MATH 3404 – Multivariate Calculus

Spring 2022

Instructor: Dr. Scott M. LaLonde

Office: RBN 4005

Phone: (903) 565-5839 (Math department main office)

Email: slalonde@uttyler.edu (preferred method of contact)

Office hours: Tuesdays & Thursdays, 1:00–2:30 P.M. or by appointment. All office hours will be conducted remotely via Zoom (link available on Canvas).

Scheduled lectures:

Section 001	**Section 002**
MWF, 9:05 A.M. – 10:20 A.M.	MWF, 10:30 A.M. – 11:45 A.M.
Location: RBN 4019	Location: RBN 4019

Note: There will be a Zoom option if you are unable to attend class due to illness or exposure to COVID-19. The link will be available on Canvas.

Course Information

Course Webpage: All course information and documents will be available on Canvas.

Textbook: *Essential Calculus: Early Transcendentals (Second Edition)* by James Stewart. (ISBN: 978-1-133-11228-0)

Prerequisites: A grade of C or better in Calculus II (MATH 2414 or equivalent).

Course Description

Vector calculus in Euclidean n-space, functions of several variables, partial differentiation and multiple integration.

Student Learning Outcomes

Upon completion of this course, students should be able to do the following:

- Use vectors to describe lines, planes, and curves in three-dimensional Euclidean space.
- Compute velocity, acceleration, curvature, and arc length along curves in space.
- Apply the operations of calculus to compute limits and derivatives of multivariable functions.
- Use derivatives to find maxima and minima of multivariable functions in both constrained and unconstrained settings.
- Set up and compute iterated integrals (i.e., double and triple integrals) of multivariable functions in rectangular, cylindrical, and spherical coordinates.
- Set up and compute line integrals and surface integrals of vector fields in two- and three-dimensional Euclidean space.

- Use the Fundamental Theorem of Line Integrals, Green's Theorem, Stokes's Theorem, and the Divergence Theorem to simplify the computation of line and surface integrals.
- Solve assorted real-world problems using all the techniques of multivariable calculus.

Assignments and Grading

Homework/Quizzes

Homework problems will be assigned weekly via Canvas. You will not turn in the assignment for a grade, but you will take a quiz in class based on each week's problems.

Quizzes will be given at the end of class on Fridays (except during exam weeks). Each homework assignment will cover material from the three class days immediately preceding the quiz (i.e. the previous Friday through Wednesday). Homework problems will come from the course textbook and other sources, and the quiz problems will be closely modeled on the homework. Therefore, you should put an honest effort into solving the homework problems in order to do well on the corresponding quiz. I will post solutions to the homework on Canvas by 5:00 P.M. on Thursday so you can check your work.

Each quiz should take no more than 20 minutes of class time. You must show all of your work and demonstrate understanding of the material in order to earn full credit on each problem. To allow for possible absences due to illness, you may miss at most two quizzes with no penalty. If you take all of the quizzes, then I will drop your lowest two scores (or the lowest one in the event that you miss one quiz).

Exams

There will be three exams given during the semester, with each covering approximately four weeks of material. The tentative dates are:

- **Exam 1:** February 4
- **Exam 2:** March 4
- **Exam 3:** April 8

All exams will be held during our usual class time. No books, notes, or calculators are allowed on exams, but you are permitted to prepare a formula sheet in advance and bring it with you to each exam. You may include whatever you want (e.g. formulas, theorems, examples, etc.) as long as **the content is handwritten and fits on one side of an 8.5" by 11" piece of paper.** You will be required to submit your formula sheet when you hand in your exam.

Final Exam

In addition to the three regular exams, you will take a comprehensive final exam at the conclusion of the semester. The tentative date for this exam is:

- **Section 001:** Friday, April 29, 8:00 A.M. – 10:00 A.M. (Location TBD)
- **Section 002:** Friday, April 29, 10:15 A.M. – 12:15 P.M. (Location TBD)

Unless otherwise stated, the final exam will cover all of the material from the semester. The exam will be scored out of 100 points, which will be distributed as follows:

Part	Material	Points
1	Exam 1/Chapter 10	15
2	Exam 2/Chapter 11	30
3	Exam 3/Chapter 12	30
4	After Exam 3/Chapter 13	25
Total		100

If your score on any of the first three parts of the final exam exceeds your score on the corresponding semester exam, then your percentage score on that part will replace your previous exam score when computing your final grade.

