BME Course Summary

DEPARTMENT OF BIOMEDICAL ENGINEERING
INSTRUCTIONAL INCUBATOR
UNIVERSITY OF MICHIGAN

Introduction

1. Course Information

Course Name	Biomedical Engineering Fundamentals and Design
Institution	*University of Wisconsin-Madison*
Course Number	**BME 201**
# credits	**2**
Meeting times	"classroom meeting from 12:05 to 12:55 pm on Fridays and has an additional scheduled two-hour lab period"
Is this a required course?	**Yes**
Pre-requisites	**BME 200**
Target audience (e.g. 1st, 2nd year):	**Sophomore Year, Second Semester (Spring)**
Textbook	**None ***
Course Website (if it exists)	**http://bmedesign.engr.wisc.edu/course/syllabus/ **** **https://aefis.wisc.edu/index.cfm/page/AefisCourse.ABETSyllabusForm?courseid=511 *****

* There is a $20 course handbook sold by BMES chapter at U of W-M (contains lab materials & design project notes)
** Contains information on entire BME design sequence.
*** Course website for BME 201 specifically

2. Course Description

In the space below, "paste" the description of the course. This can be the actual description listed in the syllabus from the course.

"second-semester sophomores … work in teams to solve a guided project using multidisciplinary hands-on technical (including electronic circuits, programming, 3D modeling in SolidWorks, machining and fabrication, and laboratory techniques) and professions design-based skills taught during the lecture and laboratory sessions."

3. Course Learning Objectives

In the space below, "paste" the course learning objectives if explicitly stated.

Course Learning Outcome

- Apply the design process to solve open-ended problems
- Use CAD tools to make plastic parts using a 3-D printer
- Use tools in the student machine shop to make machined parts
- Safely perform experiments in both wet labs and instrumentation labs.
- Implement electronic microcontroller circuits
- Write software for data acquisition, processing and display
- Practice appropriate ethical behavior, including when dealing with human and animal subjects
- Understand the sub-disciplines of biomedical engineering and make informed decisions to choose future coursework

ABET Program Outcomes Associated with this Course

- (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
- (C) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- (D) An ability to function on multidisciplinary teams
- (E) An ability to identify, formulate, and solve engineering problems
- (F) An understanding of professional and ethical responsibility
- (G) An ability to communicate effectively
- (H) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- (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

Program Specific Student Outcomes

(1) Understanding of biology and physiology as related to biomedical engineering needs.

(2) Ability to apply knowledge of advanced mathematics (including differential equations and statistics), sciences, and engineering to solve problems at the interface of engineering and biology and to model biological systems

(3) Ability to design and conduct experiments, including making measurements and interpreting experimental data from living systems and addressing the problems associated with the interaction between living systems and non-living materials and systems

4. Fundamental Tools and Skills

In the space below, describe the fundamental tools and skills that are addressed in the class. For example, labvview, arduino's, the design process etc.

SolidWorks, LabView, Matlab, design process (guided), sterile technique for biomaterials and tissue engineering, “machine shop certification – machining and fabrication”, “introduction to finite element modeling using ANSYS”, circuits and electric measurements, microcontrollers

5. Exercises or Experiential Projects of Interest

Exercise/Project	Project Overview	Learning Activities and Assessments	Required Resources for Project Completion
Guided Design (last 4 weeks of the class)	Designing a prototype of a medical device. Entire class tackles same problem in teams of 6-8 students.	(Example project from 2012 and 2013: “design and build a bioreactor system to test the mechanical properties of a biomaterial (alginate gel) that they synthesized”) Learning Activities (for example project): • Literature Review • Develop 3D model of bioreactor using SolidWorks • Bulid it using mill and lathe in Student Shop • Stress tests on alginate gels, and collected data using a microcontroller based program • Statistical analysis using Matlab • Compare results to results using MTS machine Assessment: • Written report of design process • Presentation •	Varies depending on the project for a particular year For 2012 & 2013: 3D printer, SolidWorks, mill and lathe, alginate gels from tissue engineering labs, microcontrollers, Matlab, MTS machine
Hands on laboratory sessions (first 10 weeks of the class)	Sessions serve to equip students with skills necessary to design a medical device prototype (the guided design part of the course)	Ex: a microcontroller lab, a SolidWorks lab, etc. (details not given, but the focus is building skills) Learning activities: • Hands on practice • Required reading beforehand Assessment: • Online quizzes on required pre-reading (lab manual & tutorials) • Laboratory notebook • Write ups of experiments	Each lab requires different materials but as a whole they include tissue culture materials, microcontrollers, electronics/circuits materials, computers with SolidWorks, Matlab, LabView, etc. installed

6. Additional thoughts

If you have any other thoughts about this course, but have not been able to reflect it elsewhere in the document, please feel free to do so here.

I really like how U of Washington-Madison's BME undergraduate program is set up in general. Each semester has a design course by the end of which students will develop a prototype. Design is introduced early into the curriculum and seems to be a focus. Specific skills are also explicitly taught and applied to design in the same class. A broad array of skills are taught: I think this is important because it helps level the playing field/makes sure students are approximately on the same page. In BME 201 specifically, there seems to be a good balance of theoretical, practical and design education; the three components (theoretical lectures, labs to develop skills, and the design project) tie together well/don't seem disconnected.

I like that there's no required textbook; textbooks are expensive. There is a $20 course handbook that honestly should be free in my opinion, since it sounds like it just contains lab and design instructions, which are a built in part of the course.