



Biomathematics Seminar 2

MAP 6488

Spring 2022

Instructor



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Office: 460 Little Hall



Office Hours:
■ TBA

Lecture



Mondays/Wednesdays/Fridays



Period 7 (1:55–2:45pm)



221 Little Hall

Web Site



Canvas:
<https://elearning.ufl.edu/>

Course Description

Partial Differential Equations in Biomathematics

Modeling biological phenomena using partial differential equations (PDEs) dates back to the early 1900s. As biological systems generally have underlying spatial variation, whether it's through the surrounding environment or among individuals within the population, a goal of this course is to understand how spatial effects influence motion, distribution, and behavior by introducing fundamental properties of PDEs in the context of interesting biological phenomena.

Mathematical topics covered include derivation of relevant PDEs including reaction-diffusion equations from first principles; traveling wave analysis in cases of single-species and multi-species waves; pattern formation and concepts of spatial stability and instability; and moving boundary problems.

These concepts will be introduced within the setting of classical and current problems in biology, though the approaches can be used to study a wide range of physical systems. There will be a special focus on biomedical topics such as embryonic development, wound healing, and brain tumors, and students will have the opportunity to explore other biological systems via a course project.

Prerequisites: No graduate prerequisites. Familiarity with differential equations and linear algebra and knowledge of a programming language (e.g. MATLAB, Mathematica, Maple, R, Python, C/C++, etc.) will be useful.

Textbook

While not mandatory to purchase the following textbooks, students might find them useful for the course.

- *Mathematical Biology: I: An Introduction* (3rd edition) by J.D. Murray
<https://doi.org/10.1007/b98868>
- *Mathematical Biology: II: Spatial Models and Biomedical Applications* (3rd edition) by J.D. Murray
<https://doi.org/10.1007/b98869>

The 2nd edition of the textbooks (which contains both volumes in one book) is accessible as an eBook through the UF Libraries (<https://uflib.ufl.edu>).

Additional readings will be posted on the course web site.

Software

Homework assignments and projects may require computer skills using software such as MATLAB, GNU Octave, Mathematica, Maple, R, Excel, Google Sheets, Python, C/C++, etc.

Some of this software is available to download to personal computers for no cost, while others are available through **UFApps** (<https://info.apps.ufl.edu>), **GatorCloud** (<https://cloud.it.ufl.edu>), and in computer labs (<https://labs.at.ufl.edu/computer-labs/>).

Communication

Course Announcements: Posted on **Canvas**. It is the student's responsibility to make sure they receive notifications for this course.

Discussion Board: Homework/content questions should be posted on our class discussion board on **TBA**.

Personal Matters: Students may e-mail the instructor via **Canvas Inbox** or e-mail using their official UF e-mail address.

Grading Scheme

60% Homework

40% Project

Your final course grade will be no lower than the following:

A-=[90,93) A=[93,100]
B-=[80,83) B=[83,87) B+=[87,90)
C=[70,76) C+=[76,80)
D=[60,70)
E=[0,60)

Grades are based only on academic work and are calculated using the same criteria for all students. It is unethical to bring to your instructor's attention the possible impact of your mathematics grade on your future plans, including graduation, scholarships, jobs, etc.

More information on UF grading policies (including requests for withdrawal (W) or incomplete (I*/I) grades) may be found at:

<https://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/>

Academic Calendar Dates



Wed., Jan. 5

First day of class



Tues., Jan. 11

Last day to drop/add courses with no fee liability



Mon., Jan. 17

No Classes (Martin Luther King Jr. Day)



Mon., Mar. 7–Fri., Mar. 11

No Classes (Spring Break)



Fri., Apr. 8

Last day to withdraw from courses with W



Wed., Apr. 20

Last day to petition to your college for late withdrawal



Wed., Apr. 20

Last day of class

Tentative Lecture Schedule

Weeks 1–2 (Jan. 5–14)	Reaction–Diffusion Equations
Weeks 3–5 (Jan. 19–Feb. 4)	Traveling Waves
Weeks 6–7 (Feb. 7–18)	Pattern Formation
Week 8 (Feb. 21–25)	Moving Boundary Problems
Weeks 9–10 (Feb. 28–Mar. 18)	Embryonic Development
Weeks 11–12 (Mar. 21–Apr. 1)	Wound Healing
Week 13–14 (Apr. 4–15)	Brain Tumors
Week 15 (Apr. 18–20)	Project Presentations

Homework

Written homework assignments showing all work with proper notation will be due bi-weekly via electronic submission through Canvas.

Project

You will have the opportunity to work on a project using mathematical techniques from the course to explore biological systems that were not discussed or to dive deeper into the systems introduced in lecture. The instructor will suggest topics, but you are welcome to propose others that interest you. In any case, the final topic and scope of work will be negotiated with the instructor well in advance.

You will give oral presentations and write a proposal-style paper.

Attendance

Attending lectures and other course events are vital to the learning process. Furthermore, a huge part of the transition into your professional careers is being where you are supposed to be when you are supposed to be there. As such, your attendance is expected at every lecture.

See <https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/> for more information on UF attendance policies.

Classroom/Online Behavior

To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed.

Health and Wellness Resources

- U Matter, We Care
<https://umatter.ufl.edu>
- Counseling and Wellness Center
<https://counseling.ufl.edu>
- Student Health Care Center
<https://shcc.ufl.edu>
- University Police Department
<https://police.ufl.edu>
- UF Health Shands Emergency Room/Trauma Center
<https://ufhealth.org/emergency-room-trauma-center>
- Screen, Test, & Protect
<https://coronavirus.ufhealth.org/screen-test-protect/>

Academic Resources

- Teaching Center
(tutoring, study groups)
<https://teachingcenter.ufl.edu>
- Student Success
(tutoring, coaching)
<https://studentsuccess.ufl.edu>
- Computing Help Desk
<https://helpdesk.ufl.edu>
- Career Connections Center
<https://career.ufl.edu>
- Library Support
<https://cms.uflib.ufl.edu/ask>

Important Note: Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.

Diversity, Inclusion, and Equity

I am committed to diversity and inclusion of all students in this course. I acknowledge, respect, and value the diverse nature, background and perspective of students and believe that it furthers academic achievements. It is my intent to present materials and activities that are respectful of diversity: race, color, creed, gender, gender identity, sexual orientation, age, religious status, national origin, ethnicity, disability, socioeconomic status, and any other distinguishing qualities.

Honesty Policy Regarding Cheating, Plagiarism, etc.

UF students are bound by *The Honor Pledge* (<https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>) 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 Student Conduct Code (<https://sccr.dso.ufl.edu/process/student-conduct-code/>) specifies a number of behaviors that are in violation of the honor 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 or consult with the instructor in this class.

Accessibility and Accommodations

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the Disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs as early as possible in the semester.

Online Course Evaluations

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>.

Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.