MATH 1320: Engineering Calculus II
Section 001 — Summer 2020

Instructor Information

Name: Ann Dunham
Email: dunham@math.utah.edu

Class Information

Dates: Summer 2020; May 11 – July 29
Days: Monday, Tuesday, Wednesday, Thursday, Friday
Time: 8:30 – 9:30AM, Mountain Time
Location: Canvas and Zoom

Textbook (Required)

Calculus: Concepts and Contexts, 4th Edition, by James Stewart (ISBN- 978-0495557425)

Course Description

Differential and integral calculus II, with a focus on applications for engineers. Topics include: integral expressions for moments, centers of mass, and work; infinite series and sequences; power series and Taylor series; vectors, dot and cross products, and the geometry of space; the calculus of vector functions and particle motion in space; differential calculus for functions of several variables, including linear approximation, partial and directional derivatives, chain rule, and multi-variable optimization; multivariate integration in Cartesian and polar coordinates and applications. This is a 4 credit hour course that satisfies a quantitative reasoning requirement.

Prerequisites

"C" or better in (MATH 1310 OR MATH 1311) OR AP Calc BC score of 3 or better OR Department Consent

Required Course Materials

You will need a computer or smartphone with internet to access the course Canvas page, Gradescope for submitting assignments, and Zoom for participating in lectures and office hours. Access to a scanning device (smartphones can be used as scanning devices) is also required for submitting assignments.

Course Components

You will complete weekly homework assignments, lab assignments, and quizzes, as well as two midterm exams and a comprehensive final exam. Friday class times will be dedicated to working on lab assignments, which will typically be due on the following Friday by 8:30AM on Gradescope.

Quizzes will typically be released on Canvas on Fridays after class and will be due by Monday at 11:59PM. Homework will typically be assigned on Mondays on Canvas and due the following Monday by 11:59PM on Gradescope. Details about each component of the course are given below, along with the percentage each contributes to your grade. I reserve the right to adjust due dates, details, and grade weightings as needed.

- ▷ **Homework (15% of final grade):** A set of problems from the textbook covering lecture materials from the preceding week will be due on most Mondays by 11:59PM on Gradescope. The specific problems for each assignment will be published on the Canvas page for that assignment a week before the due date. A subset of the problems will be randomly selected for grading. The two lowest homework scores will be dropped at the end of the term. *No late homework assignments will be accepted, for any reason.* I drop the two lowest scores to cover situations in which you are not able to complete the assignment on time; please reserve and use these opportunities wisely.

- ▷ **Quizzes (15% of final grade):** There will be a 15 – 35 minute timed quiz on Canvas that opens on most Fridays within an hour of class ending, and closes on the subsequent Monday at 8:30AM. You will need to complete the online quiz on your own time, outside of class hours. The quiz will cover relevant topics from the preceding week's lectures and lab. If you are keeping up with the work, these quizzes are intended to be reasonably straight forward. Quizzes are open-note and open-book; however, I recommend trying to answer the questions without your notes first to help prepare yourself for exams. Quiz questions will be a mix of multiple choice (entirely online) and free response (must upload a pdf of your work), so be prepared for either. The lowest two quiz scores will be dropped at the end of the term. *There will be no opportunities to make-up or retake quizzes, for any reason.*

- ▷ **Labs (15% of final grade):** Just before Friday classes, except on exam weeks, a 2 – 4 problem lab assignment will be released on Canvas. The lab problems will be more challenging than homework problems. They are meant to make you think more deeply about how to apply the tools learned in lecture and practiced in homework assignments to solve more complex problems. In lab assignments, the process of figuring out what the problem is asking, choosing the correct methods/strategies/tools to implement, and understanding each step in that implementation is more important than getting the right answer. The goal of these problems is to give students a deeper understanding of how the mathematics is applied, with the goal of concept learning, improving problem solving fluency, and practicing interpretation of results. Most Friday classes will be dedicated to working on the new lab assignment. Students will work mainly in groups, with facilitation by me. Lab assignments will usually be due the following Friday by 8:30AM on Gradescope. The lowest lab score will be dropped, and there will be opportunities for two extra credit labs that can replace the next two lowest scores. *No late lab assignments will be accepted, for any reason.*

- ▷ **Midterm Exams (25% of final grade, 12.5% each):** Two hour-long midterm exams will be given during class on Friday, June 5th and on Thursday, July 2nd. A practice exam and knowledge checklist will be posted roughly a week prior to each midterm, and we will have class time dedicated to review.

