

# MATH 3220-001: Foundations of Analysis II

## Spring 2021

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### TECHNICAL DETAILS

**Credit:** MATH 3220 Foundations of Analysis II is a 4-credit course.

**Prerequisites:** C or better in MATH 3210 AND (MATH 2270 OR MATH 2250).

**Course Type:** Interactive Video Conferencing

**Class Meetings:** MTWF 08:35–09:25, Zoom Meeting. Additional details (Meeting ID, Password) will be posted on Canvas before classes begin.

**Office Hours:** Tuesday 09:30–10:30am and Thursday 1–2pm, or by appointment. All office hours will be held online via Zoom. I will be posting a Zoom link/password on Canvas.

**Textbook:** *Foundations of Analysis*, by Joseph L. Taylor. You can find the electronic version of the book in the AMS Bookstore ([link](#))

**Canvas:** Canvas will be used for posting course announcements, homework assignments, grades, supplementary files, and any additional course materials such as lecture notes, extra reading material, etc. Please check the Canvas page regularly!

**Technical Requirements:** You will need to be able to use Zoom and access Canvas regularly. In particular, access to a computer and a stable internet connection will be necessary. A microphone and camera are also strongly recommended but not required. **Important:** You *will* be required to have a camera for taking the exams (see below). If you have any questions or tech-related issues, please contact me—I will be happy to help!

**Attendance:** Attending the daily video conferences is strongly encouraged but not mandatory. Think of these as regular classes: nothing bad is going to happen if you miss one or two sessions. However, if you cannot attend the video conferences for an extended period of time, please talk to me (i.e. send me an email). That way I might be able to accommodate your specific situation and work out the best way to provide any additional course materials.

## ABOUT THE COURSE

**General:** This is a course on advanced multivariate calculus. In more concrete terms, we will be dealing with continuous functions, their derivatives and integrals—in the multivariate setting. The course will emphasize the students' ability to understand and produce clear and rigorous mathematical arguments.

**Expected Outcomes:** By the end of the course, students will be expected to:

1. Understand the basic topology and convergence of sequences in Euclidean space. In particular, have a working knowledge of the definitions of open/closed/compact/connected sets. Understand limits of vector-valued sequences and their connection to the above properties;
2. Understand the concept of continuity in multiple variables;
3. Understand multivariate differentiation, in particular: finding and using the total differential, understanding its connection to partial derivatives, using the basic rules of differentiation, Taylor's theorem, and inverse/implicit function theorems;
4. Understand multivariate integration: determining bounds of integration, using Fubini's theorem and the change of variables theorem;
5. Understand and apply Stokes's theorem and its special cases.

**Course Design:** This is an IVC (“Interactive Video Conferencing”) Course. This means that the main mode of delivering the course content will be our daily Zoom meetings. These meetings are intended to replace in-person teaching; to make them truly interactive and effective, we will use the time in (at least) three different ways:

- Traditional lectures: just like normal blackboard-and-chalk classes, except the audience participates through a video link. Questions and comments are always more than welcome.
- Flipped lectures: sometimes, I will ask you to read a section of the book or watch a video I upload before our scheduled meeting. We will then use the video conference to provide additional context, discuss new concepts in more depth and answer questions about the material in question. These meetings will usually have no fixed plan; in particular, students' input is essential in this type of lectures!
- Problem sessions: the video conference will be used to discuss and solve a set of problems (alone or in groups), provide hints, solutions, context, etc.

Classes will be recorded and uploaded to Canvas. These recordings will be deleted at the end of the semester and will only be accessible to the students taking the course.

This course will utilize various modes of assessment (see below for a detailed description). All the scheduled exams will be taken online, on Canvas.

### **Assessment and Grading:**

- **Homework Assignments (45%)** A fresh new problem set will be posted on Canvas every week. Most often, there will be several problems to choose from, and students will not be required to solve all of them. The homework is due every Tuesday. Students turn in their homework through Canvas, typed-up or scanned (see more info on these options below). The lowest homework score will be dropped. No late homework will be accepted.

*Tips for turning in your homework:* An important goal of the homework assignments is to give students an opportunity to practice mathematical writing. Therefore, when grading your homework, I will also be looking at the way it is presented: Are the arguments coherent? Is the writing precise? In particular, your homework has to be readable! There are two options for compiling your work into a file you can upload:

- a) Scan it. If you don't own a scanner, there are a number of (free) apps which allow you to use a smartphone as a scanner.
- b) Type it up in L<sup>A</sup>T<sub>E</sub>X. This is more elegant, but the downside is that it's probably somewhat slower than scanning your handwriting, especially when the work involves drawings. I am available for help if you would like to try L<sup>A</sup>T<sub>E</sub>X, but haven't had any prior experience.

Whichever option you choose, please upload a single .pdf file for each homework assignment.

- **Midterm Exams (30%, 10% each)** Three 50-minute midterm exams will be given on select Fridays. You will have the whole class period to complete the exam. These exams will be taken online, through Canvas. Dates of the midterm exams will be Friday Feb. 12, Friday Mar. 12, and Friday Apr. 9.
- **Final Exam (25%)** A two-hour comprehensive exam will be given. A practice final exam will be posted a week prior. Our final exam is scheduled for Friday, April 30, 8:00–10:00am. This will also be taken online, through Canvas.

*Proctoring:* All the exams will be proctored using Zoom. You will be required to join a conference call and turn on a camera while taking the tests. Please let me know if there are technical issues which prevent you from using a camera on any of the exam dates.

**Important:** Please contact me as soon as possible if you are unable to take any of the exams at the scheduled time.

**Final grades** are determined based on your total course percentage using the standard scheme:

	<i>A</i>	[93, 100]	<i>A–</i>	[90, 93)	
<i>B+</i>	[87, 90)	<i>B</i>	[83, 87)	<i>B–</i>	[80, 83)
<i>C+</i>	[77, 80)	<i>C</i>	[73, 77)	<i>C–</i>	[70, 73)
<i>D+</i>	[67, 70)	<i>D</i>	[63, 67)	<i>D–</i>	[60, 63)
<i>E</i>	[0, 60)				

The instructor retains the right to modify this grading scheme during the course of the semester; students will be notified of any adjustments.

#### CLASS SCHEDULE AND IMPORTANT DATES

**Holidays:** Classes begin on Tuesday, January 19.

**Exam Dates:**

- Midterm 1: Friday, February 12
- Midterm 2: Friday, March 12
- Midterm 3: Friday, April 9
- Final: Friday, April 30

**Holidays:** There will be no class on Monday, Feb. 15 (Presidents' Day).

**Non-Instructional Days:** Friday, March 5 and Monday, April 5.

**Drop/Withdraw Dates:** The last day to drop is Tuesday, March 15. The last day to withdraw is Friday, April 2. Please check the academic calendar for more information pertaining to dropping and withdrawing from a course. The last day to elect CR/NC is Friday, April 9.

#### COVID-19 CONSIDERATIONS

Students must self-report if they test positive for COVID-19 via coronavirus.utah.edu.

## POLICIES AND RESOURCES

### **Academic Code of Conduct:**

Students are encouraged to review the Student Code for the University of Utah: (link). 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.

**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. 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.

**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>. You are always welcome to talk to me if someone is threatening or harassing you.

**Student Names and Personal 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 managed 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: (link).

**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](http://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. Taking care of yourself is more important than academic success at all times. For helpful resources contact the Center for Student Wellness at [www.wellness.utah.edu](http://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 ([ssa.utah.edu](http://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 [safeu.utah.edu](http://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 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 8am–5pm.