

# BME 214L: Computational Fundamentals of Biomedical Engineering Design

Fall 2016

14080 (T 9:30-12:30), 14085 Th (9:30-12:30), 14090 (T 12:30-3:30), 14100 (W 3-6), 14105 (Th 3:30-6:30)

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## Course Description

University Catalog Course Description

Development of biomedical engineering design concepts, including hands-on learning applications in the lab.

### *What is Biomedical Engineering?*

This course will introduce students to application of engineering principles to address biomedical problems. The course will strengthen students' ability to use computational methods to model biomedical systems, analyze data, and assist in the engineering design process.

The goal of the course is to provide students for opportunity for professional growth by exposing them to computational modeling, engineering design, and teamwork.

Learning objectives

By the end of the semester students will have the opportunity to:

- Be introduced to fluid dynamics for the purpose of modeling fluid flow for biomedical engineering design computational prototyping.
- Computationally analyze data to gain insight into the process of evaluating the effectiveness of new therapies.
- Learn how to design circuits to collect and process biomedical data.
- Use solid mechanics principles to design and build a working prototype of a BME project.
- Learn basic instrumentation, optics, and imaging modalities as applicable to BME.

## My Learning Objectives

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## ABET Program Outcomes

- (a) an ability to apply knowledge of mathematics, science, and engineering
- (b) an ability to design and conduct experiments, as well as to analyze and interpret data
- (i) a recognition of the need for, and an ability to engage in life-long learning
- (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

## Course Format and Learning Activities

Lectures and labs are both designed to be hands-on.

The lectures will be held in CMA 2.306 MW 10:00-11:00 AM as indicated in the course schedule. Lectures will contain some background information necessary for lab experiments, but lab-specific background and notes will be available online and must be viewed prior to beginning the experiment. Detailed background for all experiments, details of the work to be completed, and links to online lectures or other necessary material may be found on Canvas <https://canvas.utexas.edu/>. Log in with your UT EID and password.

## Prerequisites

BME 303 or EE 306, BME 203L or 303L, PHY 303K, PHY 103M

## Pre- / Co-requisites

BME 311, CH 302 or 302H, M 427J or M 427K, PHY 303L, PHY 103N

## How to be successful in this course

**Participation:** This is a hands on course. You will learn the most by participating in the experiments and the exercises. Participation includes showing up on time to both lab and scheduled lectures. Lab session attendance is mandatory.

**Preparation:** All lab assignments can be completed within the allotted time for the labs, but students are generally only able to complete an assignment on time if they properly prepare prior to lab. Proper preparation includes reading online content, attending lectures, and doing pre-laboratory planning in your laboratory notebook.

**Explore:** One major goal of college is to teach you how to find answers yourself. Research has shown that you will learn more by actively participating in learning rather than being spoon fed information from an instructor.

**Teamwork:** Much of the work will be accomplished in teams of 2-3. Teams are randomly assigned and you will have to work well with your teams in order to be successful.

**Practice safety and cleanliness:** Successfully working in the lab requires adherence to all safety guidelines. You must dress appropriately for a laboratory environment (long pants, socks, close toed shoes), follow all safety procedures, and wear PPE (lab coat, gloves, and goggles) when appropriate. You must also clean up after yourself. A cleaner lab is a safer lab and you will be graded on your ability to keep things tidy.

## Course Requirements

### Required Materials

There is no required textbook. All required content will be posted on the Canvas webpage.

You must keep a lab/design notebook. For this class you will have the option of keeping a physical lab notebook or an electronic lab notebook.

**Physical lab notebook** must meet the following criteria:

- 1) Permanently bound pages
- 2) Pages pre-numbered, without any missing numbers or pages torn out
- 3) Room for table of contents at the beginning

You can buy acceptable lab notebooks from either BMES or from the Co-op.

**Electronic lab notebook** must be Microsoft OneNote. OneNote can be downloaded free for almost every platform. The lab notebook must be a separate OneNote notebook from class notes, personal notes, etc.

Guidelines for maintaining both physical lab notebooks and electronic lab notebooks are posted on Canvas. Lab notebooks will be graded throughout the semester.

## Assignments

Your assignments for the course include written abstracts, oral presentations, pre-lecture and pre-lab quizzes, a content exam, and maintaining a proper lab notebook.

