

# MATH 4428

## Mathematical Modeling

Spring 2016 — Lecture 1

**Lecture:** Mo, We, Fr 12:20 – 1:10, Vincent Hall 20

**Lecturer:** Matthias Maier

**E-mail:** [msmaier@umn.edu](mailto:msmaier@umn.edu)

**Office:** 331 Vincent Hall

**Office phone:** (612) 625-0172

**Office hours:** We 1:30 – 2:30, Fr 1:30 – 3:30

**Website:** <http://www.math.umn.edu/~msmaier/math4428>

**Textbook:** Mark M. Meerschaert, *Mathematical Modeling*, 4<sup>th</sup> Edition.

Electronic version: <http://www.sciencedirect.com/science/book/9780123869128>

**Prerequisites:** Grade of at least C- in Math 2243, 2373 or 2573.

**Overview:** The course is divided into three parts, *optimization models*, *dynamic models* and *probability models*. In detail, we will cover the following topics. Optimization models: one variable and multivariable optimization, sensitivity and robustness, Lagrange multipliers, computational methods for optimization, Newton's method, linear programming. Dynamical models: steady state analysis, continuous and discrete time dynamical systems, stability analysis, phase portraits, simulation of dynamical models, the Euler method, instability and chaotic behavior. Probability models: discrete and continuous probability models, diffusion, Markov chains and processes, time series, Monte Carlo simulation.

### Course assessment:

- There will be two midterm exams (in lecture), to be held on **Friday February 19**, **Friday April 1**.
- The final exam is scheduled for **Wednesday May 11**, 1:30pm – 3:30pm, room TBA.
- There will be five homework projects due at the beginning of class on Friday Feb. 12, Mar. 4, Mar. 25, Apr. 15, and May 6.

**Exams:** One sheet of handwritten notes (letter page, front and back) can be brought to each exam. Calculators may be needed. Exam absences, due to recognized University-related activities, religious holidays, verifiable illness, and family/medical emergencies will be dealt with on an individual basis. Students must make arrangements *in advance* (the sooner the better) if they will miss an exam (except for emergencies that prevent prior arrangements).

**Grading:** The final grade will be determined from the following weightings (whichever is favorable):

- 30% homework, 20% Midterm I, 20% Midterm II, 30% Final,
- 30% homework, 20% Best Midterm, 50% Final.

**Other policies:** A link to other general policy statements—including statements about equal opportunity, disability accommodations, and mental health resources—appears on the course website above.