BME 2333 Biomedical Engineering Fundamentals

Fall 2016

Lecture Hour: Tuesday/Thursday 10:30AM-11:45AM in DEH 270
Office Hour 1: Tuesday 9:00AM-10:00Am in DEH 232
Office Hour 2: Thursday 3:00PM-4:00PM in Two Partners Place Suite 125

Instructor: Dr. Han Yuan
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Course Prerequisite:
Majors only; MATH 1914 or 1823; MATH 2924 or 2423; CHEM 1315; CHEM 1415; and PHYS 2514 all with a grade of B or better.

Course Description:
Introduction to material, energy, charge, and momentum balances in biological systems. Steady state and transient conservation equations for mass; energy, charge, and momentum will be derived and applied using basic mathematical principles, physical laws, stoichiometry, and thermodynamic properties.

Course Goals:
The overall goal of this course is for the students to understand the fundamental principles of describing biological systems and the engineering basis for intervening. At the successful completion of the course, student will be able to analyze an existing biological system using the principles introduced in the class and design a concept application to maintain or change the system.

Learning Objectives:
1. Develop problem-formulation and problem-solving skills;
2. Develop and understand mass, charge, momentum, and energy conservation equations;
3. Apply the conservation equations to solve problems in the biological and medical sciences and to model biological and physiological systems; and
4. Appreciate the types of technical challenges and opportunities in biomedical engineering and the rewards of an engineering approach in the life and medical sciences.

Topics:
- Approaching Problems from an Engineering Prospective
- Foundations of Engineering Calculations
- Conservation Principles
- Conservation of Mass
- Conservation of Energy
- Conservation of Charge
- Conservation of Momentum
- Selective Constitutive relations
- Applying Engineering Principles to Biological Systems

Textbook:

Required: Bioengineering Fundamentals
Ann Saterbak, Ka-Yiu San, and Larry V. McIntire
Prentice Hall, 2007
ISBN-10: 0130938386
ISBN-13: 978-0130938381

Additional Materials: Select course notes, slides, reading, and example problems will be placed on Canvas (http://canvas.ou.edu).

Reference books/resources:

1) Biomedical Engineering Fundamentals, Fourth Edition
   Joseph D. Bronzino, Donald R. Peterso
   Taylor & Francis, 2014
   ISBN: 9781439825181
2) Biomedical Engineering: Bridging Medicine and Technology, 2nd edition
   W. Mark Saltzman
   Cambridge University Press, 2015
   ISBN: 978-1107037199
3) So You Want to Become a Biomedical Engineer
   https://www.edx.org/course/so-you-want-become-biomedical-engineer-ieeex-biomed01x-0
   Online course by IEEE Engineering in Medicine and Biology Society, the world's largest international society of biomedical engineers.

Learning Activities and Assessment

Homework:
Homework is expected to be completed by each individual student. Homework can be submitted online by the due time, or on paper in class by the due time.

Quizzes:
The quizzes will take place in class and be worth twenty points each. The format of the quiz may include selected response questions and free response questions. The questions on the quizzes will come from the in-class contents, textbook chapters, required reading materials, and discussions within the online platform and in class.

Participation:
You are highly encouraged to ask questions and initiate discussions during class. Bonus points will be awarded for participation at the discretion of the instructor. You are encouraged to remind the instructor to keep records of your participation at the end of the class session.

Project 1:
The project will be completed by each individual, NOT by project groups. Choose a field of biomedical engineering, identify a system of interest or a case study, and describe the system or case using at least two out of the four fundamentals introduced in the class.

Project 2
The project can be completed in groups of no more than three members, or by an individual. The project can be based on the paper developed in Project1 or a new topic. The task of the project includes a synopsis, a presentation in the class and a paper. Group formation is due as the same time of the synopsis. Should students elect to complete the project as a group, each member of the group will receive the same grade for the project presentation and the paper. Once the deadline of group formation is past due, no formation of new groups is permitted; no addition of group members is permitted; only dropping out of an existing group will be permitted given written statements of all group members. The

dropped out person(s) will complete the Project 2 individually and no compensatory time will be added toward completion of the project.

Final Exam

The Final Exam will be 100-points and may contain both selected response (multiple choice, ranking, matching…) and free response questions (short answer, structure, mechanism…). The questions on Final Exam will come from the in-class contents, textbook chapters, and reading material, as well as discussions within the online platform and in class. The Final Exam will be given in-person and in-class during the Final Exam period.

Final Grade:

The course grade will be determined by the sum of all possible points (see below). The final letter grading for the course will be as follows: A ≥ 90%, B = 89-80%, C = 79-70%, D = 69-60%, F = <60%. The instructor will round all averages to two significant figures (69.5 will round to 70 and 69.4 will round to 69) to determine the student's letter grade in the course (70 = C, 69 = D).

The instructor reserves the right to make linear adjustments to quiz and final exam grades in cases were a quiz or exam question was found to be in error or unreasonably difficult. The instructor also reserves the right to grade the class on curve.

