradebook.

WebWork

Homework assignments are posted in Moodle and completed in WeBWork (WW), an online homework system linked directly to Moodle. You must access each assignment through Moodle first in order for it to open correctly in WeBWork. All homework links are provided within the Moodle course page.

Please feel free to discuss the homework sets in a helpful and productive manner on the course forum.

Your lowest homework grade will be dropped. Use this drop wisely.

Written Assignments

You will need to upload your written or typed work to Gradescope. I will grade each assignment holistically in Gradescope, and you will receive an automated email when the assessments are finished. The due dates for Gradescope assignments are listed on Gradescope and in Moodle.

Your lowest written homework grade will be dropped. Use this drop wisely.

Test Information

Test Dates

- Test 1: Feb 9-11
- Test 2: Mar 9-11
- Test 3: Apr 13-15
- Final Exam: Apr 30-May 6

Proctors

All examinations will be proctored through DELTA. You will either take your exam with DELTA, or coordinate remote proctoring with DELTA, according to which situation best describes you:

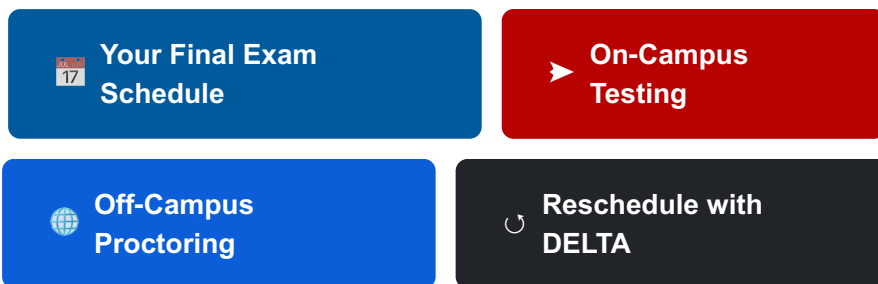
- If you live less than 50 miles away from Raleigh, NC, then you will take your tests on our campus through the Distance Education Testing Centers. Students should be mindful of closing hours for both Testing Centers, and give themselves plenty of time to complete their exams. For information, please visit [DELTA on-campus testing services](#).
- Those students who live more than 50 miles away from Raleigh, NC do not have to take their tests on NCSU campus. They may use a proctor in their town for testing. The proctor must be approved in advance through DELTA (not the instructor). It can take up to 1 week to verify a proctor and set up all needed contact info, so please do this early! Please visit the remote proctor website at [DELTA remote proctoring](#).

I encourage you to look through DELTA Testing Service's website, especially their [frequently asked questions \(FAQs\)](#).

Note: the word *remote* in this context means that you are using a professional testing site (for example, a testing center, a local library, a college, etc.) other than DELTA. Remote testing does not mean testing at home.

Quick Links

Please sign up your preferred time and date as soon as possible. Time slots fill up fast:



Calculators

Calculators are not permitted on exams.

Test Format

Each exam will be a written, in-person exam administered at an approved testing location. You must bring appropriate photo identification and any permitted materials specified in this syllabus and in my course announcements.

If you take the written exam at DELTA, then you will complete it on an iPad with an Apple Pencil.

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:

- WebWork Homework: 20%
- Written Homework: 20%
- Tests: 36% total (12% each)
- Final: 24%

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

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Grade	Range
B+	87-89.99
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](#)

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 405, with the approximate regular-semester time allocated to each:

- Unit 1: Vector Spaces (~3 weeks)
- Unit 2: Systems of Linear Equations and Matrices (~1 week)
- Unit 3: Linear Transformations (~2 weeks)
- Unit 4: Determinants and Similarity / Eigentheory (~3 weeks)
- Unit 5: Inner Product Spaces (~2 weeks)
- Unit 6: Least Squares Solutions and Symmetric Diagonalization (~1-2 weeks)

Course Continuity

To ensure course continuity, changes made to the method of instructional delivery, course structure, course schedule, number of assignments, grading or other aspects of the course after the start of the term will be communicated to all students in written form (e.g., by an instructor announcement) when course changes are implemented.

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 absence. 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](#)).

Students who receive accommodations are responsible for filing those accommodations officially with DRO before the tests occur. It is not appropriate to tell the instructor that you should receive accommodations without going through the official channels. The instructor will only adjust test conditions after receiving the official Accommodation Letter Notification from DRO. Adjustments are never made retroactively to past examinations.

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](#)
- [WebWork](#): We will use WebWork for online exercises.
 - [WebWork Accessibility Guide](#)
 - [WebWork Privacy Policy](#)
- [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](#)

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](#)

Required statement

This course engages diverse scholarly perspectives to develop critical thinking, analysis, and debate and inclusion of a reading does not imply endorsement. *This statement is required per [UNC Policy Manual 400.1.6](#), adopted 12/19/2025.*

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.