

# MAT 215 Fall 2009

## Applied Mathematics

**Instructor:** Dr. Michael Arciero

E-mail: [marciero@une.edu](mailto:marciero@une.edu)

Office: Decary 302 ph: 207-602-2439

Office hours: Tues 12:30-3:30

**Meets:** Mon 2:00-3:20 Decary 208

Fri 2:00-3:20 Decary 207

**Text:** *A First Course in Mathematical Modeling*, 4ed., Giordano, Fox, Horton, Weir Brooks/Cole 2009. Electronic or hard text. Chapters 1, 5, 6, 11, 12.

### Additional references:

- *Differential Equations*, G. Simmons, S. Krantz. McGraw Hill.
- *Advanced Engineering Mathematics*, 9ed., E. Kreyszig, Wiley, 2006.
- *Biological Sequence Analysis*, R. Durbin, S Eddy, A Krogh, G Mitchison, Cambridge University Press 1997
- *A Biologist's Guide to Mathematical Modeling in Ecology and Evolution*, S. Otto and T. Day, Princeton University Press, 2007.
- *Difference Equations*, E. Grove, G. Ladas, preprint.
- Instructor notes.

**Overview:** This course is an introduction to some of the techniques of applied mathematics, with applications in the biological and physical sciences and the use of computers in modeling and solving of problems. Many interesting problems involve the construction of quantitative mathematical models based on qualitative descriptions of physical and biological systems. While a qualitative model may give rise to speculation about a system, a quantitative model can be used to simulate the system and to make predictions. We will use techniques studied in the course, as well as computer software, to obtain analytical solutions and/or numerical solutions, and to describe qualitative behavior.

A substantial portion of the course will be devoted to solution of ordinary differential equations and their use in modeling biological phenomena such as population dynamics and disease. We will also study the discrete analog of a given model, which is given by a *difference equation*. We will also study probabilistic and statistical models to study processes that are not deterministic, or are well-suited to a probabilistic interpretation. Random processes will be simulated on the computer.

**Topics:** Solution of ordinary linear differential and difference equations, linear systems and matrix models, probability and random processes, including Markov processes and Monte Carlo simulation.

**Learning objectives:** Students will

- Formulate well-defined problems based on verbal and/or diagrammatic descriptions of phenomena which are often incomplete.
- Transform problems into mathematical models involving differential, difference, or partial differential equations, making appropriate assumptions and simplifications.
- Apply basic techniques for analytical solution, where possible.
- Use software to obtain numerical solutions and to describe qualitative behavior such as stability of equilibria and long term behavior of solutions of non-linear models.
- Verbally interpret results of solutions to and analysis of models.

**You will be responsible for the following work:**

- **Homework.** Homework will be assigned almost every week.
- **Tests.** There are two in-class exams; TBA
- **Quizzes.** There will be several short quizzes.
- **Project.**
- **Final exam.** As scheduled by the registrar.

**Grading:**

○	Homework	20%
○	Tests	30%
○	Quizzes	25%
○	Project	10%
○	Final Exam	<u>15%</u>

**Students with disabilities:** Any student with a disability that requires some form of accommodation is asked to see me within the first two weeks of class. All conversations will remain confidential. It is required that such students be registered with the Office for Student Disabilities before accommodations can be made.