

Math 6510 - Differentiable Manifolds
Fall 2020
Ken Bromberg

Class hours: 10:45 - 11:40 MWF

Zoom: <https://utah.zoom.us/j/95576024667>

Meeting ID: 955 7602 4667

Passcode: Diff

Syllabus: This course is an introduction to differentiable manifolds. Some of the topics covered include:

- Definition and basic examples;
- Vector bundles - tangent and cotangent bundles specifically;
- Vector fields and flows;
- Distributions and the Frobenius theorem;
- Transversality and intersection theory;
- Basics of Lie groups;
- DeRham cohomology.

My spiel on this course: Most of the new concepts and difficult ideas in this course will occur in the definitions. Very roughly the course is a combination of the inverse function from multi-variable calculus, linear algebra plus a lot of definitions. This can make the material at times seem dry (although I will do my best to not let this happen!).

Book: The main reference for the course will be *Introduction to Smooth Manifolds* by John Lee, however, I won't always follow the book. Some homework problems will come from the book.

Grades: Grades will be based on regular homework (30%), a midterm (30%) and a final exam (40%). Homework should be written in L^AT_EX and submitted via canvas. The midterm will be taken during class time and the final will be a two hour exam during the classes scheduled exam time. Both the midterm and final will be proctored with Zoom. For the midterm and final you will need to scan your hand written answers into a pdf file so that you can submit them via Canvas. Receiving an "A" in this course is equivalent

to a high pass on the differentiable manifolds qualifying exam. An “A-” or “B+” is a pass. If you receive a grade lower than this you will still need to take the exam.

Homework: I’m anticipating that there will be around 8 assignments for the course (roughly every two weeks). As with all math classes doing homework is essential for learning. I strongly encourage you to work together on the homework but you should write up solutions on your own. I may give one or more assignments to be worked on in groups which I’ll assign. I haven’t done this before but I think this will be a good semester to try as I want you facilitate you meeting each other (which would normally happen more organically if we were on campus).

Midterm: There will be a midterm during class time on October 9th.

Final: The final exam is December 8th from 10:30 AM - 12:30 PM.

Deadlines: This is a graduate course and my general belief is that you should be in the best position to manage your own time. This will certainly be necessary once your focus turns to research. On the other hand, especially when we are all working from home, it is good to have some structure. With this in mind I will set due dates for the homework but if you would like to turn in your homework late you should write me to arrange a new deadline. I will generally approve any reasonable requests (perhaps after asking for some clarification) but these new deadlines will be strict. You should plan on taking both the midterm and final at the scheduled time. If you cannot you should let me know as soon as possible and these requests will be dealt with on a case-by-case basis.

Format: This course is an **IVC** (Interactive Video Conferencing) course. We will meet via Zoom during the regularly scheduled class time (MWF 10:45-11:35). Zoom is free software that can be downloaded at zoom.us/download. You will be able to participate most fully with a laptop/tablet, microphone and webcam. I find the tablet particularly useful for using the shared whiteboard feature of Zoom or whatever drawing app that the tablet has. However, you only need a phone to listen.

For most classes I will lecture which I will record and post. I will be writing on an iPad and will also post my notes. You will be able to ask questions either in the chat function on Zoom or verbally. As I will post these lectures so that anyone in the class can listen to them later (they will be deleted at the end of the course) you should not reveal any personal information during lecture.

I have gained some experience working with Zoom in the past few months but it is still relatively new to me (and I expect for you) so it this may take some getting used to. The class will be a more effective learning experience if it is interactive so please don’t hesitate to ask questions during lecture. When you are not asking a question you should

keep yourself on mute so that we don't have any extra background noise.

We will also occasionally use class time to work in small groups on problems. Here we will use the "breakout room" feature of Zoom so that you can be split into groups. When we do this I may first record a preliminary brief lecture on the problems to get you started. I will expect that you will have watched them before class.

Office Hours: Office hours will also be over Zoom. I'll announce times after consulting with the class and post them on Canvas during the first week of classes. I'm also available to meet outside of office hours. You should send me an email to arrange a time to meet and let me know your availability in the email.

Study Groups: I strongly encourage that you work together on the homework and to discuss the material covered in the course. If there is interest we can also set up a time outside of the regular course to discuss the homework.

ACADEMIC CODE OF CONDUCT

Students are encouraged to review the Student Code for the University of Utah: <https://regulations.utah.edu/academics/6-400.php>. In order to ensure that the highest standards of academic conduct are promoted and supported at the University, students must adhere to generally accepted standards of academic honesty, including but not limited to refraining from cheating, plagiarizing, research misconduct, misrepresenting one's work, and/or inappropriately collaborating. A student who engages in academic misconduct as defined in Part I.B. may be subject to academic sanctions including but not limited to a grade reduction, failing grade, probation, suspension or dismissal from the program or the University, or revocation of the student's degree or certificate. Sanctions may also include community service, a written reprimand, and/or a written statement of misconduct that can be put into an appropriate record maintained for purposes of the profession or discipline for which the student is preparing. Incidents of academic misconduct (e.g. cheating, plagiarizing, misrepresenting one's work, and/or inappropriately collaborating on exams) will be subject to penalty per Section V of Policy 6-400, the Student Code.