- ▷ **Final Exam (30% of final grade):** A two-hour comprehensive exam will be given on Friday, July 31st from 7:30AM to 9:30AM. (This date and time is set by the University. I will try to announce any changes, but be sure to double-check the official University exam schedule as

we near the end of the term.) As with the midterms, a practice final and other study resources will be posted about a week prior and will be have class time to review. Any student earning lower than 60% (after any curving) on the final exam may only earn a maximum grade of C- in the course.

Course Format

As I am sure you are all aware, this class was unexpectedly moved to an online format just a few weeks before the start of the term. We are all stepping out of our comfort zones, employing new methods, and learning as we go, so I ask that you be patient with any unforeseen hiccups we may encounter during this course. For the first week, this course will be taught in a "flipped classroom" format, detailed below. After the first week, I will reevaluate, ask for your input, and decide if we should continue this format for the rest of the term.

- ▷ **Before Class:** I will prerecord "lecture" videos and post them to the course Canvas page. There will be a handful of short videos, hopefully each less than ten minutes, that you will need to watch each weekday. It is critical that you watch the videos and keep up with the schedule on Canvas, as there will be no other formal lecture. You are also encouraged to read the corresponding chapters in the textbook.

- ▷ **During Class:** The official scheduled time for our course is Mondays – Fridays, 8:30 – 9:30AM, Mountain Time. During this time I will hold "office hours"-style classes remotely via Zoom. The Zoom meeting room will be linked on the left side column in Canvas. You are not required to come to these office hours; however, I strongly encourage you to show up to ask questions about the videos and course content. I will highlight the most important points from the videos for that day, and likely bring a few example problems we can do together. You are encouraged to bring up any parts of the videos or textbook that were confusing, ask about homework problems, etc. The goal is that it will be an interactive hour where we work through any confusion about the video topics and solidify your understanding of the content. For this to work, though, you must show up, ask questions, and participate. *I will not go through the entire lecture videos during these times, so do not ask. I am more than happy to reiterate, clarify, state in a different way, or go through an example of any of the video topics if you have watched the videos. However, if you have not watched the videos, then do not show up to office hours.*

  Friday class times will be focused on working through the newly released lab assignment for that week. I will likely use the breakout room feature on Zoom so you can collaborate in small groups on the lab problems.

- ▷ **Canvas:** It is important that you check the course Canvas page each day and set up your account so that you get notifications when I make an announcement. Canvas will be where you go to check the course schedule, watch videos each day, get homework and lab assignments, and take quizzes and exams.

Course Learning Objectives

After this course, you should. . .

- be able to utilize methods of integration to compute volumes of objects rotated about an axis and compute lengths of curves. Students should understand the higher-level concept of integration underlying these methods: the summation of small volume segments dV or small length segments ds, which are computed by performing an appropriate parameterization to an integral in terms of dx.

- know how to apply integration to solve problems important in physics and engineering. Students will be able to compute the average value of a function using the mean value theorem for integrals, the center of mass of objects, and energy as a force integrated over a distance.

- be able to write down, manipulate, and interpret infinite sequences and series. Students will learn about the concepts of series convergence and divergence and related properties, and will be able to employ various methods to determine convergence and estimate errors of truncated sums. Students will be able to represent functions as a Taylor series and use Taylor's theorem to approximate functions and estimate error from using finitely many terms of the Taylor series.

- understand how to implement important tools of calculus in higher dimensions. Students will become familiar with 2- and 3-dimensional coordinate systems, vectors and vector operations including the dot and cross product, and equations of lines, planes, and other surfaces.

- know how to represent motion of objects in 3D using vector functions. Students should be able to represent velocity and acceleration using vector projections into tangential and normal components, as well as characterize curves in space by computing arc length and curvature.

- be comfortable taking limits of multivariate functions, as well as computing and interpreting partial derivatives.

- be able to characterize aspects of surfaces and volumes using partial derivatives and the gradient vector. Students will also use partial derivatives to approximate surfaces by tangent planes, and compute derivatives of multi-dimensional function compositions using a multi-dimensional version of the chain rule.

- know how to use partial derivatives and the method of Lagrange multipliers to optimize multivariate functions on a given domain.

- understand the elementary procedures and interpretations of multivariate integration on varied 2- and 3D domains using Cartesian and polar coordinates. Students will learn applications of double integrals to problems in physics and engineering.

- be comfortable working with the mathematical symbols of calculus. Students should have a firm understanding of the meaning of the mathematical symbols used in this course and be able to use them correctly in their own solutions.

