

Biomedical Engineering Fundamentals

BME 3060 Section 01EH

Class Periods: Tuesday Period 8-9 (3:00 PM – 4:55 PM)

Thursday Period 9 (4:05 PM – 4:55 PM)

Location: TUR L011

Academic Term: Spring 2020

Instructor: Prof. Edward Phelps

Email Address: ephelps@bme.ufl.edu

Office Hours: Thursdays, 9AM – 10 AM, BMS J383

Supervised Teaching Students (STs):

STs are graduate students who will facilitate in-class learning exercises, homework sets, and some lectures. Please contact them through the Canvas website. See Canvas calendar for location and times of ST office hours.

- Eric Hill <ehill1995@ufl.edu>
- Han Liu <hliu1118@ufl.edu>

Course Description:

Working specifically within the framework of biomedical engineering applications, this course provides the engineering fundamentals of the conservation laws of mass, energy, charge, and momentum. 3 credits

Course Pre-Requisites / Co-Requisites:

Prereq: (CHM 2046 General Chemistry 2 or CHM 2096 Chemistry for Engineers 2)

(MAC 2313 Analytic Geometry and Calculus 3)

each with minimum grades of C

Coreq: (PHY 2049 Physics with Calculus 2)

(MAP 2302 Elementary Differential Equations)

(BME 1008 Introduction to Biomedical Engineering)

Course Objectives:

The foundation of many biomedical engineering problems is based on conservation laws. The goals of this course are to develop problem-formulation and problem-solving skills, develop and understand conservation equations, and apply them to solve problems in biomedical engineering.

Professional Component (ABET):

This course prepares students to apply advanced mathematics to solve problems at the interface of engineering and biology.

Relation to Program Outcomes (ABET): The following ABET learning outcomes are emphasized in this course.

ABET Outcome	Coverage*
1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	High
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	
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	
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies	

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

Required Textbooks and Software:

Text: Bioengineering Fundamentals 2nd Edition, A. Saterbak, K. San, and L. McIntire, 2018, ISBN: 0-13-463743-7

Software: A means for solving systems of equations is required for completion of certain assignments (e.g., Matlab, graphing calculator, or Wolfram Alpha website).

Topics Covered in this Course:

- Approaching Problems from an Engineering Perspective
- Dimensional Analysis and Dimensionless Numbers
- Foundations of Engineering Calculations
- Conservation Principles
- Conservation of Mass
- Conservation of Energy
- Conservation of Charge
- Conservation of Momentum
- Applying Engineering Principles to Biological Systems

Course Schedule: The schedule is tentative and subject to change. See course website for official calendar.

Class Website:

- Canvas (elearning.ufl.edu) will be used extensively, including posting all assignments and grades.
- Each student is fully responsible for ensuring that they have access to Canvas and must check the course website routinely to ensure they are fully aware of all assignments and postings.
- Failure to check the course website will not be a valid excuse for not completing assignments.

Meeting Course Objectives:**Lectures:**

- Lectures will follow the textbook. Other topics will be covered at the discretion of the instructor.
- Lectures will reinforce important concepts, outline derivations, and support completion of homework.
- Class attendance and individual note-taking is critical for success in this course.

Reading:

- Reading of assigned sections from the textbook and external resource material is required PRIOR to class.
- Assigned reading will serve as the basis for class discussion and lecture.
- In-class reading comprehension quizzes will be given for a grade.

In-class Assignments:

- In-class assignments, quizzes, and discussions will be provided to supplement and reinforce learning.
- Some in-class assignments will count for a grade, others will be for practice only.

Homework:

- Homework is to be completed individually.
- In general, you will be given 1 week to complete assignments from when they are posted on Canvas.
- Homework assignments are due precisely at the date and time indicated.
- No late homework is accepted. The submission window closes automatically. There is no grace period.
- Assignments are ONLY turned in electronically via Canvas as a single PDF.
- In the event of technical issues with the website please email your assignment to Dr. Phelps. Technical issues with online submission do not excuse late assignments.
- No hard-copy homework is accepted.
- Illegible work will not be graded and counts as 0 pts.

Teamwork:

- You will be assigned to teams to work with during the semester on various assignments.
- Some in-class team-based assignments are for a grade.

Exams:

- There will be three exams, each worth 20% of the final grade.
- There is no cumulative final exam.

