


Sergei S. Pilyugin

Courses


 MAP 4484/5489  
 Mathematical Modeling in  
 Biology

 MAA 5105/4103 Advanced  
 Calculus (E and PS) 2

Publications

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## MAP 4484/5489 Mathematical Modeling in Biology

MAP 4484/5489 Mathematical Modeling in Biology (Sections 6532/6537)

 Instructor: Sergei S. Pilyugin [http://people.clas.ufl.edu/pilyugin/courses/map4484\\_s2015/](http://people.clas.ufl.edu/pilyugin/courses/map4484_s2015/)
**Announcements:**

The textbook "A course in mathematical biology" is available on Google Books.

**Prerequisites:** MAP 2302 (grade C or better).

**Time and Room:** MWF 6 (12:50 a.m – 1:40 p.m.), LIT 207.

**Final Exam Time and Room:** Apr. 29, 12:30-2:30 p.m., LIT 207 (the final exam is optional).

**Literature:** G. de Vries, T. Hillen, M. Lewis, J. Muller, B. Schonfisch, *A course in mathematical biology: Quantitative modeling with mathematical and computational methods*, SIAM, 2006 (ISBN 0-89871-612-8). Further reading: *Mathematical Models in Biology*, L. Edelstein-Keshet, SIAM Classics in Applied Mathematics 46, 2004. *Mathematical Biology I and II* (used to be 1 book), J.D Murray, Springer, 2002 and 2004. *Mathematical Physiology I and II* (used to be 1 book as well), J.P. Keener and J. Sneyd, Springer 2009. *Essential Mathematical Biology*, N.F. Britton, 3rd printing, Springer, 2005. *Applied Partial Differential Equations with Fourier Series and Boundary Value Problems* by Richard Haberman, 4th Edition, Pearson Prentice Hall. *An Introduction to Mathematical Biology*, L.J.S. Allen, Prentice Hall, 2007. *Stochastic Processes with applications to biology*, L.J.S. Allen, 1st edition, Prentice Hall, 2003. *Branching Processes in Biology*, M. Kimmel and D.E. Axelrod, Springer, 2002.

**Critical dates:** Jan. 6 (classes begin), Apr. 22 (classes end). Midterms: TBA.

**Holidays:** Jan. 19 (MLK Day), Feb. 28 – Mar. 7 (Spring Break).

**Office Hours:** MWF7 (1:55-2:45 p.m.) in LIT 458, or by appointment. Please, call me at 352-294-2326 or use e-mail: [pilyugin@ufl.edu](mailto:pilyugin@ufl.edu) for communication. For more details, see my schedule.

**Description and Objectives of the Course:**

MAP 4484/5489 is an introduction to modeling methods used in mathematical biology. It is neither a biology course nor a mathematics course. No knowledge of biology, and only basic knowledge in differential equations is required, although familiarity with linear algebra is recommended (in particular with matrices, eigenvalues and eigenvectors).

**Weekly Schedule:**

W1: Basic modeling concepts;

W2-3: Population models in discrete and continuous time: Malthusian and logistic growth;

W4: Bioreactors and competitive exclusion;

W5: Competition, mutualism and predator-prey models;

W6: Infectious diseases: SIS, SIR, disease control;

W7: Biochemical kinetics: activation/inhibition and cooperation;

W8-10: Partial differential equation models: age structured models and reaction diffusion equations;

W11-12: Stochastic models: Markov processes, linear and nonlinear birth-death processes, branching processes;

W13: Introduction to cellular automata;

W14: Introduction to game theory.

**Grading System:**

Two midterms will be given. The dates of the midterms will be announced at least a week in advance. Midterms will be closed book, scientific calculators allowed.

Three homework problem sets will be collected and graded. Some homeworks may require elementary computer skills (using such computer algebra systems as MATLAB, Mathematica, Maple).

A student may opt to take the cumulative final exam to replace the lowest midterm grade. The final exam may not be used to replace any of the homework grades.

Individual grades will be determined as follows. All midterms and homeworks will be graded on a 0-100 point scale. Each midterm is worth 27.5 % of the total score, and each homework solution set is worth 15 % of the total score. The resulting score (0 – 100 %) determines the letter grade according to the following table:

Letter Grade	A	A-	B+	B	B-	C+	C	C-	D+	D
Score	100 – 93	92 – 88	87 – 83	82 – 74	73 – 69	68 – 64	63 – 59	58 – 54	53 – 49	48 – 40

**Course policies:**

**Policy related to make-up exams or other work:** There will be no opportunities to make up for work not submitted. However, if a student provides a legitimate excuse well in advance, scores will be prorated. Work with due date should be turned in at the beginning of class on the stated due date. Late work will not be accepted and will be deemed work not submitted.

**Policy on class attendance:** Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found in the online catalog at: <https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>.

**University's honesty policy:** UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code". On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (<http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

**For students with disabilities:** Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the instructor when requesting accommodation.

**Students' evaluations of the course:** Students are expected to provide feedback on the quality of instruction in this course based on 10 criteria. These evaluations are conducted online at <https://evaluations.ufl.edu>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results>.

**Disclaimer:** I reserve the right to change the above policies if situations warrant.

**Homeworks:**

Homework Problem Set 1 (due TBA): 2.4.2, 2.4.5–6, 2.4.8, 2.4.10–11, 2.4.13, 2.4.16, 2.4.19.

Homework Problem Set 2 (due TBA): 3.9.3, 3.9.4, 3.9.6, 3.9.11, 3.9.14, 3.9.16.

Homework Problem Set 3 (due TBA): 4.5.1, 4.5.5, 4.5.7.

Review for Test 1

Review for Test 2

