

Quantification of Biological Processes

ABE 4662 Section 8095

Class Periods: MWF, period, 3 (9:35am -10:25am)

Location: Frazier Rogers Hall, Room 110 or Computer Lab 282

Academic Term: Fall 2023

Instructor:

Melanie J. Correll, Ph.D.

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Phone: 1-252-294-6722

Office Hours: Tuesdays 9 - 10:30am, after class for 30 minutes, or by appointment.

Course Description

Quantitative description and analysis of biological processes pertaining to microbes, plants, animals, and ecosystems. biological transport phenomena, bioenergetics, enzyme kinetics, metabolism, bioregulation, circulatory and muscle systems, and agroecosystems. Analytical and experimental laboratory for development of quantitative skills. (Offered Fall)

Course Pre-Requisites / Co-Requisites

ABE2062 or BSC2010/2011, EML3100, EGN3353 OR CWR3201, ABE3612C or EML4140

Course Objectives

After taking this course students will be able to:

- Gain fundamental knowledge to understand quantitative descriptions and the analyses of biological processes.
- Demonstrate proficiency in the use of computational tools to analyze and model biological processes.
- Identify, formulate, and solve problems related to biological processes.
- Develop teamwork and presentation skills to report and solve problems related to biological processes.

Materials and Supply Fees

None

Relation to Program Outcomes (ABET):

This course contributes 3 credit hours toward meeting the minimum 48 credit hours of Engineering Topics in the basic-level curriculum for the Bachelor of Science Degree in Biological Engineering.

Outcome	Coverage*
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	Medium
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	Low
3. An ability to communicate effectively with a range of audiences	High
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the	Low

impact of engineering solutions in global, economic, environmental, and societal contexts	
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	High
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	Medium
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	Low

*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not covered or assessed in the course.

Required Textbooks and Software - none required

Course notes and reading assignments are opensource or are provided by the instructor.

Recommended Materials

- Author: Angela B. Shiftlet and George W. Shiftlet
- Publication Date and edition: Princeton University Press, Copyright 2014
- Hardcover 2014 ISBN 9780691160719 OR
- E-book ISBN 9781400850556
- E-book ISBN 9781400851485

Software: Vensim®, Python/Jupyter Notebooks, and R Programming (all are opensource) and/or MATLAB (UF APPS). Details of downloading these will be provided in CANVAS.

Other Recommended Resources:

- Biological Process Engineering and other assigned reading material that will be provided by the instructor. Author: Arthur T. Johnson, Publication date and edition: John Wiley and Sons, Inc Copyright 1999 ISBN Number: 0-471-24547-X
- Mathematical Models in Biology (An Introduction). Author: Elizabeth S. Allman and John Rhodes, Publication date and edition: Cambridge University Press, Copyright 2004 ISBN Number: 0-521-52586-1
- Computer simulation in biology (A basic introduction). Author: Robert E. Keen and James D. Spain. Publication date and edition: Wiley-LISS, Copyright 1992 ISBN Number: 0-471-50971-X (out of press, used versions can be had and will be provided by the instructor)

Course Schedule

Course Schedule (topics vary by semester and student interest), this is a tentative schedule as these can be adjusted due to a variety of unforeseen issues.

- Unit 1 (week 1): Introduction to Computational Tools to Analyze Data and Model Biological Processes
- Unit 2 (week 2): Constrained and Unconstrained Growth in Biological Systems (Homework, HW1)
- Unit 3 (week 3): Compartmental Models (Pharmacokinetics, drug delivery, SIR models) (HW2)
- Unit 4 (week 4): Numerical Methods and Errors in Modeling Processes (HW3)
- Unit 5 (week 5-6): Enzyme Kinetics (HW4)

Project #1 - Presentations and Report

Unit 6 (week 6-7): Empirical Modeling and Data Analytics for Biological Systems (HW5)

Unit 7 (week 8): Stochastic Models and Diffusion (HW6)

Unit 8 (week 9): Cellular Automata of Biological Systems

Mid Term Exam #1 up to unit 6 material

Unit 9 (week 10-11): Cellular Automata Part II (HW7)

Unit 10 (week 11): Machine Learning for Image/Data Classification of Biological Systems Student Selected Unit) (HW8)

Unit 11 (week 12): Student Selected Units (or flex schedule)

Project #2 Presentations and Report

Unit 12 (weeks 13-14): Student Selected Unit(s) (HW9)

Final Presentations (week 15)

Project #3 Presentations and Report

EXAM: Final Exam – components of the semester but focused on the Units from (6 or 7)- until the last unit (exam will be due on the University Scheduled time for exams for this course)

Attendance Policy, Class Expectations, and Make-Up Policy

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies. Click here to read the university attendance policies:

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

Attending and participating in class is required (some material is only provided in class)

Absences will be excused that are consistent with the university policies noted above, if you know of a planned absence please notify the instructor at the earliest date.

