Syllabus for Mw427L (Unique # 85509) - Summer, 2020

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Teaching assistant:
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Class time/location: MWF 1-2:30pm CT (see Canvas; a recording of it will be uploaded to Canvas)
Discussion time/location: TTh 1-2:30pm CT via ZOOM
Office Hours: MWF 2:30-3:30pm CT (via ZOOM)
Webpage: all course materials will be posted on Canvas or Quest.

Course overview and objectives: we start the course with a discussion of curves and surfaces in $\mathbf{R}^2$ and $\mathbf{R}^3$. To study those objects, we introduce tools such as matrices, inner products and the cross product. We then proceed to develop calculus for scalar a vector-valued functions of several variables. In particular, we discuss their limits, derivatives and integrals. We finish the course with Stokes's theorem, which relates the integral over the boundary of a curve or surface $U \subset \mathbf{R}^3$ to the integral of a suitable object over U.

Text: No textbook is required but, if you want some recommendations, here a few textbooks that I like:

- *Vector Calculus* by J. Marsden and A. Tromba. This is UT's official textbook recommendation. It's a standard textbook that contains all the topics we will cover in the class.
- *Calculus: Early Transcendentals* by J. Stewart. If you already have this textbook from your calculus classes, you can also use it for this course. It's another standard textbook. A lot of Quest problems were adapted from this book.
- *Calculus on Manifolds* by M. Spivak. It contains a more in-depth discussion of the topics in the course. It is also a good introduction to elements from measure theory and differential topology. Don't use it as your primary source for learning the subject. Use it as a complement if you want to be become a better mathematician.
- *Vector Calculus* by P. Baxandall and H. Liebeck. This textbook is for those who want a more rigorous approach to vector calculus. Don't use it as your primary source for learning the subject. Use it as a complement if you want to be become a better mathematician.

Prerequisites: M 408D, 408L, or 408S with a grade of at least C-.

Letter grades: All grades will be recorded in Canvas. Attendance will not be taken and it will not be used in the computation of your grade. Partial numerical grades are not rounded. The final numerical average (whose computation is described in the next two sections) is rounded up and computed on a scale from 0 to 100, to one decimal place. Your final letter grade will be converted from your final numerical average using a scale not stricter than the following:

A :	$92.6 - 100$	C :	$72.6 - 76.5$
A− :	$89.6 - 92.5$	C− :	$69.6 - 72.5$
B+ :	$86.6 - 89.5$	D+ :	$66.6 - 69.5$
B :	$82.6 - 86.5$	D :	$62.6 - 66.5$
B− :	$79.6 - 82.5$	D− :	$59.6 - 62.5$
C+ :	$76.6 - 79.5$	F :	$0 - 59.5$

Assignments and exams:

1. **Homework**: weekly available on Quest. Homework is always due at 11:59pm CT on Sundays unless otherwise stated. Solutions to the problems will become available on Quest right after the submission deadline, so no late homework will be accepted. Your homework average (HA) will be the arithmetic mean of your 7 highest homework grades.

2. **Quizzes**: biweekly on Tuesdays and Thursdays during discussion. Before each discussion, you will be assigned a problem. This problem will often be a variation of one of the problems from the homework. Your solution must be submitted online via Canvas as a single PDF file. The deadline for the submission is 11:59pm CT on the same day the problem is assigned. Solutions to the quizzes will become available on Canvas right after the submission deadline, so no late quiz will be accepted. Your quiz average (QA) will be the arithmetic mean of your 15 highest quiz grades.

3. **Midterm**: there will be 2 take-home midterm exams, hence two midterm grades, (M1) and (M2). Each midterm will be posted on a Friday and it will be due 48 hours after it is posted, on a Sunday. Solutions must be submitted online via Canvas as a single PDF file. For instance, you may scan a handwritten work using an app like Adobe Scan using a smartphone. Solutions to the midterms will become available on Canvas right after the submission deadline, so no late submission will be accepted. Midterm 1 is due 07/05 and Midterm 2 is due 08/09.

