

Mathematics in Medicine and Biology
MATH-4720
Fall 2015

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Office Hours: MTr 3-4:15

Tentative Outline

I. First Third: Discrete Processes

- a) Example biological systems
- b) Theory and methods for linear difference equations (first and second order)
- c) Theory and methods for nonlinear difference equations
- d) Biological examples

Exam 1: about Sept 30

II. Second Third: Continuous Processes (in time)

- a) Example biological systems
- b) First order linear and nonlinear differential equations (scalar)
- c) First-order systems
- d) Biological examples

Exam 2: about Nov 2

III. Third Third: Continuous Processes (in time and space)

- a) Diffusion
- b) Molecular: random walk
- c) Continuous: Fick's law
- d) Theory and methods for diffusion equations
- e) Biological examples

Exam 3: December 10 or during finals week

Course Web-site

eaton.math.rpi.edu/faculty/Holmes/Courses/MathBio/Fall15/index.html

Note that I write my own code (including html), and for this reason I don't use the Rensselaer Learning Management System (LMS).

Textbook and Notes

Mathematical Models in Biology by L. Edelstein-Keshet

Available (free) through RensSearch

Lecture Notes on Mathematical Systems Biology by Eduardo D. Sontag

Available at: www.math.rutgers.edu/~sontag/FTP_DIR/systems_biology_notes.pdf

Additional References

Intro to Mathematical Biology by L. Allen

Math Models of Biological Systems by H. van den Berg

Mathematical Biology: I. An Introduction by J. D. Murray

Grading

Homework: 40%, Exams 60% (no final exam)

Difficulty Level and Prerequisites

This course requires mathematical maturity and familiarity with the basic concepts from first year calculus (MATH-1010 and 1020). Very little time, if any, will be spent reviewing these background skills and concepts.

Course Objectives

We will try to cover many of the early sections in the three parts of the textbook. In addition to getting a solid grounding on the core material in these sections, it is anticipated that students will gain the following: An ability to model biological systems; Improved skills at deriving analytical solutions of the mathematical models; An ability to determine the qualitative behavior for the solutions of nonlinear problems.

Attendance, Course Material and Exams

In the course outline, where possible, the relevant sections of the text are indicated. However, the text does not include all of the material that will be covered (e.g., the text misses some topics completely and even the sections indicated can provide incomplete coverage). For this reason alone class attendance is very strongly recommended as you will be responsible for any information given out in class (in addition to the information in the text and homework problems).

Academic Integrity

Do not copy or cheat during exams. With respect to homework, you are free to seek assistance or advice from any person, book, or computer. However, what you hand in must be your own work. Violating this policy will result in a score of zero for the assignment. Also, all the rules and policies in the Rensselaer handbook should be followed.

Grade Appeals

Appeals must be made within one week of the date the item is returned in class. It is important that you keep all the returned material for the entire semester as they will be your only method for correcting any recording errors that may accidentally occur on my part.

Late Policies

Late homework is usually not accepted without a legitimate excuse. Missing an exam without a legitimate excuse results in a grade of zero and cannot be made up. If you have an excuse, you should contact me as soon as possible and I may ask for verification.