MATHEMATICS 5740

MATHEMATICAL MODELING

MODELING DISEASE SPREAD AND ITS CONSEQUENCES

Time and Place:	MWF 12:55 PM-1:45 PM , JTB 320
Instructor:	Fred Adler
Offices:	304 LCB and 319 South Biology
Office Hour:	TBA
Phones:	1-6848 or 5-6202
email:	adler@math.utah.edu
Prereqs:	C or better in Math 2250 or Math 2270–2280

The Course: The COVID-19 pandemic has brought mathematical modeling unprecedented prominence and critical attention. Predicting the spread of the virus through populations has received the most attention. But mathematics plays a key role in understanding many other processes, including the physics of virus movement and survival, the operations management of flow of patients through hospitals and of drugs and equipment, and the cascading economic effects of control measure.

This course will use a series of case studies to examine models of the biological, physical, and economic processes described above. We'll use ordinary differential equations and linear algebra from the prerequisite courses, and introduce methods from partial differential equations, stochastic processes, computer simulation, and whatever else we need as they arise. For each case study, we will work as a group to understand, challenge, and extend an existing model. Each student will pick one topic for further investigation as a project.

Class Meetings: We are scheduled to meet in person and I'll have Zoom available when in-person meeting is not possible. I'll set up a Zoom meeting which available for both class and office hours.

Learning objectives: Engage with the many steps of mathematical modeling. At the end of the course, the student will be able to:

1. Frame a question that can be answered
2. Develop mathematical models
3. Check results on the computer
4. Collaborate with those with complementary skills
5. Present results in both speech and writing.

Readings: We will have readings from the research literature posted regularly on Canvas. Students should read assigned materials in advance of class and be prepared to discuss them.

Deliverables: There will be **homework** every two weeks, a **journal** describing ideas related to the course, including successes, failures, questions, inspirations, connections to the rest of their lives and so forth. Journals will also include a one-page response to specific assigned readings, with a half-page summary of the key points of the article and a half-page reflection to challenge or extend the ideas, with reminders and instructions posted on Canvas. Journals will be handed in every three weeks (Sep 13, Oct 4, Nov 1, Nov 22) on Mondays and with comments returned by Friday, and at the end of the semester on Dec 8. There will be a midterm on Friday Oct 8 (open book and open page of notes), and a **project** as described next.

Projects: By the fifth week of the semester, I will have met with each student to discuss a project, ideally generated from your own research or interests, that is interesting, worthwhile and feasible. The project is central to the course, and will include presentation of the project idea and final results to the class. Project write-ups will be due at the end of the semester on Dec 10, with detailed instructions to be made available on Canvas.

Grading: Grades will be weighted according to the following scheme.

Midterm (Oct 8)	20%
Written homework	20%
Journal	20%
Class participation	10%
Project	30%

Canvas: Readings, announcements, and discussions will be hosted on Canvas, so please check the site frequently, and at a minimum at least once a few hours before each class.

COURSE OUTLINE

Week	Dates	Topic
1	Aug 23 - 27	Introduction to Mathematical Modeling
2-4	Aug 30 - Sep 17	Modeling the spread of infectious diseases
5-7	Sep 20 - Oct 06	Modeling the movement and spread of viruses
8-9	Oct 18 - Oct 29	Modeling the health care system
10-12	Nov 01 - Nov 19	Modeling economic effects
13-14	Nov 22 - Dec 03	Special topics drawn from current events
15	Dec 06 - Dec 08	Project presentations

COVID stuff: According to the CDC, wearing a mask remains an effective means of preventing infection for both unvaccinated and vaccinated people (we'll be studying this!). And we'll be studying the vaccine, which is highly recommended. If you are not yet vaccinated, get weekly asymptomatic coronavirus tests. This is a helpful way to protect yourself and those around you because asymptomatic individuals can unknowingly spread the coronavirus to others. Saliva based testing is available at alert.utah.edu/covid/testing. Voluntary asymptomatic testing will continue to be available weekly for all members of the campus community. You must self-report if you test positive for COVID-19 via this website: https://coronavirus.utah.edu/. And similarly if you have been exposed, or are experiencing symptoms, self-report and follow university guidelines for exposure.

Attendance: Because much of the course material will be developed as a group in class, attendance is essential when possible, and class participation is portion of the grade. All materials developed during in-class meetings will be made available after the class, including computer programs. If we need to go online, we'll move to Zoom, and we'll go hybrid if students are forced to quarantine. Adjustments to allow non-attendance can only be granted in collaboration with the Center for Disability and Access (CDA). CDA will work with us to determine a fair and effective strategy.

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 Services, 162 Olpin Union Building, 581-5020 (V/TDD). CDS will work with you and the instructor to make arrangements for accommodations.

Accommodations policy: The instructor does not grant content accommodation requests as the course content fulfills legitimate pedagogical goals

Classroom etiquette: Students will maintain a respectful and safe learning atmosphere, and class will be canceled if this atmosphere is violated. We honor use of preferred pronouns, embrace a diversity of perspectives and backgrounds, and encourage constructive debate about all topics related to the course.

Sources of Support: Assistance for students with challenges related to immigration status is available through the Dream Center, for those with personal or health concerns through Center for Student Wellness, for veterans through the Veterans Support Center. The University Counseling Center staff is committed to supporting the mental health needs of our campus community. Their phone number is 801-581-6826 (M-F, 8:00am-5:00pm, and 24/7 Crisis Line at 801-587-3000) . More information is at https://counselingcenter.utah.edu/

Legalistic Language: This syllabus is meant to serve as an outline and guide for our course. Please note that I may modify it with reasonable notice to you, and I am open to suggestions to improve any aspect of the course. Any changes will be announced in class and posted on Canvas under Announcements.