MAT 118A - Partial Differential Equations  
Fall 2021

This is a preliminary syllabus that will continue to be updated as the fall quarter approaches.

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Office Hours: TBD
Course Website: Canvas

Course Description
Partial differential equations (PDEs) are widely used across the sciences to model continuous quantities in both space and time. Examples range from the vibrations of a guitar string to the density of traffic on a highway. The primary goal of Math 118A is to introduce standard techniques used to find solutions of PDEs and understand the behavior of the physical system being modelled. Our analysis will focus on three representative PDEs, the transport, wave, and diffusion equations. These equations are paradigms for broader classes of PDEs, and we will highlight the distinct properties of each. The majority of the class will focus on analytical techniques, but we utilize numerical methods to visualize the behaviors of the equations. Throughout we will see applications in the physical and biological sciences. The topics learned in this course set the foundation for advanced undergraduate and graduate courses in PDEs.

Prerequisite: MAT 021D ∩ MAT 022B ∩ (MAT 022A ∪ MAT 067)

Topics
Specific course topics include, but are not limited to:

- Derivation of transport, diffusion, and wave equations from physical principles
- First-order linear equations (transport equation) and method of characteristics
- Diffusion equation: solutions and properties on the whole real line, half line, and bounded intervals
- Wave equation: solutions and properties on the whole real line, half line, and bounded intervals
- Fourier Series
- Applications to biological and physical systems

Specific learning outcomes for each section will be posted on Canvas.

Class Time
I encourage you to attend all classes. Math is best learned by doing! Thus, class time will include lectures and short active-learning activities that allow you to see the material first hand. Lectures will not be recorded, but notes will be available on Canvas.
**Homework**
Weekly homework assignments will allow you to practice the course concepts, and allow for the most direct and individualized feedback about how you are progressing as a learner. Homework will count for 40% of the final course grade.

- Assignments will be available online every Friday and will be due the following Friday.
- Students are encouraged to collaborate on homework assignments, but assignments must be written up separately and individually.
- Homework assignments will be uploaded to Gradescope and must have neatly written (or typed) solutions labeled with problem numbers. *On Gradescope, please select which pages correspond to each problem.* Solutions should show all work, not just the final answer. Assignments that do not meet these requirements will receive a 20% deduction.
- Late assignments will not be accepted without prior approval. Please communicate with me as early as possible to make appropriate arrangements.
- By filling out two anonymous surveys about the course and quarter, you will have the opportunity to replace your lowest homework grade. These surveys will be available near the middle and end of the quarter on Canvas.

**Exams**
- The **midterm exam** will be take-home. The exam will be open notes and textbook, but collaboration or external sources (i.e. the internet) are not allowed.
- The **final exam** will be a 30-minute oral exam with the instructor. Exam problems will be released ahead of time. During the exam, the student will present two problems, one of the students choice and one randomly selected by the instructor. *Exam format subject to change if class enrollment significantly increases.*

If a serious conflict or family emergency arises for either exam, please contact me as soon as possible to make alternate arrangements.

**Final Project**
The final project will allow you to further explore a topic from this course. In groups of 1-3 students will investigate a topic of their choice that extends concepts learned in the course. Suggestions of topics will be provided throughout the course. Assessment will include a group visual component (format TBD) and short individual papers.

**Assessment**

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<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Homework</td>
<td>40%</td>
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<tr>
<td>Midterm Exam</td>
<td>20%</td>
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<tr>
<td>Final Exam</td>
<td>20%</td>
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<tr>
<td>Final Project</td>
<td>20%</td>
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Course Materials


The course will most closely follow Logan and use some sections of Olver. PDF versions of Logan and Olver are both available free through the library. These textbooks are there to help you and will provide additional examples not covered in class. Homework will be posted on Canvas.

Additional Course Tools

- **Office Hours:** Weekly office hours will be hosted both in person and on Zoom. The instructor and TA office hours are a great place to come ask questions about course materials, receive guidance on homework problems, and ask about math research! *Online office hours will not be recorded.* Additional office hours can always be made by appointment - just ask!

- **Canvas:** We will use Canvas as the course webpage. All announcements, assignments, and course notes will be posted on Canvas and organized in weekly modules.

- **Campuswire:** We will use Campuswire as a course discussion board. Students are encouraged to post questions about logistical and course materials here so that other students have the opportunity to view and answer them.

Diversity and Inclusion Statement

I strive to create a learning environment that supports a diversity of thoughts, perspectives, experiences, and honors your identities. To help accomplish this:

- As a participant in all aspects of the course, you should strive to honor the diversity of your classmates and differing viewpoints the diversity contributes.

- If you have a name and/or set of pronouns that differ from those that appear in your official records, please let me know.

- Please come talk with me if you feel your performance in the course is being impacted by your experiences outside of class, including, but not limited to, religious holidays, family emergencies, jury duty, and long-term health problems.

- If something was said in class (by anyone) that made you feel uncomfortable, please talk to me about it.

I recognize that the pandemic is not over and many of you have additional responsibilities, stresses, and unique situations at this time. Appropriate extensions will be given on a case by case basis. In order to best help you, I need you to communicate with me as early as possible so that we can make appropriate accommodations.
Additional Course Policies and Expectations

- Please create a respectful learning space for your peers by arriving on time and prepared.

- It is your responsibility to check Canvas for assignments, notes, and reminders on course policies.

- Emails to me will be answered within 24 hours on weekdays and 48 hours on weekends. Please be respectful of your TA and instructor by being courteous and professional in emails. Please use email, not Canvas messager!

- In the event that classes are temporarily moved online due to the pandemic or wildfire smoke, lectures will happen live over Zoom at the scheduled class time.

- All students are expected to comply with and uphold the principles described in the UC Davis Code of Academic Conduct.

- I am here to facilitate your learning; let me know if you have questions! I can always be reached by e-mail.

Accommodations for Students with Disabilities

Any student with a documented disability (e.g. physical, learning, psychiatric, vision, hearing, etc.) who needs to arrange reasonable accommodations must contact the Student Disability Center (SDC). Faculty are authorized to provide only the accommodations requested by the SDC. If you have any questions, please contact the SDC at (530) 752-3184 or sdc@ucdavis.edu. If you are given any accommodations, please let me know as soon as possible so that I have time to make appropriate arrangements.

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