Using notes, projects, reports, and/or codes from previous offerings of this course or from answer books for text books is considered cheating.

The use of ChatGPT or other AI software will be allowed on some assignments, you need to cite the use of the AI software giving the key prompts and the date/software used. Ask the instructor if in doubt.

Giving code or other materials provided in class to other students that missed class is considered cheating unless expressly approved by the instructor

Assisting other students on troubleshooting their code is cheating on exams or if indicated by instructor, but is helpful and Not Cheating on homework and projects (limit the amount of code you provide so other students can learn how to troubleshoot).

Letting the instructor know of a known missed absence ahead of time is expected.

Getting materials from the instructor for excused absences is expected.

Using professional attitudes and meeting deadlines is expected.

Making an appointment (or using the office hours) for out-of-class assistance with instructor prior to the day that an assignment is due is expected.

Putting your best effort in this course is expected.

Completing the To Do Lists/Assessments in the Units with your BEST EFFORT is expected.

Using supplemental material to cover areas you need to get to the level required by the unit is expected.

Late assignments (for projects and homework, no late exams are accepted except in university excused absences) start with 10% deduction at 5 minutes after the due date/time and then this 10% deduction continues until 9:35am for the next class meeting (usually a Monday). Then at 9:36am on the next class date (usually a Monday) 20% deducted until 9:35am on the next class date (usually a Wednesday) after 9:36am on this second class date (usually a Wednesday) until the end of the third class day (usually a Friday) by end of this work day (5pm) 30% will be deducted. No late homework beyond the third missed class (usually Friday) will be accepted unless arranged with the instructor.

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Homework Sets (9)	10 each	40%
Projects (3)	100 each	30%
Midterm Exam	100	15%
Final Exam	100	15%
Total:		100%

Grading Policy

Percent	Grade	Grade Points
93.5 - 100	A	4.00
89.5 - 93.4	A-	3.67
86.5 - 89.4	B+	3.33
83.5 - 86.4	B	3.00
79.5 - 83.4	B-	2.67
76.5 - 79.4	C+	2.33
73.5 - 76.4	C	2.00
69.5 - 73.4	C-	1.67
66.5 - 69.4	D+	1.33
63.5 - 66.4	D	1.00
59.5 - 63.4	D-	0.67
0 - 59.4	E	0.00

More information on UF grading policy may be found at:

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

Students Requiring 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.

Course Evaluation

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.ua.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.bluer.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.ua.ufl.edu/public-results/>.

In-Class Recording

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

University 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 (<https://sccr.dso.ufl.edu/process/student-conduct-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.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values varied perspectives and lived experiences within our community and is committed to supporting the University’s core values, including the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of race, creed, color, religion, age, disability, sex, sexual orientation, gender identity and expression, marital status, national origin, political opinions or affiliations, genetic information, and veteran status.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- HWCHE Human Resources, 352-392-0904, student-support-hr@eng.ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual

violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html>

Campus Resources:

Health and Wellness

U Matter, We Care:

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

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

Sexual Discrimination, Harassment, Assault, or Violence

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the [Office of Title IX Compliance](#), located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)

Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.
<https://lss.at.ufl.edu/help.shtml>.

Career Connections Center, Reitz Union, 392-1601. Career assistance and counseling; <https://career.ufl.edu>.

Library Support, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.

<https://teachingcenter.ufl.edu/>.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.

<https://writing.ufl.edu/writing-studio/>.

Student Complaints Campus: <https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>; <https://care.dso.ufl.edu>.

On-Line Students Complaints: <https://distance.ufl.edu/getting-help/>; <https://distance.ufl.edu/state-authorization-status/#student-complaint>.