1. **Laboratory related assignments.**
  - a. Heart valve design letter *(10% of final grade)*
  - b. Hand dynamometer and EMG project *(10% of final grade)*
2. **Lecture related assignments.**
  - a. My learning objectives *(2.5% of final grade)*
  - b. BME job requisition *(2.5% of final grade)*
  - c. Biomedical informatics project *(10% of final grade)*
3. There are **pre-lab quizzes** before most labs and **pre-lecture quizzes** before most lectures. The purpose of the pre-lab quizzes is to help ensure that you have properly prepared for lab and help you feel confident in the experiments that you are about to run. The purpose of the pre-lecture quizzes is to help transition from the previous lecture and give you insight into what I consider are the key concepts that you should know. *(15% of final grade)*
4. **Exams** – There are 2 exams during the semester during the scheduled lecture times. Each exam is scheduled for 2 lecture sessions. During the first session, students will take the exam individually. The students will then take the exact same exam with their lab teams on the second exam session. 70% of your exam score will be from the individual portion, 30% will be from the team portion. *(30% of final grade)*
5. You must maintain a **lab/design notebook**. If you maintain a physical lab notebook, it will be checked after each module by the LAs/TAs. If you maintain an electronic lab notebook, you must submit the exported notebook on Canvas to be graded for each module. *(10% of final grade)*
6. The final 10% of your grade is labeled **participation**. Participation includes attendance, safety, teamwork, and cleaning up after yourself and your team when you are done *(10% of final grade)*

## Course Schedule

note: schedule can be adjusted to better meet learning goals

Week	Lecture date	Lecture topic	Lab	Due
1	8/24/2016	Intro / syllabus	NO LABS	
2	8/29/2016	Fluid mechanics	Safety / Solidworks tutorials	
	8/31/2016	Fluid mechanics		My learning objectives
3	9/5/2016	NO LECTURE - Labor Day	Heart valve model in Solidworks	
	9/7/2016	Fluid mechanics		
4	9/12/2016	Modeling	Flow simulation of heart valve	
	9/14/2016	Modeling		
5	9/19/2016	Modeling	Flow simulation of heart valve	
	9/21/2016	Introduction to mechanics		
6	9/26/2016	Introduction to mechanics	Circuits / LabView	Heart valve design letter
	9/28/2016	Biomedical Informatics		
7	10/3/2016	Introduction to mechanics	Biomedical Informatics Project	
	10/5/2016	NO LECTURE - BMES		
8	10/10/2016	Review	Soldering / strain gages	
	10/12/2016	Exam I		
9	10/17/2016	Exam I	Hand dynamometer	
	10/19/2016	Biomedical engineering careers		
10	10/24/2016	Instrumentation	Hand dynamometer	
	10/26/2016	Instrumentation		
11	10/31/2016	Instrumentation / filtering	Filters	Job requisition
	11/2/2016	Instrumentation / filtering		
12	11/7/2016	Optics	EMG circuit design / multisim	Biomedical Informatics Project
	11/9/2016	Optics		
13	11/14/2016	Biomedical imaging	EMG circuit building	
	11/16/2016	Optics		
14	11/21/2016	NO LECTURE - Thanksgiving	NO LABS - Thanksgiving	
	11/23/2016	NO LECTURE - Thanksgiving		
15	11/28/2016	Review	Hand dynamometer and EMG demo	Hand dynamometer / EMG
	11/30/2016	Exam II		
16	12/5/2016	Exam II	NO LABS	

## Course Policies

### Class participation and attendance

Lecture and lab attendance is **mandatory**. Students are expected to attend all lab sessions and to show up on time. All absences must be discussed with the Instructor prior to the session. In some cases, it may be more convenient for a team to schedule time on a particular piece of equipment or to finish an experiment outside of normal lab hours. These requests will be handled on a case-by-case basis.

### Lab cleanliness

Before leaving lab, you must clean up after yourself. If the TA or instructor has to clean up after you, you will lose points on your participation grade.

### Grading Policy and Procedures

The TA(s) or LA(s) will grade all assignments. Quizzes on Canvas are graded automatically by Canvas. Written assignments must be submitted electronically on Canvas **before the beginning of your lab session** on your due date. Any late submission will be penalized 5 points before close of business (5:00 p.m.) and 10 points per day after that. A student (and an assignment) is considered “late” 20 minutes after the start of the lab session.

### Regrade requests

Grading questions and clarifications should be initiated with the Instructor for quizzes and the TA for all other assignments. If you believe the assignment was unfairly graded, you must submit, in writing, a re-grade request to the instructor within 3 days of the assignment being returned. The instructor will re-grade the ENTIRE assignment from scratch.

### Late assignments

No late assignments are accepted without penalty unless approved prior to the due date of the assignment or in exceptional cases (e.g., death in immediate family, hospitalization, etc.) Assignments will be posted via Canvas unless otherwise specified. If there are extenuating circumstances they must be cleared in advance if possible, and if not, supported by a doctor’s note or other official source.