Example: Suppose your scores on the first three exams are 88, 79, and 68, respectively. The following table describes the breakdown of your final exam score:

Part	Points	Percentage
1	10	67%
2	22	73%
3	25	83%
4	20	80%
Total	77	77%

Since your score on Part 3 of the final exam is higher than the grade you originally earned on Exam 3, your overall grade will be computed using 83 as your Exam 3 score (instead of the original 68).

Grading

Your overall numerical grade will be computed as follows:

Assignment	Total %
Quizzes	10
Exams	$20\% \times 3 = 60$
Final exam	30
Total	100

Based on your numerical grade, you will be assigned a letter grade according to the following chart:

Numerical	Letter
90 – 100	A
80 – 89	B
70 – 79	C
60 – 69	D
Below 60	F

Your final grade will be computed according to these two tables (and the final exam grading scheme described in the previous section) using only the listed assignments. In particular, there will be no "extra credit" available in this course, nor will there be a "curve" applied to any assignments.

Course Policies

Canvas

You must activate your Canvas account and check it regularly. You can activate your account and log in at `https://www.uttyler.edu/canvas`. If you are registered for the course, then you should already have access to the Canvas page. All announcements and important documents will be posted there.

Email

Along with the built-in Canvas messaging system, the preferred means of communication for this course is official UT Tyler email. If you email me, it needs to be sent from your Patriots account to my UT Tyler email address (`slalonde@uttyler.edu` – note that this is **not** a Patriots address). In the event that I need to contact you, I will send an email to your Patriots account, and I will assume that you have read any such message.

Office Hours

I have regularly scheduled office hours, which are set aside as time for you to talk to me about the course. Attending office hours should be your first course of action if you find that you are struggling. You should not be afraid to come ask me questions when you are studying or working on homework. This course moves quickly—*don't let yourself fall behind.* If you are unable to attend my scheduled office hours, you can always set up an appointment or ask questions via email.

I am happy to answer questions about homework problems in office hours, and you should attend and talk to me if you're having trouble. However, I expect you to put a reasonable amount of thought into the problems before coming to me. In particular, office hours are not simply times to sit down and do your homework in front of me.

Attendance

You should plan to attend class every day unless you are sick or you have been exposed to COVID-19. (See the COVID-19 policy for more details.) Attendance is not officially part of your grade, but poor attendance will affect your grade indirectly by impacting your performance on exams and other graded assignments. This class moves quickly, so it will be difficult for you to succeed in this course if you do not keep up with the material.

In the event that you do miss class, you are responsible for catching up on the material that was covered that day. (I will be posting notes and/or videos to accommodate absences due to illness.) You are also responsible for any announcements made in class.

Make-up Policy

Make-ups for exams will only be granted in the case of severe illness, excused absences that are required as part of a UT Tyler obligation, or for religious observances. You need to notify me as

soon as possible (or at least one week ahead of time in the case of a planned absence) and provide appropriate documentation. Makeups or extensions on quizzes will be granted only in extreme cases and at the discretion of the instructor. Makeups will not be granted after the fact **under any circumstances**.

Cell Phones, Calculators, and Electronic Devices

When class is about to begin, place any electronic devices (e.g., cell phones) in silent mode and put them out of sight. You may use a laptop or tablet to take notes or consult the textbook (if you have the electronic version). If you are using these devices for other purposes, I will ask you to put them away. No calculators of any kind are allowed on exams.

Plagiarism and Academic Dishonesty

Any work you submit must represent your own effort. If I determine that this is not the case, I will prosecute plagiarism and academic dishonesty to the fullest possible extent.

- All quizzes and exams are closed book, with no books, notes, or calculators allowed. You may not give help to or receive help from your classmates, and you should not expect help from the instructor aside from clarification of exam problems.
- You are allowed to bring a formula sheet to each exam. There are no restrictions on the content, but it must be handwritten and it may occupy no more than one side of one 8.5" by 11" sheet of paper. You are required to submit your formula sheet with the exam.
- Finally, you are forbidden from posting any documents or resources from this course (notes, assignments, solutions, etc.) to any third-party websites (such as Chegg or Coursehero). If I find that materials have been posted to any such website, I will treat it as a case of academic misconduct and deal with it accordingly.

Any violation of these rules will be considered a case of academic misconduct, which may result in a score of zero on one or more assignments and referral to the UT Tyler Office of Student Conduct and Intervention for further action.

