Applied Mathematics 50: Introduction to Applied Mathematics

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Lectures and Section: MWF 9:00am-10:15am, Pierce 301

Teaching Staff:

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Course Description:
This course provides an introduction to the problems and issues of applied mathematics, focusing on areas where mathematical ideas have had a major impact on diverse fields of human inquiry. The course is organized around two-week topics drawn from a variety of fields, and involves reading classic mathematical papers in each topic. The course also provides an introduction to mathematical modeling and programming.

See course schedule for topics. We will use Python as our programming language, and Google Colab as our programming environment.

Course Organization:
The course is organized around four-class cycles. The first two classes in each cycle will introduce a topic and review a paper of interest. The third class will be a computer lab, an interactive Python programming session that will help you investigate ideas related to the topic, as well as develop basic programming skills. The fourth class will include student presentations that summarize mathematical papers related to the topic and peer comments and questions. Toward the end of the course, students will carry out a final project, alone or together, on constructing and exploring a mathematical model and associated data analysis.

Course Aims and Learning Objectives:

This course will expose you to a wide variety of topics where applied mathematics is used. Through reading and working through classical papers, you will learn how mathematical modeling can be effective and crucial in asking and answering questions in different fields of science and engineering.

On the practical side, you will learn

1. how to formulate and analyze simple mathematical models.
2. how to program mathematical models in Python.
3. how to communicate mathematical ideas

Resources:
All required readings and other materials will be posted on the course Canvas site.

Communication:
We will primarily communicate through a Slack channel dedicated to the course.

Prerequisites:
This course is mainly aimed at freshman and sophomores. Math 1b or equivalent is a prerequisite. Some ideas from AM21a will be used, which can be taken concurrently. If you haven't taken AM21a or are not taken it concurrently, you are likely to be fine. Prior programming experience is expected, although not at the level of CS50 or AM10, and not necessarily in Python.

Enrollment:
We posted a short survey link on Canvas. Please fill it and petition to enroll on my.harvard.edu. We will approve petitions as they come in. The following will be taken into account:

- Major & year: The class is primarily intended for sophomores with an AM concentration. Freshmen with sufficient mathematics and programming background will be considered. Juniors and seniors are unlikely to qualify.
- Math background: If you have completed APMTH 21B or similar, you have considerably more choice of courses in the Spring than if you have not. For those with good math background, APMTH 115 is an excellent alternative.
- Programming experience: Preference is given to students with some programming experience. See above.
- Program requirements: Please explain if you have a unique situation in the survey.

Course policies:

In a typical week, MW will be lectures and F will be a section. See the course schedule for exact timing.

Lectures: Lectures will be held in person.

Sections: Sections will mostly be either a Python tutorial or Math tutorial.

Homework and Labs:
You will be given 5 lab and 6 homework assignments.

1. In-class labs on the third class of each module. You are expected to complete this work, if necessary, by yourself and hand in the completed lab work usually that same Friday (check course schedule).
2. Homework will be due two weeks after assignment.

Late submissions will be accepted, as long as the solutions have not been posted. Each late day will incur a 5% penalty (midnight cutoff).

Paper presentations:
Each student will present two papers through the semester in groups. Details will be announced.

Final project:

The final project will involve developing and testing a mathematical model. Students can work in pairs. Timeline and details will be announced.

Attendance:
Attendance is required for labs and paper presentations. If you have a valid excuse to miss these, you should let me know beforehand.

Grading:
5% attendance
20% paper presentations in class
55% homeworks and labs (equal weight, top 9 out of 10).
20% final project

Office hours:
Format and time will be posted.

AI Policy:
We expect that all work students submit for this course will be their own. In instances when collaborative work is assigned, we expect for the assignment to list all team members who participated. We specifically forbid the use of ChatGPT or any other generative artificial intelligence (AI) tools at all stages of the work process, including preliminary ones. Violations of this policy will be considered academic misconduct. We draw your attention to the fact that different classes at Harvard could implement different AI policies, and it is the student's responsibility to conform to expectations for each course**.**

Academic Integrity:
Discussion and the exchange of ideas are essential to doing academic work. For assignments in this course, you are encouraged to consult with your classmates as you work on problem sets. However, after discussions with peers (or course instructional staff), make sure that you can work through the problem yourself and ensure that any answers you submit for evaluation are the result of your own efforts. In addition, you must cite any books, articles, websites, lectures, etc that have helped you with your work using appropriate citation practices. Similarly, you must list the names of students with whom you have collaborated on problem sets.

Supporting Student Diversity
This class has participatory components, and different students bring different perspectives, experiences, and areas of expertise. Every voice in our classroom is important, and because of this we ask you to work to purposefully maintain a respectful environment during all interactions with your classmates.