# Math 462: Mathematical Models

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| **Instructor:** | Ruby Kim | **Class Schedule:** | MW 11-11:50am in 3866 EH |
| **Email:** | rshkim@umich.edu | **Lab Schedule:** | Fridays 11-11:50am in B745 EH |
| **Office:** | 4843 East Hall | **Office Hours:** | TuTh 4-5pm or by appointment |

## Course Description
The focus of this course is the application of a variety of mathematical techniques to solve real-world problems. Students will learn how to formulate and analyze mathematical models that can be used to investigate complex phenomena in biology and the social sciences. Concepts and calculations, using applied analysis and numerical simulations, are emphasized. The course will consist of lectures, group discussions, and computer laboratory exercises, with Friday classes usually spent in the computer lab.

## Prerequisites
Students are expected to have a solid foundation in differential equations (Math 216, 256, 286, 316, or equivalent) and linear algebra (Math 214, 217, 417, 419, or equivalent). Some prior experience with programming is useful but not required.

## Homework and Quizzes
There will be weekly homework sets due on Fridays at 11am. Students are encouraged to discuss problems with each other, but the solutions handed in must be their own. Solutions should be written or typed neatly and uploaded to Gradescope in Canvas. Homework will be graded on a 3-point scale based on completion. Late homework will not be accepted unless previously discussed with the instructor. There will be short (10-minute) weekly quizzes after homework is due with problems taken from or inspired by that week's homework. Students may bring a hard copy of their homework to use as a reference.

## Projects
There will be one midterm project and one final project for the course. For both projects, students will work in groups of 2-3 to address a problem of their interest using mathematical tools and analysis. For each project, students will submit a written report and give a 10-minute presentation. Detailed guidelines will be provided in Canvas.

## Services for Students with Disabilities
If you need an accommodation for a disability, please let me know at your earliest convenience. Some aspects of this course, the assignments, the in-class activities, and the way the course is taught may be modified to facilitate your participation and progress. As soon as you make me aware of your needs, we can work with the Office of Services for Students with Disabilities (SSD) to help us determine appropriate academic accommodations. SSD (http://www.ssd.umich.edu) typically recommends accommodations through a Verified Individualized Services and Accommodations (VISA) form. Any information you provide is private and confidential and will be treated as such.

## Academic Dishonesty
Any act of academic dishonesty as defined in the LSA Community Standards of Academic Integrity will result in an F in the course or a zero on the item in question, subject to the determination of the instructor.

## Course Grade
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| Homework | 25% |
| Quizzes | 20% |
| Midterm project | 20% |
| Final project | 35% |

**Tentative Course Schedule**

| Week | Topic | Due |
|------|-------|-----|
| 1 | Mathematical Modeling Process | |
| 2 | Linear Models, Linearized Conceptual Models | HW0 on Friday |
| 3 | The Least-Squares Error, Modified Logistic Models | HW1 on Friday |
| 4 | Intro to Numerical Methods for ODEs | HW2 on Friday |
| 5 | SIR and SEIR Models | HW3 on Friday |
| 6 | Cellular Automata, Agent-Based Epidemic Models | |
| 7 | MIDTERM PRESENTATIONS | Midterm report by Friday |
| 8 | Enzyme Kinetics, Chemical Oscillators | HW4 on Friday |
| 9 | BREAK | |
| 10 | Periodic and Quasiperiodic Dynamics, Chaos | HW5 on Friday |
| 11 | Network Models | HW6 on Friday |
| 12 | Bounded Confidence Models, Opinion Dynamics | HW7 on Friday |
| 13 | Markov Chains, Queuing Models | |
| 14 | Scientific Computing | HW8 on Monday |
| 15 | FINAL PRESENTATIONS | |
| 16 | NO CLASS | Final report by Tuesday |

The instructor reserves the right to change the content of the course material if needed.