Quantitative Physiology

BME 4409 Class #10956 Section 01AH Fall 2025

Day	Period	Time	Location
Mondays	*3*	*9:35am – 10:25am*	*Communicore CG-011*
Wednesdays	*3*	*9:35am – 10:25am*	*Communicore CG-011*
Fridays	*3*	*9:35am – 10:25am*	*Communicore C1-003*

Instructor:

Meghan C. Ferrall-Fairbanks, Ph.D. (she/her)
Email: mferrall.fairbanks@bme.ufl.edu
Office Phone Number: (352) 846-2762
Office Hours: *see Canvas for scheduled times, or by appointment*

Supervised Teaching Student:

Chris Spencer, Graduate Student, Biomedical Engineering
STS Office Hours: *see Canvas for scheduled times and location*

Course Description

A junior/senior level physiology course. Quantitative modeling of organ system physiology of the nervous system, the cardiovascular system and the respiratory system are discussed and students work on quantitative problems.

Course Pre-Requisites / Co-Requisites

Pre-requisites with minimum grades of C:

- PCB 3713C - Cell and system physiology or similar course (with instructor approval)
- BME 3053C – Computer Applications for BME
- BME 3060 – Biomedical Engineering Fundamentals
- BME 3508 – Biosignals and Systems

Course Objectives

- to be able to describe a physiologic system in a quantitative way
- to be able to analyze physiologic measurements and use them for parameter estimation

Materials and Supply Fees – None

Relation to Program Outcomes (ABET):

This course incorporates mathematics and basic sciences appropriate to Biomedical Engineering. Basic sciences are defined as biological, chemical, and physical sciences. It also incorporates engineering topics, consisting of engineering sciences, and engineering design appropriate to Biomedical Engineering.

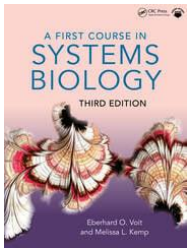
Outcome	Coverage*
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	**High** (Emphasized)
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	Medium (Reinforced)
3. An ability to communicate effectively with a range of audiences	
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the 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	
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	Medium (Reinforced)

7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	Medium (Reinforced)

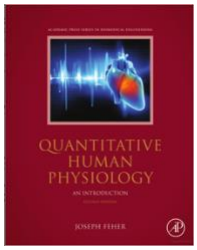
*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not covered or assessed in the course.

Required Textbooks and Software – None

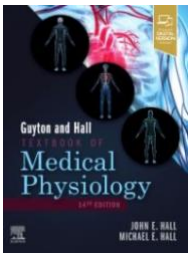
Recommended Materials
This course pulls material from a variety of different areas and these three texts cover material that most of the coursework will draw on.



- *Title*: **A First Course in Systems Biology**
- *Author*: Eberhard O. Voit & Melissa L. Kemp
- *Publication date and edition*: Third Edition (2025)
- *Publisher*: Routledge, Taylor & Francis Group
- *ISBN number*: 978-1-03-251543-4
- Prior edition available online through UF Libraries



- *Title*: **Quantitative Human Physiology**
- *Author*: Joseph Feher
- *Publication date and edition*: Second Edition (2012)
- *Publisher*: Academic Press/Elsevier
- *ISBN number*: 978-0-12-800883-6
- Available at Marston Science Library in Course Reserves



- *Title*: **Guyton & Hall Textbook of Medical Physiology**
- *Author*: John E. Hall & Michael E. Hall
- *Publication date and edition*: 14th Edition (2020)
- *Publisher*: Elsevier
- *ISBN number*: 978-0-323-59712-8
- Earlier editions available online through UF Libraries

Required Computer
Computer access is integral to a biomedical engineering student's success in Quantitative Physiology. UF's Recommended Computer Specifications are available: https://it.ufl.edu/get-help/student-computer-recommendations/. The HWCOE specifications for computer requirements for undergraduate students in the HWCOE are available: https://www.eng.ufl.edu/students/advising/fall-semester-checklist/computer-requirements/

This course will use HiPerGator with Python (or open-source language of your choice) to give students real-world experience for developing collaborative computing environments. If your preferred programming language is MATLAB, it can be accessed online at https://info.apps.ufl.edu/.

Course Schedule
The schedule below is tentative and may change according to needs and circumstances. Any revisions will be announced in class and will be posted on Canvas. Notes detail important deadlines within a given week (holidays, project due dates, midterm, etc.) and the assignments associated with the unit. Assignments are typically due 1 week after the conclusion of the unit.