COVID-19 Mitigation

As of January 2022, the city of Tyler is in a high-transmission area for COVID-19. Per CDC guidelines and university recommendations, **you are expected to wear a face mask covering your nose and mouth during our class meetings**, regardless of your vaccination status. I also expect you to **stay home if you are not feeling well** (particularly if you have symptoms like sneezing, coughing, or a higher than normal temperature) at any time during the semester. There will be a Zoom option available if you are unable to attend class due to illness.

Please consult the "University Policies and Information" page on Canvas for more detailed information on current UT Tyler policies regarding COVID-19. You can also visit the UT Tyler website for information on vaccines, testing, and what to do if you have been exposed:

`https://www.uttyler.edu/coronavirus/`

Changes to Syllabus

I reserve the right to make changes to the syllabus during the semester. Any changes to course policies will be announced in class, and an updated version of the syllabus will be posted to Canvas.

Important Dates

- **January 10:** Classes begin.
- **January 17:** Martin Luther King, Jr. holiday. No class.
- **January 24:** Census date. Last day to change schedule or file for grade replacement.
- **March 7–12:** Spring break. No classes.
- **March 28:** Last day to withdraw.
- **April 25:** Study day.
- **April 29:** Final exam.

University Policies

Information on University policies concerning the following topics:

- UT Tyler Honor Code
- Students Rights and Responsibilities
- Campus Carry
- UT Tyler Tobacco-Free Policy
- Grade Replacement/Forgiveness and Census Date
- State-Mandated Course Drop Policy
- Student Accessibility and Resources
- Student Absence due to Religious Observance
- Student Absence for University-Sponsored Events and Activities
- Social Security and FERPA Statement
- Emergency Exits and Evacuation
- Student Standards of Academic Conduct
- UT Tyler Resources for Students

can be found at

`https://www.uttyler.edu/academic-affairs/files/syllabuspolicy.pdf`

Tentative Daily Schedule

This schedule is subject to change as we move through the semester, though we should follow it pretty closely (barring any unforeseen circumstances). The topic and textbook section is listed for each class day, and it would be beneficial to read the appropriate section before coming to class.

Week	Date	Topics covered	Textbook
1	1/10	Overview of multivariable calculus. Geometry of three-dimensional Euclidean space.	§10.1
	1/12	Vectors.	§10.2
	1/14	The dot product, length, and distance.	§10.3
2	1/17	Martin Luther King, Jr. holiday – no class.	
	1/19	Determinants and the cross product.	§10.4
	1/21	Lines and planes in $\mathbb{R}^3$.	§10.5
3	1/24	Vector functions and space curves.	§10.7
	1/26	Vector functions and space curves (continued).	§10.7
	1/28	Arc length and curvature.	§10.8
4	1/31	Application to physics: motion in three-dimensional space.	§10.9
	2/2	Cylinders and quadric surfaces.	§10.6
	2/4	**Exam 1**	
5	2/7	Functions of several variables.	§11.1
	2/9	Limits and continuity for functions of several variables.	§11.2
	2/11	Partial derivatives.	§11.3
6	2/14	Tangent planes and linear approximations.	§11.4
	2/16	The multivariable Chain Rule.	§11.5
	2/18	Directional derivatives and the gradient of a function.	§11.6
7	2/21	The significance of the gradient.	§11.7
	2/23	Maxima and minima of multivariable functions.	§11.7
	2/25	Constrained optimization and Lagrange multipliers.	§11.8
8	2/28	Double integrals over rectangles.	§12.1
	3/2	Double integrals over general regions.	§12.2
	3/4	**Exam 2**	
9		Spring Break – no classes.	
10	3/14	Double integrals in polar coordinates.	§12.3
	3/16	Applications of double integrals.	§12.4
	3/18	Triple integrals.	§12.5
11	3/21	Triple integrals in cylindrical coordinates.	§12.6
	3/23	Triple integrals in spherical coordinates.	§12.7
	3/25	The change of variables formula for multiple integrals.	§12.8

12	3/28	Line integrals of scalar functions.	§13.2
	3/30	Vector fields.	§13.1
	4/1	Line integrals of vector fields.	§13.2
13	4/4	The Fundamental Theorem of Calculus for line integrals.	§13.3
	4/6	Green's Theorem.	§13.4
	4/8	**Exam 3**	
14	4/11	Curl and divergence.	§13.5
	4/13	Parametric surfaces.	§13.6
	4/15	Surface integrals.	§13.7
15	4/18	Stokes's Theorem.	§13.8
	4/20	The Divergence Theorem.	§13.9
	4/22	Summary of the Stokes family of theorems.	
	4/29	**Final Exam**	