COURSE GRADE:

Quizzes	2@20	40
Homework	6@10	60
Participation	10	10
Project 1	30	30
Project 2 – presentation	30	30
Project 2 – paper	30	30
Final Exam	100	100
Points Possible		300

Course Schedule (subject to change):

Module	Topic	Readings/Materials	Due
1	Syllabus; Introduction to canvas;	Chapter 1; Canvas;	-
2	Variables and Systems; Conservation Equations;	Chapter 1, 2; Canvas;	Homework1 (09/06/16);
3	Mass	Chapter 3; Guest speaker 1; Guest speaker 2; Canvas;	Homework2 (09/15/16);

Module	Topic	Readings/Materials	Due
4	Energy	Chapter 4; Guest speaker 3; Guest speaker 4; Canvas;	Homework3 (09/29/16); Quiz1;
5	Charge	Chapter 5; Guest speaker 5; Guest speaker 6; Canvas;	Homework4 (10/25/16); Quiz2;
6	Momentum	Chapter 6; Guest speaker 7; Guest speaker 8; Guest speaker 9; Canvas;	Homework5 (11/03/16); Homework6 (11/22/16);
7	Project 1	Canvas;	Submission (10/13/16);
	Project 2	Canvas;	Synopsis and Groups (10/20/16); Presentation submission (11/28/16); In-class presentation 1 (11/29/16); In-class presentation 2 (12/1/16); Project paper (12/5/16);
8	Final Exam	-	12/12/16

Teaching Philosophy:
Learning is a process. To learn, a student must engage in the process. I design my courses to facilitate the learning process, but a student will only learn if they engage in course through reading, discussions, interactions, assignments, and assessments.

Learning is social. The feedback from the instructor and fellow students is important in mastery of the content and concepts within the course. Collaboration is strongly encouraged in this course during the learning process. Of course, collaboration on graded assignments is a violation of academic integrity unless the assignment is specifically noted as a group assignment.

Learning takes time and effort. You are building new connections in your brain when learning. This cannot be done quickly or without effort. It is important to take time to study, practice, and reflect in this course.

Expectations:
You can expect me to:
- Challenge you to think about and understand the material in this course.
- Encourage you to learn the material in this course and become a lifelong learner.
- Be available for office hours and return e-mails in a timely fashion, within 24 hours.
- Return written assignments, quizzes and exams in a week or less.

- Engage you in the lecture and around campus.

I expect you to:

- Attend class and be engaged.
- Study at least 2 hours outside of class for every hour of class (Nationwide Standard)
- Keep up with reading and end of chapter problems.
- Accept responsibility for your learning.

Course Policies

Make-up Policy

Turning work in on time is a sign of professionalism and respect for not only your instructor, but also for the other students in the course. Any assignment turned in late (that has not been previously discussed with the instructor) will be worth 50% of the possible value. No assignment will be evaluated that is received one week after the due time.

No make-up quiz for the two quizzes will be provided.

Absences

Attending every lecture is highly recommended and expected. Not attending class will have an indirect negative effect on your grade. If low attendance to lectures becomes problematic, the instructor reserves the right to use attendance as extra-credit. There will not be assigned seating in the lecture, but students are expected to sit next to their study group partners to facilitate communication during problem solving sessions in class.

Civility

All students are expected to follow proper classroom behavior and treat other students and the instructor with respect. If the instructor deems a student's actions or behavior disruptive to the class, the students will be asked to leave the class for that day.

Emergency Contact

In case of family or medical emergencies, students can leave a message on the instructor's voice mail (405-325-4665) or by e-mail (hanyuan@ou.edu). Once the emergency has passed, the student can meet will the instructor to discuss what material/assignments the student has missed and what steps would beneficial to aid the student in continued success in the course.

Changes in the Syllabus

As the course develops, it might be desirable/necessary to make appropriate changes in aspects of this syllabus. The Instructor reserves the right to make changes if desirable or necessary.

University Policies

Academic Integrity

Cheating is strictly prohibited at the University of Oklahoma, because it devalues the degree you are working hard to get. As a member of the OU community it is your responsibility to protect your educational investment by knowing and following the rules. For specific definitions on what constitutes cheating, review the Student's Guide to Academic Integrity at http://integrity.ou.edu/students.html

Religious Observance

It is the policy of the University to excuse the absences of students that result from religious observances and to reschedule examinations and additional required classwork that may fall on religious holidays, without penalty.

Disability Accommodation

Students requiring academic accommodation should contact the Disability Resource Center for assistance at (405) 325-3852 or TDD: (405) 325-4173. For more information, please see the Disability Resource Center website http://www.ou.edu/drc/home.html. Any student in this course who has a disability that may prevent him or her from fully demonstrating his or her abilities should contact me

personally as soon as possible so we can discuss accommodations necessary to ensure full participation and facilitate your educational opportunities.

Title IX Resources and Reporting Requirement

For any concerns regarding gender-based discrimination, sexual harassment, sexual misconduct, stalking, or intimate partner violence, the University offers a variety of resources, including advocates on call 24/7. To learn more or to report an incident, please contact the Sexual Misconduct Office at 405-325-2215 (8 to 5, M-F) or OU Advocates at 405-615-0013 (24/7). Also, please be advised that a professor/GA/TA is required to report instances of sexual harassment, sexual assault, or discrimination to the Sexual Misconduct Office. For more information, please see http://www.ou.edu/eoo.

Adjustments for Pregnancy/Childbirth Related Issues

Should you need modifications or adjustments to your course requirements because of documented pregnancy-related or childbirth-related issues, please contact your professor or the Disability Resource Center at 405/325-3852 as soon as possible. Please see http://www.ou.edu/eoo/faqs/pregnancy-faqs.html for answers to commonly asked questions.

Canvas Support

If you need assistance, please contact Canvas Support at canvas@ou.edu, or call 405-325-2323.