Two-Stage Collaborative Assessment:

- We will experiment with implementing two-stage collaborative assessment to increase engagement and confidence while decreasing exam anxiety.
- Exams will consist of two-stages: Stage 1 will be an individual component that is worth 80%. Stage 2 will be a collaborative component completed in a small team that is worth 20%.
- In the event that the collaborative grade is lower than the individual grade, the individual grade will count for 100%. (Two-stage testing cannot hurt your individual grade).
- At the midterm evaluation, if a majority of the class feels that two-stage collaborative assessment is not working out, we will elect to drop this style of exam taking.

Attendance Policy, Make-Up Policy, Class Expectations, and Assistance:

Attendance:

- Attendance is not monitored directly, but is essential for success in this course.
- There will be in-class only assignments for a grade (each of equal weight).
- It is your responsibility to keep up to date on the materials/assignments when you have missed class.
- Please notify Dr. Phelps in advance if you will be missing more than 2 consecutive classes.

Make-Up Assignment Policy:

- No late homework and no late in-class assignments are accepted.
- No make-up homework and no make-up in-class assignments are permitted.
- This policy is to ensure timely posting of solutions due to the fast pace of the class.
- See the **life-happens policy** which accounts for routine unexpected situations.
- Missed class due to official UF or professional travel (e.g. interview, scientific conference, etc.) must be arranged with the instructor in advance and will only be granted on an individual case-by-case basis. Any missed assignments must be submitted in advance.
- Extended university approved excused absences resulting in multiple missed assignments will be handled on a case-by-case basis.

'Life Happens' Policy:

- This policy does not apply to exams.
- Students are permitted one unexcused homework, no questions asked.
- Students are permitted one unexcused individual in-class assignment, no questions asked.
- Students are permitted one unexcused team-based in-class assignment, no question asked.
- The way this policy will be implemented is that the lowest homework and the lowest of each type of in-class assignment will be dropped from the final grade.

Make-Up Exam Policy:

- Make up exams are permitted only for documented university approved excused absences.
- In the event of a missed exam due to an excused absence only the individual part of the exam will be offered during the makeup (counts for 100%). There is no option to make-up the team exam grade.
- Please review your student handbook to ensure that you understand the requirements for a university approved absence. Excused absences are consistent with university policies and require appropriate documentation. (<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>).

Communication:

- Class announcements will be posted to Canvas. All students are responsible for ensuring awareness of these postings. Failure to review the course website is not an excuse for missing announcements.
- Please use only your official UF email address to communicate with Dr. Phelps or your STs.
- Dr. Phelps prefers that you use Canvas when sending messages for automatic association with the class.
- Include BME 3060 in the subject line.
- Although he is usually faster, please allow up to 48 hours for Dr. Phelps to respond, longer if at night or on the weekend / holidays / breaks.

Electronics policy:

- The use of personal electronic devices in class is not permitted except for the sole purposes of:
 - (1) electronic notetaking.
 - (2) referring to the text / figures of assigned readings during class discussion.
 - (3) participation in class activities such as interactive response questions.
- The use of electronic devices for non-class related activities (social media, web surfing, gaming, texting, etc) is not permitted and will result in your device being confiscated for the remainder of the class period.
- **Unauthorized recordings** or photography of any class activity are not permitted without prior express permission from the instructor.

Professional conduct:

- Students are expected to engage with the instructor and fellow students in a courteous and professional manner.
- Peer-evaluation and feedback should be respectful and constructive.
- Any student who behaves in a disrespectful or disorderly manner may be asked to leave the classroom.

Assistance with Course Material:

You should expect this course to challenge you and require time, effort, and thoughtful analysis for success. When a concept or problem presents a challenge, spend the time to really think about how to approach the problem, as this thoughtful analysis will train you for success in exams (and future classes). If you are struggling with a concept or problem, you have 3 primary resources: 1) your peers, 2) your STs, and 3) your professor. Before you reach out to any of these resources, you are expected to have spent considerable time on your own attempting to understand or complete the problem.