- have improved mathematical thinking, reasoning, and communication skills. Students should be able to formulate their problem solutions as grammatically correct sentences that incorporate all of the necessary mathematical work and computations.

- have improved problem-solving skills. Students should be able to read and understand problem descriptions and then formulate equations modeling the problem, usually by applying geometric or physical principles. Students will be able to select the appropriate calculus tools to apply to a given problem, execute them accurately, and interpret the results in the context of the problem.

Grading Policies

Final grades will be assigned according to the following scale:

A	93 – 100	C+	77 – 79
A–	90 – 92	C	73 – 76
B+	87 – 89	C–	70 – 72
B	83 – 86	D	60 – 69
B–	80 – 82	E	0 – 59

▷ **Collaboration and Outside Resources:** You are highly encouraged to work with others on homework and lab assignments. Mathematics is a social activity! However, all final work must be your own; that is, despite a group deriving a solution, your work and/or explanations are expected to be unique. Quizzes and exams must be entirely your own work. *Plagiarism is unacceptable* and will result in a zero grade for all persons involved, as well as serious academic repercussions. Quizzes are open-note and open-book, but you may not collaborate with other students or use any other external resources. Exams are closed-note and closed-book and no collaboration with other students or any other external party or web resources are allowed. Any collaboration on exams is cheating.

▷ **Gradescope Submissions:** Homework assignments, lab assignments, and exams will be submitted by students on Gradescope, which is linked on the course Canvas page. You will need to scan your assignments (a smartphone can act as a scanning device) and upload them to the appropriate page on the course Gradescope site. When submitting an assignment, you MUST look at the provided outline and match each question to the pages of your submission on which you answer them. If you do not match your submission, you risk getting a score of zero.

▷ **Regrade Requests:** Should you feel a homework, lab, or exam question was scored unfairly, you may submit a regrade request in Gradescope, *not in office hours or via email*. For homework, labs, and midterms, regrade requests must be made within a week of grade posting. Final exams will be posted and three days will be allotted to lodge regrade requests before final scores are posted. You must state in your request *why* you feel you deserve more points, making sure you have carefully reviewed the rubric. A regrade request may result in a increase in score, no change in score, or in rare cases a decrease in score. There will be no regrade requests for quizzes.

▷ **Making-up or Re-taking Exams:** There will be no retakes or make-ups of exams, for any reason. If you have an emergent, extenuating circumstance that makes it necessary to take an alternate exam, it is your responsibility to discuss that with me well before the exam occurs, or as soon as possible. I may allow exams to be taken early, but not late. Should an

emergency occur during or just before an exam, contact me as soon as possible; with a valid written excuse from a physician or the Dean's Office, we may be able to arrange an alternate option.

- ▷ **Online Proctoring of Exams:** Exams will be released in Canvas as a pdf. You can write directly on the pdf digitally or answer the questions on your own paper. The exams will be timed and you will need to scan and upload your work and answers as a single pdf in the allotted time frame. Likely, the exams will be split up into 2 – 5 timed sections of 20 – 30 minutes each, and you will need to take and upload your answers to each section separately. You are allowed to use a writing tool and paper during the exams. Calculators, notes, phones, online resources, and consulting with other human beings is not allowed. If it occurs, this would be considered a case of academic misconduct and will be penalized as such. The exams may be proctored through Zoom. You will be given more complete information and instructions regarding the exams the week before they occur.

Contacting Me Outside of Class

The best way to reach me is either via Canvas message or via email (see above). I typically answer emails/messages once per day during the week, so please send your emails/messages with this in mind. For emails/messages sent over the weekend, I will do my best to respond in a timely manner, but do not expect a response until Monday. Please do reach out if you have any questions or concerns about the course. If you have crisis-level extenuating circumstances which affect your class performance and you need guidance/advice/flexibility, please communicate with me as soon as possible so I can help you in some manner, which I am truly happy to do. The longer you wait to communicate with me, the less I can and am willing to do to help.

Student Resources

If you find yourself struggling with any aspect of the course material, even if it is just one topic or one homework problem, please utilize one of the resources below. It is best to resolve any confusion as early as possible, especially because as we progress in the course, new topics will assume a mastery of material we have already covered.

- ▷ **My office hours:** I will hold regular daily office hours (see above) via Zoom. Please show up to make sure you understand the course content. If you have any questions, comments, and/or concerns and are either unable to attend office hours or do not feel comfortable speaking in front of the class, please email me and we will figure something out.

