

Math 3510/3510H Syllabus

1. COURSE INFORMATION

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Book: **Shifrin, Multivariable Mathematics**

2. COURSE SCHEDULE

Topics	Sections	Course Meetings (planned)
Integrability and Partitions	7.1	1/12, 1/13
Fubini's Theorem	7.2	1/18, 1/19
Polar, Cylindrical, Spherical Coordinates	7.3	1/20, 1/25
Average, Center of Mass, Moment of Inertia	7.4	1/25, 1/26, 1/27
Determinants and their uses	7.5	2/1, 2/2, 2/3, 2/8
The Change of Variables Theorem	7.6	2/9
Multilinearity and Differential Forms	8.1/8.2	2/10, 2/15
Line Integrals and Green's Theorem	8.3	2/16, 2/17, 2/22, 2/24
Surface Integrals and Flux	8.4	3/1, 3/3 (virtual), 3/15
Midterm, Part 1.	(Chapter 7)	3/16
Midterm, Part 2.	(Chapter 7, 8.1 and 8.2)	3/17
Stokes' Theorem	8.5	3/22, 3/23, 3/24
Vector Fields and the Dictionary in \mathbb{R}^3	8.6	3/29, 3/30, 3/31
Topology of Domains in \mathbb{R}^3 and Hodge Theorem	8.7 and paper	4/5, 4/6, 4/7 (Extra)
Linear Transformations as Change of Basis	9.1	4/12
Eigenvalues, Eigenvectors, Diagonalizability	9.2	4/13, 4/14
Difference Equations, Matrix exponentiation	9.3	4/19, 4/20
Symmetric Matrices and the Spectral Theorem	9.4	4/21, 4/26
The Singular Value Decomposition	(Notes)	4/27, 4/28
PCA (and Face Recognition)	(Notes)	5/3
Final Exam (12:00pm-3:00pm), Boyd 303	Chapters 7-9	5/3 (Tuesday)

3. PREREQUISITES

Students are expected to have taken MATH 3500/3500H in the preceding semester. (Since this is the second half of a two part course, exceptions to this are extremely rare.) Students should be prepared for a very challenging and fast-paced theoretical course. Computer skills in Mathematica or similar symbolic computation environment (Sage or Maple) will also be helpful.

4. COURSE GOALS

Students will develop a deep understanding of multivariable integration, including determinants and the n -dimensional change of variables theorem. Students will learn the basics of differential forms and integration on manifolds, including line integrals and conservative vector fields, surface integrals and the flux theorem, and the general form of Stokes' theorem. Students should understand the consequences of Stokes' theorem in physics and topology. Students should understand eigenvectors and eigenvalues and the spectral theorem, as well singular values and the singular value decomposition. We hope to cover the basics of principal component analysis and independent component analysis.

5. DISCLAIMER

The syllabus is a general course plan, but deviations may become necessary over the course of the semester.

6. PRINCIPAL COURSE ASSIGNMENTS

The course will have a midterm and a final exam. Homework will be assigned using Gradescope, with course entry code X3627Y. Reading assignments will be an integral part of the course, with quizzes on the reading assignments given in class. These quizzes may be marked “excused”, but cannot be made up. Students with excused absences have the “homework and quiz” portion of their grade computed as if fewer quizzes had been assigned.

7. GRADING AND POLICIES, PEDAGOGY

This course mixes reading, lecture, and active learning instructional styles. Each class will be preceded by a reading assignment (with a quiz at the start of class designed to assess what you’ve learned from the reading). Class will mostly consist of an interactive lecture, with some group and individual in-class exercises. Out-of-class homework will complete the process, giving you harder problems to think and write about.

The overall course grade is computed from homework, exam, and final grades by the formula:

- (1) 25% for the midterm.
- (2) 35% for the final exam.
- (3) 30% for the homework assignments
- (4) 10% for the reading quizzes.

After grades are calculated for each student using these weights, the instructor will rank the students by average and determine thresholds for grades of A, B, C, D, and F. Generally, these are somewhat lower than 90%, 80%, 70%, and 60% of the total points in the course. Though improvement and other circumstances are taken into account in deciding thresholds for letter grades, students with a higher numerical average almost always receive higher letter grades than those with lower numerical averages.

In order to receive a grade of “WP”, you must have attended class regularly and turned in homework assignments representing a good faith effort for all homework assignments due before the date of withdrawal.

8. ATTENDANCE POLICY

Students are expected to attend class regularly unless they have a medical or pandemic-related reason to miss class. Students who miss more than 3 classes (one full week of class) with no excuse may be withdrawn from the course by the instructor.

9. ACADEMIC HONESTY

As a University of Georgia student, you have agreed to abide by the University’s academic honesty policy, “A Culture of Honesty,” and the Student Honor Code. All academic work must meet the standards described in A Culture of Honesty found at: www.uga.edu/honesty. Lack of knowledge of the academic honesty policy is not a reasonable explanation for a violation. Questions related to course assignments and the academic honesty policy should be directed to the instructor.

It is strongly encouraged to work on homework problems in groups in this course. However, the help you should get from your fellow students should enable you to complete the problem on your own. Recruiting another student to complete the homework for you, or to simply provide answers to the problems, is a violation of the honesty policy. If you really can’t figure out a problem, you’re encouraged to discuss it with the class and with the instructor. Looking up answers on the internet is a last resort. If you do, just cite your source (i.e. “The following solution is based on this discussion on MathOverflow (url)”) and try to write up the answer in your own words to make sure that you understand it. If you don’t cite the source, but try to represent the internet solution as your own unaided work, that is an academic honesty violation. More importantly, I will also be personally disappointed in you.

10. MAKE-UP EXAMINATIONS

No makeup examinations will be given in the course. You may be marked “excused” from an exam if you have an acceptable excuse for missing the exam (generally, these are medical or legal in nature). In this case, your grade on the other exam will count for 60% of the course grade. Students who are excused from both the midterm and the final will receive a course grade of “Incomplete”.

11. TENTATIVE PANDEMIC BACK-UP PLAN(S)

If the University must pivot away from in-class instruction mid-semester and the instructor is neither ill nor caring for ill family members, we will try to film and upload lectures with as many students present as are allowed in the room. Exams will still be given in person if possible, though we may have to schedule multiple seatings in order to meet room capacity requirements.