Week	Unit	Topic	Notes
1-3	1	**Modeling**	*Labor Day – 9/1 – No Class*

			Quantitative Skills Survey, Modeling Basics Assignment, HPG Assignment, Mechanistic vs Non-mechanistic Modeling Assignment
4-5	2	**Homeostasis and Control Theory**	Control Loop Group Presentations Peer Evaluations – Control Loops
5-10	3	**Physiologic Case Studies**: (Bio)Mechanical, (Bio)Electrical, (Bio)Chemical Models	Project Milestones, Case Study Assignments, *Career Showcase – 10/1 – No Class* **Midterm Exam** – 10/15 – During Class *Homecoming – 10/17 – No Class*
11-12	4	**Semester Project**: Group Work in Class	In-class time to work on projects
13-14		Semester Project Presentations	All Semester Project Presentations due 11/10
15		*Thanksgiving Break – No Class All Week*	
16		**Professional Skills for Engineers**	Semester Project Final Reports and Project Evaluations Due 12/3

Important Dates

F Sep 19 *Semester Project Milestone 1 Report & 1-Slide Question/Motivation Summary (due 9:35am, Canvas)*
W Oct 15 *Midterm Exam (9:35am, Communicore C1-011* --- note different classroom than usual)*
F Oct 10 *Semester Project Milestone 2 Report & 1-Slide Update with Approach/Model (due 9:35am, Canvas)*
M Nov 10 *Semester Project Presentations Due (9:35am, Canvas)*
W Dec 3 *Semester Project Final Reports & Peer Evaluations Due (11:59pm, Canvas)*

GRADING ==========

Evaluation of Grades

Student performance will be assessed by:

- ***Assignments*** that will be assigned approximately per distinct topic and will account for 25% of the final grade.
- The ***Semester Project*** and its accompanying reports/presentations will account for 35% of the final grade. The end goal of the project is to work in small teams to apply the tools and techniques we discussed in class to work in small groups to develop a simple model of a physiological phenomenon and evaluate the model for a specific system. The project will be evaluated based on an oral presentation of your team's novel model adaptation and implementation and interpretation of how it helps answer your team's scientific question and a written 5-page report detailing the modeling approaches, results, and interpretation of the findings. There are two milestone reports and accompanying 1-slide summaries throughout the semester to help keep your team on track for successfully engaging with and continuously making progress on the semester project.
- One ***midterm exam*** will be administered around Week 9 of and will each account for 25% of the final grade. This midterm exam will assess fundamental concepts in modeling that can be applied to a variety of different physiologic systems.
- ***Participation*** will account for 15% of the final grade and will be assessed through in-class activities/participation and peer evaluations.

Assessment	Percentage of Final Grade
Assignments	**25%**
Midterm Exam	**25%**
Semester Project	**35%**
Participation	**15%**
	100%

Grading Policy

Grade	**A**	**A-**	**B+**	**B**	**B-**	**C+**	**C**	**C-**	**D+**	**D**	**D-**	**E**
Percent	4.00	3.67	3.33	3.00	2.67	2.33	2.00	1.67	1.33	1.00	0.67	0.00
Grade Points	92.0-100	90.0-91.9	87.0-89.9	83.0-86.9	77.0-82.9	76.0-76.9	74.0-75.9	70.0-73.9	66.7-69.9	64.0-66.6	61.0-63.9	0-60.9

More information on UF grading policy may be found at:
https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

Re-Grade Policy
We do our best to grade evenly and fairly, but mistakes in grading can happen. Requests to modify points on assignments, project milestones, or exams must be submitted in writing to Dr. Ferrall-Fairbanks within 1 week from when the graded assignment was made available. The request should identify the question and provide clear justification/reasoning for the requested change. The instructor will then review the request and modify the grade, as necessary. For grade challenge requests, the instructor reserves the right regrade the entire assignment, not just the points in question. The instructor also reserves the right to turn down unreasonable or frivolous grade challenge requests. Any request for re-grading where the student has altered the assignment after it was returned to gain a grade benefit will be considered a violation of the University honor code.

COURSE & UNIVERSITY POLICIES ==========

Academic Policies & Resources
To support consistent and accessible communication of university-wide student resources, instructors must include this link to academic policies and campus resources: https://go.ufl.edu/syllabuspolicies. Instructor-specific guidelines for courses must accommodate these policies.

Commitment to a Positive 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.

