MA 242: Calculus III

Syllabus and Brochure, Spring 2023, 4 credits

Welcome to Calculus III. The subject of this course is "multivariable calculus". In earlier calculus courses you have taken, you have studied functions with an input x and output $f(x)$ like $f(x) = x^2$. Multivariable calculus investigates functions with several inputs like $g(x, y) = x^2 + y^3$ and applies the main ideas of calculus (differentiation and integration) in this setting. Along the way, we will learn to use three-dimensional geometry to help us understand these functions and vice versa. Simply put, multivariable calculus is calculus in 3-D.

Learning Outcomes

After taking this course, you will be able to apply the ideas of differential and integral calculus to multivariable functions, vector-valued functions, and vector fields, e.g. to find volumes and surface area, to answer multivariable optimization problems, and to calculate physical quantities like velocity, work, flux, and potential. You will learn how to work with, describe, and analyze geometric figures in three dimensions with the tools of calculus. You will see generalizations of the fundamental theorem of calculus to multivariable settings.

Teaching Staff

- Instructor of Record: Dr. Souradip Chattopadhyay – schatto5@ncsu.edu
- Teaching assistant: Yiling Wang – ywang327@ncsu.edu
- Teaching assistant: Kylan Schatz – kaschatz@ncsu.edu

Course Structure

(i) **Lecture:** The lecture component of this course will take place Mondays, Wednesdays, and Fridays at the assigned "Lec" time slot. Students are expected to attend and participate in polls and group discussions during the lecture time. Recordings of the lectures will be posted to Moodle. We will keep track of attendance through the participation in polls, but they are not counted as part of your grade.

(ii) **Recitation:** You have also signed up for a "Lab" component for this course that meets Tuesdays and Thursdays. These recitations are designed to give you practice with concepts and skills you learn in lecture. You will also have a chance to ask your recitation leader questions and work together with your classmates. We will keep track of attendance, but it is not counted as part of your grade. You will also take midterms during these recitation sections.

(iii) **WebAssign Homework:** You will have online homework assignments through WebAssign due on Monday and Thursday nights at 11:59pm.

(iv) **Written Homework:** In addition to WebAssign homework, you will also be assigned written homework (WebAssign homework assignments have been shortened to compensate for this). The written assignments will be posted to Moodle, and you will scan and submit your solutions through Gradescope. Assignments received up to one day late will receive 80% credit (a 20% penalty). Some questions will be checked off for completeness and others will be graded for correctness. You will need to show your work to receive full credit.

Exams

We will have **three** midterms and **one final exam** during the semester. The (tentative) midterm dates are:

(i) **Midterm 1:** Friday, Feb 3

(ii) **Midterm 2:** Friday, Mar 3

(iii) **Midterm 3:** Friday, Apr 7

On the last day of class, everyone will take a cumulative pre-final "gut-check" exam. If you missed an exam for an excused reason earlier in the semester, your score on the gut-check exam will replace that exam score. For everyone else, the gut-check exam is ungraded practice.

The course will have a **final exam** during finals week, which you will take in your usual lecture classroom. Details will be posted closer to that time.

Course Schedule

Table 1: The following rough schedule is tentative and subject to change.

Week 1	$\mathbb{R}^2, \mathbb{R}^3$, and vector arithmetic
Week 2	Dot product and cross product
Week 3	Lines and planes & vector-valued functions
Week 4	Vector-valued functions, tangent vectors and arc length
Week 5	Multivariable functions, Equations in $\mathbb{R}^3$, Surface parameterization
Week 6	Partial derivatives, Linearization, chain rule, gradient
Week 7	Tangent planes, Optimization Intro
Week 8	Optimization
Week 9	Double integrals, triple integrals
Week 10	Changing coordinates for integration, Parameterizing Surfaces
Week 11	Surface area, Vector fields, div and curl
Week 12	Line integrals, Conservativeness, FTLI, Green's Theorem
Week 13	Flux, 3D curl
Week 14	Stokes' Theorem, Divergence Theorem, Gut-Check exam

Grading Policy

To cast your performance in the class in the best possible light, your grade for the course will be calculated as the following grading scheme:

10% WebAssign + 15% Written Homework + 45% Midterms + 30% Final exam

We will use NC State's standard letter grading:

$$97 \leq \textbf{A+} \leq 100, \quad 93 \leq \textbf{A} < 97, \quad 90 \leq \textbf{A-} < 93, \quad 87 \leq \textbf{B+} < 90, \quad 83 \leq \textbf{B} < 87,$$
$$80 \leq \textbf{B-} < 83, \quad 77 \leq \textbf{C+} < 80, \quad 73 \leq \textbf{C} < 77, \quad 70 \leq \textbf{C-} < 73, \quad 67 \leq \textbf{D+} < 70,$$
$$63 \leq \textbf{D} < 67, \quad 60 \leq \textbf{D-} < 63, \quad 0 \leq \textbf{F} < 60.$$

Extra Help

We encourage and expect you to work together with your classmates on homework assignments and studying, either remotely or in person.

