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Department of Mathematics

MAP 4484/5489 Mathematical Modeling in Biology Spring 2021

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Instructor: Sergei S. Pilyugin

(<https://people.clas.ufl.edu/pilyugin/>) https://people.clas.ufl.edu/pilyugin/courses/map4484_s2021/

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Announcements:

Any updates, announcements etcetera will now be posted on canvas. If something does not work properly, please let me know and we'll figure out how to fix it.

The class will be taught in HyFlex mode: online sections will be delivered synchronously via Canvas/Zoom and the live section will meet in LIT 217 on MW and online on F. Any changes will be announced ahead of time. The lectures will be also recorded and the links to the recordings will be posted in canvas. All testing will be done in Canvas.

Please, follow all the University guidelines regarding the Covid-19 situation.

Prerequisites: MAP 2302 (grade C or better).

Time and Room: MWF 6 (12:50 p.m – 1:40 p.m.), LIT 217 or Online (via Zoom).

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. 11 (classes begin), Apr. 21 (classes end). Midterms: M1 – 02/03->05, M2 – 03/03->05, M3 – 03/29->31, M4 – 04/14->16.

Holidays: Jan. 18 (MLK Day), Mar. 24 (Recharge Day).

Office Hours: MWF 4 (10:40-11:30 a.m.) via Zoom (Meeting ID: 707 834 2997, Passcode: see in Canvas), or by appointment. Please, use e-mail: pilyugin@ufl.edu (<mailto:pilyugin@ufl.edu>) for communication. For more details, see my schedule. (<https://people.clas.ufl.edu/pilyugin/schedule/>)

Description and Objectives of the Course:

MAP 4484/5489 is an introduction to modeling methods used in mathematical biology. It is neither a true biology course nor a true 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: All testing will be done in Canvas. The individual score will be determined by four take home midterms (25% each, 48 hours to submit the solutions). The resulting score determines the letter grade according to the following table

Letter Grade	A	A-	B+	B	B-	C+	C	C-	D+	D
Score	≥ 92	≥ 89	≥ 85	≥ 81	≥ 77	≥ 72	≥ 67	≥ 62	≥ 56	≥ 50

Course policies:

Video recordings consent: Our class sessions may be audio-visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who unmute during class and participate orally are agreeing to have their voice recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the “chat” feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials by students or any other party is prohibited.

Closed-book policy: No use of calculators, or books will be allowed during in-class tests.

Grading disputes: Any issues or questions about the grading of exams must be brought to the instructor’s attention within one week after the exams are returned to the class.

Excused absences: In certain circumstances, a student will be able to make up a missed exam. These circumstances could include medical situations, family emergencies, travel for University activities (eg. band, debating club, etc), and religious observances. In these cases the student must inform the instructor before or within one week after the missed work and **provide written documentation**. All make ups must be taken during the final exam time slot.

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 at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

Most students benefit a great deal from attending class regularly. Arriving late and/or leaving early, reading the newspaper, looking at your cell phone, etc. disrupts the class and is rude and unprofessional.

UF Honor Code: “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 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 TA's in this class.”

Diversity statement: The University of Florida and the Department of Mathematics are committed to diversity and inclusion of all students. We recognize the diversity of backgrounds and learning needs of our students and strive to create a more inclusive and welcoming environment for everyone. We strongly believe that an inclusive learning environment promotes higher academic achievements.

For students with disabilities: “Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://www.dso.ufl.edu/drc/>) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.”

Online evaluations: 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>.

Contact information for the Counseling and Wellness Center: <https://counseling.ufl.edu/>, 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

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