If you feel like your performance in class is being impacted, please contact your instructor or any of the following:
• Francis Lai, BME Undergraduate Academic Advisor, 352-273-8096, undergrad@bme.ufl.edu
• HWCOE Human Resources, 352-392-0904, student-support-hr@eng.ufl.edu
• Pam Dickrell, Associate Dean of Student Affairs, 352-392-2177, pld@ufl.edu

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/

Attendance: This course is designed to give students practical experience of modeling physiologic systems, and it is critical for students to regularly attend class ready to engage with the content. Excused absences must be consistent with university policies in the Undergraduate Catalog (https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/) and require appropriate documentation. Absences will be excused under the following conditions:

- 24 hours ahead of time that you have a legitimate, unavoidable absence
- Verifiable medical or family emergency
- Travel for a student conference – provided all excuse request prior to travel
- Need to come to class late or leave early for a legitimate reason
- Contact the instructor at least 24 hours before missing class due to interview, conference, UF official sporting event

Class Expectations

- ***Be an engaged learner***. Students are expected to attend and participate in class. The material you will learn is very application based and is not taken from a single source. In case of an absence, ask a classmate for lecture material, review the recommended readings, and access supporting slides and activities on Canvas. Don't be afraid to ask for help during class or office hours. Be an active learner – ask yourself questions during lectures, as you read, and as you attempt problems.

- Don't wait until the day before the exam or assignment deadline to get clarification on the material.
- Check Canvas for class updates, assignments, announcements, lessons, calendar, and resources.
- When using a laptop or other device in class, you shouldn't be on Facebook, Netflix, Hulu, etc. or do other things that are not class related. If the instructor asks you to put your device away, please do so.
- You need to notify your instructor if you need accommodations from the Disability Resource Center. Your instructors want to help you.

- ***Communication***. Address the instructor as Dr. Ferrall-Fairbanks or Prof. Ferrall-Fairbanks in all communications. Dr. Ferrall-Fairbanks will do her best to be available to all students for questions and discussions. Please allow up to 48 hours for Dr. Ferrall-Fairbanks to respond or longer if the email is sent at night or during the weekend, holidays, or breaks.
  - Please only use your official UF email address to communicate with Dr. Ferrall-Fairbanks or your STS. Dr. Ferrall-Fairbanks prefers that you use Canvas when sending messages for automatic association with the class. If reaching out via your UF email address, please include BME4409 in the subject line.
  - Announcements will be shared periodically during class and on Canvas. It is your responsibility to attend class and read any emails/announcements from Canvas. Emails, announcements, and feedback may occur outside business hours.
  - After each assignment is graded, you are responsible for reviewing your instructor's feedback.
- ***Generative AI Tools Policy***. Generative AI is a powerful new tool that can help learners to engage with a topic of interest. Please be aware of the limitations of generative AI including the tendency to hallucinate (invent) incorrect responses. The use of generative AI tools (e.g. NaviGator, ChatGPT) is permitted in this course for the following activities with appropriate citation/disclosure:
  - As part of your study regimen to help you better understand course material (keeping in mind AI can and does give incorrect responses)
  - Brainstorming and refining your ideas
  - Fine tuning your problem statement and solutions
  - Finding information and troubleshooting code
  - Drafting an outline to organize your thoughts
  - Checking grammar and style; rewording and editing
  - Creating individual images, icons, or graphics to be used in presentations or assignments

  The use of generative AI tools is **not** permitted in this course for the following activities:
  - Substitute AI for primary sources of information (textbooks, lecture materials, scientific literature).
  - Impersonating you in classroom contexts, such as using the tool to create answers for assignments or provide feedback to classmates
  - Completing group work that your team has assigned to you, unless it is mutually agreed upon that you may utilize the tool
  - Use AI to do the writing of any substantive portion of an assignment for you (e.g. writing entire sentences, paragraphs, or abstracts/reports to complete class assignments). I will treat this as plagiarism and an honor code violation, the same as hiring any other external person, entity, or service to complete your assignments for you.

  You are responsible for the information you submit based on your AI query (for example, that it does not violate intellectual property law or contain misinformation/incorrect information). Your use of AI tools must be reported in the assignment. Any assignment that is found to have used generate AI tools in unauthorized ways, will receive a 30% penalty. When in doubt about permitted usage, please ask for clarification
- ***Changes to the Syllabus***. Occasionally, course policies may need to be changed due to unforeseen circumstances or to improve the course. The instructor reserves the right to make necessary changes.

Make-Up Policy

- Assignments: Assignments may be submitted late with a 5% per day late penalty.
- Midterm Exam: The midterm exam may only be made up if scheduled in advances for an approved conflict and this will likely include an earlier midterm exam time than the scheduled for the rest of the class.