DEPARTMENT OF BIOMEDICAL ENGINEERING
INSTRUCTIONAL INCUBATOR
UNIVERSITY OF MICHIGAN

# BME Course Summary – Brendan Berg

## Introduction

## 1. Course Information

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| **Course Name** | *Biomedical Engineering Lab* |
| **Institution** | *Carnegie Mellon University* |
| **Course Number** | **42-203** |
| **# credits** | **9 units (unsure of conversion to typical credits, but may be ~3 units/credit)** |
| **Meeting times** | **Mon/Wed 1:30-2:50 pm or Tue/Thur 10:30-11:50 am** |
| **Is this a required course?** | **Yes** |
| **Pre-requisites** | **42-101 Introduction to Biomedical Engineering and 03-121 Modern Biology** |
| **Target audience** (e.g. 1st, 2nd year): | **2nd year** |
| **Textbook** | **None (articles and references posted to class website, CMU Canvas equivalent)** |
| **Course Website (if it exists)** | **http://www.cmu.edu/blackboard** |

## 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.

This laboratory course is designed to provide students with the ability to make measurements on and interpret data from living systems. The experimental modules reinforce concepts from 42-101 (Introduction to Biomedical Engineering) and expose students to four areas of biomedical engineering: biomedical signal and image processing, biomaterials, biomechanics, and cellular and molecular biotechnology. Several cross-cutting modules are included as well. The course includes weekly lectures to 3 42-203: BME Lab Spring 2014 complement the experimental component. Priority for enrollment will be given to students who have declared the Additional Major in Biomedical Engineering.

## 3. Course Learning Objectives

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

By the end of this course, the students should be able to do the following: 1. Understand and follow guidelines regarding biological safety 2. Maintain a laboratory notebook that

follows the guidelines given in class 3. Prepare a laboratory report 4. Demonstrate aseptic cell culture techniques 5. Perform transformation into a bacterial cell 6. Describe and demonstrate basic concepts and examples of biomedical signal and image processing, biomaterials, biomechanics, and cellular and molecular biotechnology 7. Perform literature search 8. Prepare a scientific poster 9. Collect, analyze, and interpret physiological measurements

## 4. Fundamental Tools and Skills

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

*Cell Culture, bacterial transformation, EKG measurement and interpretation, electromyography measurement and interpretation, literature review, data analysis with MATLAB.*

## 5. Exercises or Experiential Projects of Interest

| Exercise/Project | Project Overview | Learning Activities and Assessments | Required Resources for Project Completion |
|---|---|---|---|
| 1 | Students learn cell culture and transform bacterial cells | **Learning Activities**<br>• Students will plate *E. coli* and transform with GFP vector<br>• Students will passage mammalian cells<br>**Assessment**<br>• Students will complete a lab report describing experiment with background, materials and methods, results and analysis with discussion and conclusions.<br>• Students will keep a lab notebook which will be assessed for completeness and accuracy<br>• Homework will assess student understanding of lecture component material | Cell culture materials for bacterial and mammalian culture and bacterial transformation – Biosafety cabinet(s), plates/culture flasks, pipettes, buffers, cell lines, appropriate DNA vectors and sequences and restriction enzymes, etc. |
| 2 | Students learn biomedical data gathering and image processing | **Learning Activities**<br>• Students will operate and gather data from an EKG<br>**Assessment**<br>• Students will complete a lab report describing experiment with background, materials and methods, results and analysis with discussion | EKG set-up and computer with operation software, model sample for measurement, access to computer with data analysis software (MATLAB?) |

| Exercise/Project | Project Overview | Learning Activities and Assessments | Required Resources for Project Completion |
|---|---|---|---|
| | | and conclusions.<br>• Students will keep a lab notebook which will be assessed for completeness and accuracy<br>• Homework will assess student understanding of lecture component material | |
| 3 | Students learn about biomaterial properties through mammalian cell culture on | **Learning Activities**<br>• Students will plate mammalian cells on PDMS samples of varying stiffness and observe changes in cell adhesion and spreading<br>• Students will quantify changes with ImageJ software<br>**Assessment**<br>• Students will complete a lab report describing experiment with background, materials and methods, results and analysis with discussion and conclusions.<br>• Students will keep a lab notebook which will be assessed for completeness and accuracy<br>• Homework will assess student understanding of lecture component material | Materials for mammalian cell culture, polydimethylsiloxane samples for plating (various stiffnesses), access to computer with ImageJ data analysis software. |
| 4 | Students learn about biomechanics through electromyography | **Learning Activities**<br>• Students will measure and analyze electromyographs<br>• Students will use electromyography to control a virtual robotic arm to understand interaction between electrical signals and mechanical response<br>**Assessment**<br>• Students will complete a lab report describing experiment with background, materials and methods, results and analysis with discussion and conclusions.<br>• Students will keep a lab notebook which will be assessed for completeness and accuracy<br>• Homework will assess student understanding of lecture component material | Electromyography set-up and computer with operation software, samples to measure, software for modeling virtual robotic arm with control by electromyograph-style input. |
| 5 | Students learn about and present relevant current research in a biomedical field | **Learning Activities**<br>• Students will review current literature and present a topic in biomedical research<br>**Assessment**<br>• Students will present their chosen topic in the form of an academic | Access to recent publications in biological and biomedical journals. |

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| | | poster at an in-class presentation | |

## 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.

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| *This course seems to be focused on surveying techniques and data analysis in a variety of concentrations of BME, rather than focusing on a specific element of the field, and does not appear to provide more than cursory experience with field-relevant software programs. It also appears to be heavily geared toward a research path rather than an industry or medical school path, which are areas in which many BME students see their future.* |