4. **Final**: there will be a take-home final that will become available on the last day of class and will be due at 11:59 PM CT on 08/16. Solutions must be submitted online via Canvas as a single PDF file. For instance, you may scan a handwritten work using an app like Adobe Scan on your phone. Solutions to the final will become available on Canvas right after the submission deadline, so no late submission will be accepted. If you miss the final, your final exam grade (FE) will be 0. The final is cumulative and it will contain three sections. Section 1 consists of problems covering the

topics from midterm 1, section 2 consists of problems covering the topics from midterm 2, and section 3 consists of problems covering the topics introduced in class after midterm 2.

5. **Replacing a midterm grade**: when submitting your final, you can choose to replace one and only one midterm grade with the percentage you obtain in the corresponding section of the final, should this percentage be higher than your midterm grade. For instance, suppose your M1 grade is 75 and, when submitting your final, you declare that you would like to replace your M1 grade. If you get 81% of the points from section 1 in the final, then your new M1 grade is 81. If however you get only 70% of the points from section 1 in the final, then your M1 grade stays as 75. Your scores in sections 2 and 3 from the final will not be reflected in the M1 grade.

Grade calculation: With the notation from the previous section, the final numerical average (FNA) will be computed as follows:

$$\text{FNA} = 0.15\,(\text{HA} + \text{QA}) + 0.2\,(\text{M1} + \text{M2}) + 0.3(\text{FE}).$$

Academic Dishonesty: Academic dishonesty of any kind will not be tolerated, and is punished to the fullest extent allowed by university policy.

Students with Disabilities: Upon request, The University of Texas at Austin provides appropriate academic accommodations for qualified students with disabilities. For more information, contact the Office of the Dean of Students at 512-471-6259, 512-471-4641 TTY. If you plan on using accommodations, please notify me early in the semester.

Mental Health Services: The Counseling and Mental Health Center may be reached at 512-471-3515 (appointments) and 512-471-CALL (crisis line).

Religious holidays: Per university policy, you must notify me of your pending absence at least fourteen days prior to the date of observance of a religious holiday. You will be given an opportunity to complete any missed work within a reasonable amount of time after the absence.

Tentative schedule: Any change will be communicated via Canvas.

06/05: $\mathbf{R}^n$ is an inner product space.

06/08: Determinants and the cross product.
06/10: Lines and planes.
06/12: Parametrized curves and surfaces.

06/15: Cylindrical and spherical coordinates.
06/17: Limits.
06/19: Differentiability and the Jacobian matrix.

06/22: Chain rule.
06/24: Directional derivatives and the gradient of a scalar function.
06/26: Tangent lines and tangent planes.

06/29: Taylor's theorem.
07/01: Critical points, local extrema and the second derivative test.
07/03: Lagrange multipliers.

07/06: Vector fields and differential forms: gradient, divergence and curl.
07/08: Exact vs closed differential forms and potential functions.
07/10: Double and triple integrals (I).

07/13: Double and triple integrals (II).
07/15: Change of variables.
07/17: Arclength and path integrals.

07/27: Orientation of parametrized curves and line integrals.
07/29: Surface area and the surface integral of a scalar function.
07/31: Orientation of parametrized surfaces and the surface integral of a vector field.

08/03: Boundaries and orientability for parametrized curves and surfaces; Stokes's theorem.
08/05: Stokes's theorem for 1-forms in $\mathbf{R}^2$: Green's theorem.
08/07: Stokes's theorem for 1-forms in $\mathbf{R}^3$: the Kelvin-Stokes theorem.

08/10: Stokes's theorem for 2-forms in $\mathbf{R}^3$: Gauss's theorem.
08/12: Integrating vector fields with isolated discontinuities.
08/14: Conservative and solenoidal vector fields.