DEPARTMENT OF BIOMEDICAL ENGINEERING
INSTRUCTIONAL INCUBATOR
UNIVERSITY OF MICHIGAN

BME Course Summary

Introduction

1. Course Information

Course Name	Bioreaction engineering and design
Institution	*University of Michigan*
Course Number	**321**
# credits	**3**
Meeting times	Tuesday/Thursday 9:00-10:30 AM (Starts at 9:10 AM)
Is this a required course?	**-**
Pre-requisites	**BIOMED 221, MCDB 310 or Biol Chem 415 or CHEM 351 (310 can be concurrent)**
Target audience (e.g. 1st, 2nd year):	**3rd year**
Textbook	-Shuler, M. L. and F. Kargi. Bioprocess Engineering, Basic Concepts. Prentice Hall, Inc. NJ 2002 - Online journal articles
Course Website (if it exists)	**Ctools**

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 course will introduce students to topics in enzyme kinetics, enzyme inhibition, materials and energy balance, cell growth and differentiation, cell engineering, bioreactor design, and analysis of the human body, organs, tissues, and cells as bioreactors. The application of bioreaction/bioreactor principles to tissue engineering will also be discussed.

3. Course Learning Objectives

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

1. To train students to understand enzyme structure and function, and able to analyze enzymatic reactions and enzyme inhibition.
2. To teach students applied cellular and molecular biology concepts.
3. To introduce students to methods of materials and energy balance
4. To teach how bioreactors are designed and operated
5. To teach how bioreaction/bioreactor principles apply to formation and function of tissues
6. To teach students how to work in groups to solve engineering problems in bioreactions and bioreactors.
7. To enhance students' communication skills through oral in-class presentation of contemporary issues in bioreactions/bioreactors.

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.

1. Be able to derive the Michaelis-Menten equation as well as equation for different modes of inhibition (competitive,etc.)
2. Given velocity vs substrate data, make a Lineweaver-Burk plot, calculate Km, Vmax,Ki and describe mode of inhibition
3. Be able to describe basic steps of how to engineer cells
4. Use principles of materials and energy balances to design reactions/media or understand the mechanism of bioreactions
5. Solve problems on cell growth kinetics and product formation
6. Be able to describe how transport affects cell growth, differentiation, and tissue formation
7. Be able to search the literature and present an oral presentation to class on a contemporary issue in bioreactions and bioreactors.

5. Exercises or Experiential Projects of Interest

Exercise/Project	**Project Overview**	**Learning Activities and Assessments**	**Required Resources for Project Completion**
Develop bioreaction and bioreactor intuition.	Use the principle of materials and energy balances to design reactions/media or understand the mechanism of	**Learning Activities** • In class discussion and exercises with collaborative, group problem solving • Oral presentation with powerpoint slides	

Exercise/Project	Project Overview	Learning Activities and Assessments	Required Resources for Project Completion
	bioreactors and familiarization with bioreactions/bioreactors literature and applications.	• End of term student evaluations **Assessment** • Graded homework assignments (biweekly) • in-class quiz • Written examination (one midterm and one final exam)	
Litreature research, presentation and discussion	Student presentations are designed to promote independent investigation of research articles and to polish effective oral communication skills vital to the exchange of scientific ideas. Student pairs/trios will give a short presentation on a select JOURNAL ARTICLE on original research (not review articles) that involve bioreactions/bioreactors (e.g. microliver chips, multi-enzyme reactions, etc.).	**Learning Activities** - Sharpen critical thinking and analysis - Practice effective communication of ideas - Cultivate innovative thinking - Learn how to learn new fields - Learn teamwork **Assessment** Grading of Oral Presentation (25 pts Total; 15 pts by me; 10 by peers)	• paper is an original research article/letter/communication. Not a review paper or commentary. • Good problem/topic and clear problem statement • Effective explanation of technology/methods & biology 5 pts - use of visuals - equations mechanisms • Effective background research and Q/A - Group peer evaluation of contribution - Class evaluation of quality
Field trip	Learn what is available/going here at Michigan	**Learning Activities** Field trips or guest speaker	

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.

Even though it is a design course, it does not really design anything. It is more theoretical than project based.