- ▷ **The math tutoring center:** The T. Benny Rushing Mathematics Student Center offers **free** tutoring Mondays-Thursdays, 8:00AM–8:00PM and Fridays, 8:00AM–6:00PM. They have tutors specialized in most areas of undergraduate mathematics. Check their website for the most up-to-date information, but they should currently be operating entirely online.

- ▷ **Private tutoring:** The Learning Center offers very inexpensive tutoring at just $5 per hour. They also currently have funding that allows them to provide your first three tutoring session for free, and there are scholarships available if covering further costs is an issue. Check their website for the most up-to-date information, but they should currently be operating entirely online. I also know many excellent math tutors I can connect you with directly; feel free to email me if you would like a recommendation.

ADA Statement

The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in the class, reasonable prior notice needs to be given to the Center for Disability & Access (CDA), 162 Olpin Union Building, 801-581-5020 (V/TDD). The CDA will work with you and me to make arrangements for accommodations. All information in this course can be made available in alternative format with prior notification to CDA. As I am sure you are aware, if you need accommodations, it is your responsibility to give me the relevant paperwork and take initiative in telling me what you need.

Wellness Statement

Personal concerns such as stress, anxiety, relationship difficulties, depression, cross-cultural differences, etc., can interfere with a student's ability to succeed and thrive at the University of Utah. For helpful resources contact the Center for Student Wellness (801-581-7776) or the Counseling Center (801-581-6826).

Student Code

All students are expected to maintain professional behavior in the classroom setting, according to the Student Code, spelled out in the Student Handbook. You have specific rights in the classroom as detailed in Article III of the Code. The Code also specifies proscribed conduct (Article XI) that involves cheating on tests, collusion, fraud, theft, etc. Students should read the Code carefully and know you are responsible for the content. According to Faculty Rules and Regulations, it is the faculty responsibility to enforce responsible classroom behaviors, beginning with verbal warnings and progressing to dismissal from class and a failing grade. Students have the right to appeal such action to the Student Behavior Committee.

Addressing Sexual Misconduct

Title IX makes it clear that violence and harassment based on sex and gender (which includes sexual orientation and gender identity/expression) is a civil rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, color, religion, age, status as a person with a disability, veterans status, or genetic information. If you or someone you know has been harassed or assaulted, you are encouraged to report it to the Title IX Coordinator in the Office of Equal Opportunity and Affirmative Action, 135 Park Building, 801-581-8365, or the Office of the Dean of Students, 270 Union Building, 801-581-7066. For support and confidential consultation, contact the Center for Student Wellness, 426 SSB, 801-581-7776. To report to the police, contact the Department of Public Safety, 801-585-2677(COPS).

Classroom Social Equity

I strive to be ethical, kind, fair, inclusive, and respectful in my classroom. I expect my students to behave likewise. In this regard, I have these requests of you, my student:

- Please do tell me, discreetly, if you have any sort of anxiety disorder, TBI, PTSD, C-PTSD, or any other challenge that would cause psychological harm to you by me calling on you in

class. I want students to feel a little uncomfortable and stretched during class, while working on problems as a large group, but I definitely do not want to cause anyone harm. So, please tell me, in a way you feel comfortable, if that is the case for you and I will confidentially accommodate your request.

- Class rosters are provided to the instructor with the students' legal name as well as preferred first name (if previously entered by you in the Student Profile section of your CIS account). I will honor you by referring to you with the name and pronoun that feels best for you in class, on papers, exams, group projects, etc. Please advise me of any name or pronoun changes (and update CIS) so I can help create a learning environment in which you feel respected. If you need assistance getting your preferred name on your U-ID card, please visit the LGBT Resource Center, Room 409 in the Olpin Union Building. If your preferred name is different than your legal first name (the preferred name you chose does show up in CIS on my roll sheet, but not yet in Canvas), please log into Canvas and go to Account (on the far left)$\rightarrow$ Settings and change your Display Name to be the name you prefer. This will help me greatly in knowing students' names and to address you correctly when responding to Canvas messages/comments/discussions.

- If you would like, please let me know through writing, or in person, your preferred name and/or pronouns. In return, if someone discloses their personal pronoun to you/the group, I expect you respect their identity and maintain a safe learning environment. You may not understand their personal preferences (and you do not have to), but you must respect them. I will not tolerate disrespectful behavior.

- If there is ever a time that you feel this course or the curriculum is not equitable, please email me or meet with me to discuss your concerns so I have a chance to address them.