Peers:

Establishing a strong and fruitful peer network is an important resource in your major and will help serve you well as you progress in BME, so seek out colleagues that can serve as a strong peer network. Brainstorming on problems with your peer group (after you have attempted to solve them independently) is permitted; however, this dynamic interaction should be one that leads to improved conceptual understanding on how to approach problems – not one used as a crutch to copy solutions. Assignments are used to train you for exams, so copying solutions from friends will inevitably result in a poor exam performance. In the end, individual assignments must be your own work, not a copied solution. All team members must participate in the collaborative assignments. **See Plagiarism Policy.**

STs/Professor:

The STs and professor are another resource to assist you in succeeding in this course. You are welcome to see the STs or Dr. Phelps during posted office hours. Due to multiple demands, we are typically unavailable outside of these times, but can be reached via email. Office hours are for answering questions focused on clarifying concepts or providing a new perspective on how to approach a problem, not for providing answers to problems or walking you through each problem. When notes are left on assignments and exams to “see me”, this means that the professor or ST would like to take extra time to work out concepts with the student. Scheduling this time, however, is expected to be initiated by the student, otherwise the impression is given that the student is not willing to put in the extra effort to succeed in the course.

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://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 STs in this class.

Plagiarism:

Plagiarism is a common infraction to the UF Honor Code. If you are confused as to what constitutes plagiarism, see <https://guides.uflib.ufl.edu/copyright/plagiarism>. Plagiarism on any of your assignments **will be reported to the Dean of Students as a UF Student Honor Code violation**. Also, note that **copying solutions for any assignment, regardless of the source (e.g. other students, pirated website solutions), will be treated as plagiarism**. If you have any questions or concerns, please consult with the instructor in this class. Note that failure to comply with this commitment will result in disciplinary action compliant with the UF Student Honor Code Procedures.

Evaluation of Grades

- 60% Three in-class exams (20% each)
 - Each exam is 80% individual grade and 20% team grade
 - Two-stage testing may be suspended based on the midterm student feedback
 - Makeup exams are 100% individual grade
- 30% Individual homework assignments
- 5% In-class individual quizzes
- 5% In-class teamwork quizzes

To maximize your partial credit in grading:

1. Write legibly and do not crowd your work.
2. Construct a clear diagram, if appropriate.
3. Write the equations you are using in symbols before substituting in numbers.
4. Label all numerical quantities/values with units.
5. Box your final answer.

Grading Policy

Percent	Grade	Grade Points
93.4 - 100	A	4.00
90.0 - 93.3	A-	3.67
86.7 - 89.9	B+	3.33
83.4 - 86.6	B	3.00
80.0 - 83.3	B-	2.67
76.7 - 79.9	C+	2.33
73.4 - 76.6	C	2.00
70.0 - 73.3	C-	1.67
66.7 - 69.9	D+	1.33
63.4 - 66.6	D	1.00
60.0 - 63.3	D-	0.67
0 - 59.9	E	0.00

Final cumulative numerical grades will be rounded to the nearest tenth of a point. Curving of assignments is exceptionally rare and typically only due to the entire class missing a question. No extra assignments for additional credit are given in this course. There is no curving of final grades.

Note: A grade of “C” is the qualifying grade for critical tracking courses (BME 3060 is one of these). Thus, BME majors who earn a “C minus” or lower must retake this course.

Note: In order to graduate, students must have an overall GPA and an upper-division GPA of 2.0 or better (C or better). A grade of “C minus” is equivalent to a GPA of 1.67. For more information on grades and grading policies, please visit: <https://catalog.ufl.edu/ugrad/current/advising/info/academic-progress.aspx>

Grade challenges:

We do our best to grade evenly and fairly, but mistakes in grading can happen. Requests to modify points on assignments, quiz, or exams must be submitted in writing to the STs or Dr. Phelps 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 to 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.

Students Requiring Accommodations:

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.

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

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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>

Inclusion Statement:

It is my intention that students from all backgrounds and perspectives will be well served by this course and that the diversity that students bring to this class will be viewed as an asset. I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, socioeconomic background, family education level, ability – and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class. Your suggestions are encouraged and appreciated.

Lived Name / Pronoun Statement:

I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records.

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: <http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

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 Resource Center, Reitz Union, 392-1601. Career assistance and counseling. <https://www.crc.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://care.dso.ufl.edu>.

On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process>.

Commitment to a safe and inclusive learning environment

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination.

It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

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
- Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@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@ufl.edu

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

It is mandatory for UF faculty members to report incidents of harassment or discrimination to the Title IX office. Because of this requirement, if you tell your professor about sexual discrimination, misconduct, harassment, or violence involving members of the campus, **your professor is required to report this information**, even if the reporting goes against the wishes of the student confiding in the faculty member.

For more information or to report a Title IX issue: <https://titleix.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/>.