## Grading

The breakdown of your final grade is as follows

Assignment	Points possible	Percent of total grade
Lab related assignments	200	20%
Heart valve design	100	10%
Hand dynamometer / EMG	100	10%
Lecture related assignments	150	15%
My learning objectives	25	2.5%
BME job requisition	25	2.5%
Biomedical informatics	100	10%
Quizzes	150	15%
Pre-lab	75	7.5%
Pre-lecture	75	7.5%
Exams	300	30%
Exam I individual	105	10.5%
Exam I team	45	4.5%
Exam II individual	105	10.5%
Exam II team	45	4.5%
Lab notebook	100	10%
Participation	100	10%

Grade	Cutoff	Points needed
A	94%	940
A-	90%	900
B+	87%	870
B	84%	840
B-	80%	800
C+	77%	770
C	74%	740
C-	70%	700
D	65%	650
F	0%	0

## University Policies

### Religious Holy Days

By UT Austin policy, you must notify me of your pending absence at least fourteen days prior to the date of observance of a religious holy day. If you must miss a class, an examination, a work assignment, or a project in order to observe a religious holy day, I will give you an opportunity to complete the missed work within a reasonable time after the absence.

### Q Drop Policy

If you want to drop a class after the 12th class day, you'll need to execute a Q drop before the Q-drop deadline, which typically occurs near the middle of the semester. Under Texas law, you are only allowed six Q drops while you are in college at any public Texas institution. For more information, see:

<http://www.utexas.edu/ugs/csacc/academic/adddrop/qdrop>

### Student Accommodations

Students with a documented disability may request appropriate academic accommodations from the Division of Diversity and Community Engagement, Services for Students with Disabilities, 512-471-6259 (voice) or 1-866-329- 3986 (video phone). <http://ddce.utexas.edu/disability/about/>

- Please request a meeting as soon as possible for us to discuss any accommodations
- Please notify me as soon as possible if the material being presented in class is not accessible
- Please notify me if any of the physical space is difficult for you

### Academic Integrity

Each student in the course is expected to abide by the University of Texas Honor Code:

**“As a student of The University of Texas at Austin, I shall abide by the core values of the University and uphold academic integrity.”**

Plagiarism is taken very seriously at UT. Therefore, if you use words or ideas that are not your own (or that you have used in previous class), you must cite your sources. Otherwise you will be guilty of plagiarism and subject to academic disciplinary action, including failure of the course. You are responsible for understanding UT's Academic Honesty and the University Honor Code which can be found at the following web address: [http://deanofstudents.utexas.edu/sjs/acint\\_student.php](http://deanofstudents.utexas.edu/sjs/acint_student.php)



## University Resources for Students

The university has numerous resources for students to provide assistance and support for your learning

- Sanger Learning and Career Center: [www.utexas.edu/ugs/slc](http://www.utexas.edu/ugs/slc)
- University Writing Center: <http://uwc.utexas.edu/>
- ITS: <http://www.utexas.edu/its/>
- Counselling and Mental Health Center: <http://www.cmhc.utexas.edu/individualcounseling.html>
- Student Emergency Services: <http://deanofstudents.utexas.edu/emergency/>
- Libraries: <http://www.lib.utexas.edu/>
- Canvas: <https://utexas.instructure.com/courses/633028/pages/student-tutorials>

## Important Safety Information

If you have concerns about the safety or behavior of fellow students, TAs or Professors, call BCAL (the Behavior Concerns Advice Line): 512-232-5050. Your call can be anonymous. If something doesn't feel right – it probably isn't. Trust your instincts and share your concerns.

The following recommendations regarding emergency evacuation from the Office of Campus Safety and Security, 512-471-5767, <http://www.utexas.edu/safety/>

Occupants of buildings on The University of Texas at Austin campus are required to evacuate buildings when an alarm or alert is activated. Alarm activation or announcement requires exiting and assembling outside, unless told otherwise by an official representative.

- Familiarize yourself with all exit doors of each classroom and building you may occupy. Remember that the nearest exit door may not be the one you used when entering the building.
- Students requiring assistance in evacuation shall inform their instructor in writing during the first week of class.
- In the event of an evacuation, follow the instruction of faculty or class instructors. Do not re-enter a building unless given instructions by the following: Austin Fire Department, The University of Texas at Austin Police Department, or Fire Prevention Services office.
- Link to information regarding emergency evacuation routes and emergency procedures can be found at: <http://www.utexas.edu/emergency>