MATH 1380 *Mathematical Biology* - Winter Semester 2016 (2164)

CLASS MEETINGS: Tu/Th, 4:00-5:15 PM, Allen Hall 106

Note: A few classes may be held in a computer lab. This information will be announced in class and in weekly handouts and posted online. Be sure to check on this each week!

INSTRUCTOR: Dr. Jonathan Rubin

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office hours: TBA
web: http://www.math.pitt.edu/∼rubin/ will contain assignments, handouts, due dates, and announcements

TEXT: *A Course in Mathematical Biology* by Gerda de Vries et al., published by SIAM, and a course packet available at the University Bookstore

A copy of the course textbook will be placed on 2-hour reserve in the Benedum library, behind the front desk, listed under Math 1380. Also on reserve there will be:

- *Mathematical Models in Biology* by L. Edelstein-Keshet,
- *Mathematical Models in Biology: An Introduction* by E. Allman and J. Rhodes,

and available online through the Pitt library are:

- *Mathematical Modeling in Systems Biology: An Introduction*, by B. Ingalls,
- *Mathematical Biology* by J. Murray.

Additional books may be added as the semester progresses.

COURSE OBJECTIVES: Mathematical biology is an extremely diverse field. This observation is not surprising, given the diversity of biological phenomena that exist; with biological diversity comes the need to use diverse forms of mathematical analysis to study biological systems. To undertake a mathematical treatment of something biological, it is necessary to complete a bridging step by developing a mathematical representation or model of the biological entity. Once this mathematical description is formulated, it can be used to try to gain information about the system that it describes.

In Math 1380, students will be exposed to a selection of mathematical techniques that tend to be useful in modeling biological systems. Each approach will be presented in parallel with biological examples where it may be applied. Students will have extensive opportunities to practice the modeling process and to explore mathematical models of biological systems.

Students who complete Math 1380 are expected to:

- develop the ability to translate a description of a biological scenario into a mathematical model.
- gain comfort at making assumptions and at assessing the impact of assumptions that are made as part of the modeling process.

- learn about a variety of types of mathematical models for biological systems and some mathematical techniques that are particularly useful for extracting information from these models.

- enhance their skills at simulation of simple mathematical systems and gain an appreciation for the role of simulation in mathematical modeling.

- improve their ability to convey mathematical ideas, including the results of mathematical study, clearly in writing.

ASSESSMENT:

homework:	100 points total
lab assignments:	150 points total
project:	50 points total
midterm exam:	one exam at 50 points
final exam:	one exam at 100 points
total:	450 points

Notes: (1) The above point totals are estimates. Depending on the total number of homework and lab assignments, these may change. (2) The lowest homework score will be dropped. Extensions on assignments are not given on an individual basis. (3) If a student scores particularly well on the final exam, then the final may be given extra weight relative to the midterm exam. (4) Students looking to boost their grades should put extra effort into their remaining assessments.

LOGISTICS: One cannot really learn mathematics without doing mathematics. Thus, in a typical calculus class, an instructor/TA does some example problems, and then students go off and do many similar homework problems. In this mathematical biology class, the goal is to learn how to undertake the mathematical modeling process itself, in addition to learning some mathematical techniques. Since each mathematical modeling problem has its own characteristics, this goal can only be achieved if students are mentally active in class and are ready to participate and explore ideas in class, in addition to working on assignments outside of class.

The topics that we will consider comprise a subset of the sections of the course textbook together with the material in the course packet. In a typical week, a handout will be distributed in class, describing the agenda for upcoming class meetings, assignments, and due dates. All or part of a some class meetings will be spent on in-class worksheets or labs, a few of which may be held in a computer classroom such as Posvar 1200. The lab assignments will involve some combination of work with mathematical techniques, possibly going beyond what was done in class, brief modeling challenges, and simulations. By meeting in Posvar, we will have access to computer software. **An old but useful primer for getting started with MATLAB will be posted on the course website, while Chapter 8 of the course textbook provides an introduction to Maple.** Labs and homework problems should be written up and submitted individually, although students are welcome to interact during completion these assignments. The format for lab reports will be presented separately. There will also be a course project due near the end of the semester. This project is to be completed individually and the details will differ for different students. Project topics can relate to extensions of lab assignments, so be sure to think about project options as each lab comes up, or to other subjects of interest in mathematical biology. Specific project requirements will also be presented later in the semester.

The midterm and final exams are intended simply to check that all students are mastering the mathematical techniques covered in the course. They will be held in class, at dates announced ahead of time. Once an exam date has been announced, you should contact me immediately if you have any conflict. If you are sick the week of the exam or something like that, contact me ahead of time. Except in true, documented emergencies, makeup midterm exams will only be given through arrangements made prior to the exam time. **The final exam is scheduled for TUESDAY, APRIL 26TH, 8-9:50 AM, in 106 Allen Hall**. All students should plan to take the final exam at that time.

HOW TO SUCCEED IN THIS COURSE: I hope that this will be a fun course! The labs and project are designed to be more interesting than routine homework assignments, but you will need to manage your time to complete labs thoroughly. You are encouraged to *think* at all times during our classes. This includes challenging assumptions that are made, considering how results might change if models were adjusted, and of course asking for clarifications when confused. **Please remember that your questions are always welcome.**

DISABILITY CONCERNS: If you have a disability for which you are or may be requesting accommodation, you are encouraged to contact both your instructor and Disability Resources and Services (DRS), 216 William Pitt Union, (412) 648-7890/(412) 383-7355 (TTY), as early as possible in the term. DRS will verify your disability and determine reasonable accommodations for this course.

ACADEMIC INTEGRITY: The University of Pittsburgh Academic Integrity Code is available at http://www.as.pitt.edu//fac/policies/academic-integrity. The code states that "A student has an obligation to exhibit honesty and to respect the ethical standards of the academy in carrying out his or her academic assignments." The website lists examples of actions that violate this code. Students are expected to adhere to the Academic Integrity Code, and violations of the code will be dealt with seriously.

MATH SUMMER OPPORTUNITIES AND CAREER INFO (in no special order):

- American Mathematical Society Research Experience for Undergraduates list: `http://www.ams.org/programs/students/emp-reu`
- Mathematical Alliance REU list: `http://mathalliance.org/?page_id=3157`
- National Science Foundation REU list: `http://www.nsf.gov/crssprgm/reu/list_result.jsp?unitid=`
- Summer opportunities in Mathematical Biology: `http://www.math.pitt.edu/~rubin/classes/MATH1380/summer.html`
- Summer opportunities: `http://www.mathematics.pitt.edu/researchopportunities`
- More summer opportunities: `http://www.toroidalsnark.net/mathsummer.html`
- Society for Industrial and Applied Mathematics Career Site: `http://www.siam.org/careers`
- Math Sciences Career Site: `http://www.ams.org/careers/`
- Mathematical Association of America Career Site: `http://www.maa.org/careers/`
- Job Listings: `http://www.all-acad.com/jobs/Mathematics_Statistics`

"Anyone who cannot cope with mathematics is not fully human. At best he is a tolerable subhuman who has learned to wear shoes, bathe, and not make messes in the house." Robert Heinlein, *Time Enough for Love*