Department of Biomedical Engineering

BME 385 – Cell and Biomaterial Engineering Laboratory

3 Credits, 4 Contact hours
Instructor: Eun Jung Lee, Ph.D.
Course Coordinator: Eun Jung Lee, Ph.D.

Textbook(s)/Materials Required:
No textbook is required for this lab course. Class handouts of lectures and lab protocols will be provided.

Description:
This laboratory course is designed to provide students with valuable hands-on experience in the field of cell and biomaterial engineering. Experiments include biomaterial fabrication and characterization, mechanical testing of biomaterials, colorimetric protein assay, the basics of cell and tissue culture techniques, cell-based assays, the basics of light and scanning electron microscopy, flow cytometry analysis, and image capture and analysis. A lecture on the principles of a given technique will be followed by a laboratory activity. Generally, lab activities will be run at one week interval.

Prerequisites by topic:
BME 304 and (BME 303 or R120:102 (Biology II)) and (Math 279 or Math 333)
This is a required course for the Biomaterials and Tissue Engineering Track.

Course Learning Outcomes (CLOs):
1. To gain hands-on experience with biomedical engineering techniques and methods in the field of cell, tissue, and biomaterials engineering.
2. To learn the principles and practical experience of interfacing with the living systems for collection of biological data
3. To develop skills to design and conduct experiments, as well as analyze and interpret data
4. To be able to apply knowledge of biology to biomedical problems
5. To be able to apply modern engineering tools to collect, analyze and interpret biological systems
6. To be able to work in groups and develop written communication skills

Student Outcomes:
Student outcome 6 – An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
Related CLO – 3, 5

Student outcome 1 - An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
Related CLO – 1, 3

Program Specific Criteria:

A - an understanding of biology and physiology
Related CLO - 4

B- the capability to apply advanced mathematics (including differential equations and statistics) to solve the problems at the interface of engineering and biology
Related CLO – 3, 5

D - the ability to make measurements on and interpret data from living systems
Related CLO - 2

Course Topics: Basic Lab Skills, Colorimetric Protein Assay using Spectrophotometer, Fabrication of Biomaterials, FTIR Characterization of Biomaterials, Optical Microscopy and Quantitative Image Analysis, Scanning Electron Microscopy, Flow Cytometry Analysis, Basic Techniques in Mammalian Cell Culture I and II, Tensile Testing of Biomaterials Using Instron Mechanical Tester, Microencapsulation Techniques, DNA Quantitation Assay Using Spectrofluorometer

Laboratory Schedule

Class	Topic
Week 1	Basic Lab Skills
Week 2	Colorimetric Protein Assay using Spectrophotometer
Week 3	Sterile Techniques for Cell Culture
Week 4	Basic Techniques in Mammalian Cell Culture
Week 5	Basic Techniques in Mammalian Cell Culture II
Week 6	Optical Microscopy and Quantitative Image Analysis
Week 7	Basic Techniques in Mammalian Cell Culture III/fluorescent microscopy
Week 8	**Presentations/ Quiz 1**
Week 9	Fabrication of Biomaterials-Part 1
Week 10	Fabrication of Biomaterials-Part 2
Week 11	Tensile Testing of Biomaterials Using Instron Mechanical Tester
Week 12	Microencapsulation Techniques
Week 13	DNA Quantitation Assay Using Spectrofluorometer
Week 14	Collagen Type I extraction/processing
Week 15	**Final Presentations/Quiz 2**