(i) **Office Hours:** The office hours schedule gives a list of the teaching staff's office hours. We are all on the same schedule, so you should feel free to stop by any of our office hours. No appointment is necessary. You can ask questions about the homework, or general questions about course material.

(ii) **Course Resources:** On the Moodle site, there is a section called "Resources", which has links to all of the course materials (worksheets, homework, lecture problems, midterm practice problems) along with other study materials. You can also access the textbook through WebAssign which has many worked examples.

Academic Integrity

On WebAssign and written homework, we encourage you to work together with your peers and seek help from the teaching staff, textbook, and other resources as needed. However, you should make sure you understand the solutions you submit.

On Midterms and the Final Exam, you may not work with anyone else nor seek outside help–collaboration is **strictly prohibited** unless otherwise specified. Each assessment will have instructions outlining exactly what resources or electronic aides you are permitted to use.

Posting course materials to websites like Chegg 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.

You are expected to abide by the Code of Student Conduct (NCSU POL11.35.01) and Pack Pledge. Violations of academic integrity will be handled in accordance with the Student Discipline Procedures (NCSU REG 11.35.02). Your signature on any test or assignment indicates "I have neither given nor received unauthorized aid on this test or assignment."

Additional Information

(i) **Course catalog description:** Third of three semesters in a calculus sequence for science and engineering majors. Vectors, vector algebra, and vector functions. Functions of several variables, partial derivatives, gradients, directional derivatives, maxima and minima. Multiple integration. Line and surface integrals, Green's Theorem, Divergence Theorems, Stokes' Theorem, and applications. Use of computational tools. Prerequisite: MA 241 with grade of C- or better or AP Calculus credit, or Higher Level IB credit.

(ii) **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.

(iii) **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.

(iv) **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.

(v) **Attendance Policy:** For complete attendance and excused absence policies, please see http://policies.ncsu.edu/regulation/reg-02-20-03

(vi) **Digital Course Components:** 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. The following digital components may be used: Moodle, WebAssign, Gradescope, Google Forms. Please be advised this course is being recorded for current and potential future educational purposes. By your continued participation in this recorded course, you are providing your permission to be recorded.

(vii) **Accommodations for Disabilities:** 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, 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 (REG02.20.01) (https://policies.ncsu.edu/regulation/reg-02-20-01/).

(viii) **Non-discrimination Policy:** NC State provides equal opportunity and affirmative action efforts, and prohibits all forms of unlawful discrimination, harassment, and retaliation ("Prohibited Conduct") that are based upon a person's race, color, religion, sex (including pregnancy), national origin, age (40 or older), disability, gender identity, genetic information, sexual orientation, or veteran status (individually and collectively, "Protected Status"). Additional information as to each Protected Status is included in NCSU REG 04.25.02 (Discrimination, Harassment and Retaliation Complaint Procedure). 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 https://oied.ncsu.edu/divweb/. 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.

(ix) **Additional NC State Rules and Regulations:** 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:

   (a) Equal Opportunity and Non-Discrimination Policy Statement https://policies.ncsu.edu/policy/pol-04-25-05 with additional references at https://oied.ncsu.edu/divweb/policies/

   (b) Code of Student Conduct https://policies.ncsu.edu/policy/pol-11-35-01.

COVID Addendum

Due to the Coronavirus pandemic, public health measures have been implemented across campus. Students should stay current with these practices and expectations through the Protect the Pack website (https://www.ncsu.edu/coronavirus/). The sections below provide expectations and conduct related to COVID-19 issues.

(i) **Health and Participation in Class:** We are most concerned about your health and the health of your classmates and instructors/TAs.

   (a) If you test positive for COVID-19, or are told by a healthcare provider that you are presumed positive for the virus, please work with your instructor on health accommodations and follow other university guidelines, including self reporting (Coronavirus Self Reporting): Self-reporting is not only to help provide support to you, but also to assist in contact tracing for containing the spread of the virus.

   (b) If you feel unwell, even if you have not been knowingly exposed to COVID-19, please do not come to class.

   (c) If you are in quarantine, have been notified that you may have been exposed to COVID-19, or have a personal or family situation related to COVID-19 that prevents you from attending this course in person (or synchronously), please connect with your instructor to discuss the situation and make alternative plans, as necessary.