ADDITIONAL POLICIES AND RESOURCES

Inclusivity Statement: It is my intent that students from all diverse backgrounds and perspectives be well served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. It is my intent to present materials and activities that are respectful of diversity: age, color, disability, gender, gender identity,

gender expression, national origin, political affiliation, race, religion, sexual orientation, and veteran status, and other unique identities. gender, sexuality, disability, age, socioeconomic status, ethnicity, race, culture, and other unique identities. Your suggestions are encouraged and appreciated. Please let me know ways to improve the effectiveness of the course for you personally or for other students or student groups. In addition, if any of our class meetings conflict with your religious events, please let me know so that we can make arrangements for you.

Discrimination and Harassment: 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 Office of the Dean of Students, 270 Union Building, 801-581-7066. To report to the police, contact the Department of Public Safety, 801-585-2677(COPS). Please see Student Bill of Rights, section E: <http://regulations.utah.edu/academics/6-400.php>. I will listen and believe you if someone is threatening you.

Names/Pronouns: Canvas allows students to change the name that is displayed AND allows them to add their pronouns to their Canvas name. Class rosters are provided to the instructor with the student's legal name as well as "Preferred first name" (if previously entered by you in the Student Profile section of your CIS account, which can be managed at any time). While CIS refers to this as merely a preference, I will honor you by referring to you with the name and pronoun that feels best for you in class or on assignments. Please advise me of any name or pronoun changes so I can help create a learning environment in which you, your name, and your pronoun are respected. If you need any assistance or support, please reach out to the LGBT Resource Center. https://lgbt.utah.edu/campus/faculty_resources.php

English Language Learners: If you are an English language learner, please be aware of several resources on campus that will support you with your language and writing development. These resources include: the Writing Center (<http://writingcenter.utah.edu/>); the Writing Program (<http://writing-program.utah.edu/>); the English Language Institute (<http://continue.utah.edu/eli/>). Please let me know if there is any additional support you would like to discuss for this class.

Undocumented Student Support: Immigration is a complex phenomenon with broad impact - those who are directly affected by it, as well as those who are indirectly affected by their relationships with family members, friends, and loved ones. If your immigration status presents obstacles to engaging in specific activities or fulfilling specific course criteria, confidential arrangements may be requested from the Dream Center. Arrangements with the Dream Center will not jeopardize your student status,

your financial aid, or any other part of your residence. The Dream Center offers a wide range of resources to support undocumented students (with and without DACA) as well as students from mixed-status families. To learn more, please contact the Dream Center at 801.213.3697 or visit dream.utah.edu.

Veterans Center: If you are a student veteran, the U of Utah has a Veterans Support Center located in Room 161 in the Olpin Union Building. Hours: M-F 8-5pm. Please visit their website for more information about what support they offer, a list of ongoing events and links to outside resources: <http://veteranscenter.utah.edu/>. Please also let me know if you need any additional support in this class for any reason.

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 at www.wellness.utah.edu or 801-581-7776.

Student Success Advocates: The mission of Student Success Advocates is to support students in making the most of their University of Utah experience (<https://ssa.utah.edu>). They can assist with mentoring, resources, etc. Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact a Student Success Advocate for support (<https://asuu.utah.edu/displaced-students>).

The Americans with Disabilities Act: 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, 162 Olpin Union Building, 801-581-5020. CDA will work with you and the instructor to make arrangements for accommodations. All written information in this course can be made available in alternative format with prior notification to the Center for Disability & Access. 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, veteran's status or genetic information. If you or someone you know has been harassed or assaulted on the basis of your sex, including sexual orientation or gender identity/expression, you are encouraged to report it to the University's Title IX Coordinator; Director, Office of Equal Opportunity and Affirmative Action, 135 Park Building, 801-581-8365, or to 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 police, contact the Department of Public Safety, 801-585-2677(COPS).

Campus Safety: The University of Utah values the safety of all campus community members. To report suspicious activity or to request a courtesy escort, call campus police at 801-585-COPS (801-585-2677). You will receive important emergency alerts and safety messages regarding campus safety via text message. For more information regarding safety and to view available training resources, including helpful videos, visit <https://safeu.utah.edu>

University Counseling Center: The University Counseling Center (UCC) provides developmental, preventive, and therapeutic services and programs that promote the intellectual, emotional, cultural, and social development of University of Utah students. They advocate a philosophy of acceptance, compassion, and support for those they serve, as well as for each other. They aspire to respect cultural, individual and role differences as they continually work toward creating a safe and affirming climate for individuals of all ages, cultures, ethnicities, genders, gender identities, languages, mental and physical abilities, national origins, races, religions, sexual orientations, sizes and socioeconomic statuses.

Office of the Dean of Students: The Office of the Dean of Students (<https://deanofstudents.utah.edu/>) is dedicated to being a resource to students through support, advocacy, involvement, and accountability. It serves as a support for students facing challenges to their success as students, and assists with the interpretation of University policy and regulations. Please consider reaching out to the Office of Dean of Students for any questions, issues and concerns. 200 South Central Campus Dr., Suite 270. Monday-Friday 8 am-5 pm.