Lodging Complaints

If you feel that I have disrespected you, not accommodated you, made you feel unsafe, harassed you in any way, etc., *please* let me know. I will be more than happy to change my behavior and work with you to make the class more safe and/or accessible; I strive to create a safe learning environment for all students. Though you can reach out to me, I understand confronting someone who has disrespected/offended/harassed/upset/hurt you can be difficult. If you would like to lodge a formal complaint against me (for my teaching, behavior, class conduct, etc.), you may email Kelly MacArthur at macarthur@math.utah.edu, or my course coordinator, Will Nesse, at nesse@math.utah.edu.

I reserve the right to change my policies stated in this syllabus at any point in the semester. If I do make a change to a policy, I will announce it in class as well as communicate the change via email or an announcement in Canvas.

Tentative Daily Schedule

The daily coverage may change depending on the progress of the class. However, you must keep up with the video/reading assignments.

Date	Material Covered	Assignments Due
M, May 11	Introduction and Expectations, Review	Quiz 0
T, May 12	6.4 – 6.5: Arc Length, Average Value of a Function	
W, May 13	6.6: Applications of Integration to Physics	
Th, May 14	8.1: Sequences	
F, May 15	Lab 1, **Quiz 1 released**	
M, May 18	8.2: Introduction to Series,	HW 1, Quiz 1
T, May 19	8.3 – 8.4: Series Convergence Tests	
W, May 20	8.3 – 8.4: Series Convergence Tests	
Th, May 21	8.3 – 8.4: Series Convergence Tests	
F, May 22	Lab 2, **Quiz 2 released**	Lab 1
M, May 25	**No Class**	HW 2, Quiz 2
T, May 26	8.5 – 8.6: Power Series	
W, May 27	8.5 – 8.6: Power Series	
Th, May 28	8.7 – 8.8: Taylor Series	
F, May 29	Lab 3, **Quiz 3 released**	Lab 2
M, June 1	8.7 – 8.8: Taylor Series	HW 3, Quiz 3
T, June 2	Series Error Estimation	
W, June 3	Review for Midterm 1	
Th, June 4	Review for Midterm 1	
F, June 5	**Midterm 1**	
M, June 8	9.1 - 9.2: 3D Coordinate Systems and Vectors	
T, June 9	9.3: Dot Product	
W, June 10	9.4: Cross Product	
Th, June 11	9.5: Equations of Lines and Planes	
F, June 12	Lab 4, **Quiz 4 released**	Lab 3, EC Lab 1
M, June 15	9.5: Equations of Lines and Planes	HW 4, Quiz 4
T, June 16	9.6: Surfaces	
W, June 17	9.7: Cylindrical and Spherical Coordinates	
Th, June 18	10.1: Vector Functions	
F, June 19	Lab 5, **Quiz 5 released**	Lab 4
M, June 22	10.2: Derivatives and Integrals of Vector Functions	HW 5, Quiz 5
T, June 23	10.3: Arc Length and Curvature	
W, June 24	10.4: Motion in Space	
Th, June 25	10.4: Motion in Space	
F, June 26	Lab 6, **Quiz 6 released**	Lab 5
M, June 29	10.5: Parametric Surfaces	HW 6, Quiz 6
T, June 30	Review for Midterm 2	
W, July 1	Review for Midterm 2	
Th, July 2	**Midterm 2**	

F, July 3	**No Class**	
M, July 6	11.1: Multivariate Functions	
T, July 7	11.2: Limits and Continuity of Multivariate Functions	
W, July 8	11.3: Partial Derivatives	
Th, July 9	11.4: Linear Approximations	
F, July 10	Lab 7, **Quiz 7 released**	Lab 6, EC Lab 2
M, July 13	11.5: The Chain Rule	HW 7, Quiz 7
T, July 14	11.6: Directional Derivatives and The Gradient	
W, July 15	11.6: Directional Derivatives and The Gradient	
Th, July 16	11.7: Multivariate Optimization	
F, July 17	Lab 8, **Quiz 8 released**	Lab 7
M, July 20	11.8: Lagrange Multipliers	HW 8, Quiz 8
T, July 21	12.1: Double Integrals over Rectangular Regions	
W, July 22	12.2: Iterated Integrals	
Th, July 23	12.3: Double Integrals over General Regions	
F, July 24	**No Class**, **Quiz 9 released**	Lab 8
M, July 27	12.4: Double Integrals in Polar Coordinates	HW 9, Quiz 9
T, July 28	Review for Final	
W, July 29	Review for Final	
Th, July 30	**No Class**	
F, July 31	**Final Exam: 7:30 – 9:30 AM**	Finally done! ☺