

The University Of Toledo

Existing Graduate Course Modification Form

* denotes required fields

Contact Person*: Eda Yildirim-Ayan Phone: 530-8257 (xxx - xxxx) Email: eda.yildirimayan@utoledo.edu

Present

Proposed

Supply all information asked for in this column.(Supply core, research intensive and transfer module info if applicable)

Fill in appropriate blanks only where entry differs from first column.

College*: College of Engineering

College: College of Engineering

Dept/Academic Unit*: Bioengineering

Dept/Academic Unit: Bioengineering

Course Alpha/Numeric*: BIOE 8310

Course Alpha/Numeric: BIOE 8310

Course Title: Biochemical Engineering Principles

Course Title: Cell and Tissue Engineering Laboratory

Credit hours: Fixed: 3 or Variable: to

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Cross Listings:

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To add a course, type in course ID and click the Insert button.

To remove a course, select the course on left and click the Remove button.

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To remove a course, select the course on left and click the Remove button.

Prerequisite(s)(if longer than 50 characters, please place it in Catalog Description):

Prerequisite(s)(if longer than 50 characters, please place it in Catalog Description):

Corequisite(s)(if longer than 50 characters, please place it in Catalog Description):

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Catalog Description (only if changed) 75 words max:

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Has course content changed?


 Yes No

If course content is changed, give a brief topical outline of the revised course below(less than 200 words)

Proposed effective term*: (e.g. 201140 for 2011 Fall)

File Type	View File
Syllabus	View

List any course or courses to be deleted.

Effective Date: 

Effective Date: 

Comments/Notes:

The new title is proposed to more accurately represent what is taught in the course.

Rationale:

Approval:

Department Curriculum Authority:	Patricia A. Relue	Date	2017/05/02
Department Chairperson:	Arunan Nadarajah	Date	2017/05/02
College Curriculum Authority or Chair:	Efstratios Nikolaidis	Date	2017/05/17
College Dean:	Mohamed Samir Hefzy	Date	2017/05/17
Graduate Council:	Andrea Kalinoski (GCEC 08-11-17)	Date	2017/08/11
Dean of Graduate Studies:	Amanda C. Bryant-Friedrich	Date	2017/08/14
Office of the Provost :	Margaret F. Traband	Date	2017/08/15

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Administrative Use Only

Effective Date: 2018/01/15  (YYYY/MM/DD)

CIP Code:

Subsidy Taxonomy:

Program Code:

Instructional Level:

Registrar's Office Use Only

Processed in Banner on:



Processed in Banner by:

Banner Subject Code:

Banner Course Number:

Banner Term Code:

Banner Course Title:



BIOE 6310/8310: Biochemical Engineering Principles (Cell and Tissue Engineering Laboratory)

The University of Toledo
Department of Bioengineering, College of Engineering
BIOE 6310:001 and BIOE 8310:001

Instructor: Dr. Eda Yildirim-Ayan Email: eda.yildirimayan@utoledo.edu Office Hours: By Appointment Office Location: NI 5031 Office Phone: 4195308257 Term: Spring 2016	Class Location: Palmer 3040 Class Day/Time: TR@ 11:00 Lab Location: Palmer 1150 Lab Day/Time: W @ 13:00 Credit Hours: 3 cr hr
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COURSE OVERVIEW

The main objective of this course is to teach fundamentals of tissue engineering and mammalian cell culture. Lectures and laboratory are designed to teach and to demonstrate the important segments of tissue engineering including basic aseptic technique for mammalian cell culture, mammalian cell culture, cell growth cycle and proliferation, DNA extraction, tissue engineering biomaterials and scaffolds, three-dimensional biomaterial preparation and scaffold manufacturing, scaffold characterization, and cell-scaffold interaction (an *in vitro* study).

STUDENT LEARNING OUTCOMES

Relation to Abet criterion three outcomes: 0 = No content; 1 = Some content; 2 = Significant content

Outcomes a - k	Content	Assessment
a. An ability to apply knowledge of mathematics, science, and engineering.	1	Homework
b. An ability to design and conduct experiments as well as to analyze and to interpret data.	2	Homework and Poster and Oral Presentations
c. An ability to design a system, component or process to meet desired needs.	2	Homework and Poster and Oral Presentations
d. An ability to function on multidisciplinary teams.	2	Poster and Oral Presentations
e. An ability to identify, formulate and solve engineering problems.	2	Experiments
f. An understanding of professional and ethical responsibility.	0	NA
g. An ability to communicate effectively	2	Poster and Oral

		Presentations
h. The broad education necessary to understand the impact of engineering solutions in a global/societal context	0	NA
i. A recognition of the need for and an ability to engage in lifelong learning	0	NA
j. A knowledge of contemporary issues	2	Homework
k. An ability to use the techniques, skills and modern engineering tools necessary for engineering practice	2	Experiments

RELATION TO ABET CRITERION 8 OUTCOMES:

Outcomes 8a - 8c	Content	Assessment
8a. An understanding of biology and physiology	2	Midterm exams and final exam
8b. The capability to apply advanced mathematics (including differential equations and statistics), science, and engineering to solve the problems at the interface of engineering and biology	2	Midterm exams and final exam
8c. The ability to make measurements on and interpret data from living systems, addressing the problems associated with the interaction between living and non-living materials and systems	0	Experiments and Laboratory Notebooks

PREREQUISITES AND COREQUISITES

Restrictions: Enrolled in graduate program

REQUIRED TEXTS AND ANCILLARY MATERIALS

- *Tissue Engineering, Bernhard O. Palsson, Sangeeta N. Bhatia, Pearson Prentice Hall, Inc., Upper Saddle River, NJ.*
- *A Laboratory Course in Tissue Engineering, Melissa Kurtis Micou, Dawn Kilkenny, CRC Press 2012.*

TECHNOLOGY REQUIREMENTS

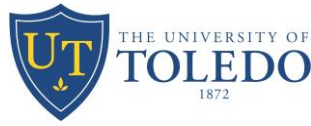
Blackboard website - <http://blackboard.utdl.edu/>

UTAD login is required for access to course materials. Lecture slides, homework assignments, additional course handouts, and grades will be accessible at this site. Refer to this site often for announcements, assignment due dates, and updated material. Additional items will be posted to this site as needed.

UNIVERSITY POLICIES

Policy Statement on Non-Discrimination on the basis of Disability (ADA)

The University is an equal opportunity educational institution. Please read [The University's Policy Statement on Nondiscrimination on the Basis of Disability Americans with Disability Act Compliance.](#)



Academic Accommodations

The University of Toledo is committed to providing equal access to education for all students. If you have a documented disability or you believe you have a disability and would like information regarding academic accommodations/adjustments in this course please contact the [Student Disability Services Office](#)

Accessibility Statement: *The University of Toledo abides by the Americans with Disabilities Act (equal and timely access) and Section 504 of the Rehabilitation Act of 1973 (non-discrimination on the basis of disability). If you have a disability and are in need of academic accommodations but have not yet registered with the Office of Accessibility (OA) (Rocket Hall 1820; 419.530.4981; officeofaccessibility@utoledo.edu) please contact the office as soon as possible for more information and/or to initiate the process for accessing academic accommodations. I also encourage students with disabilities receiving accommodations through OA to discuss these with me, after class or during my office hours, so that I may be better informed on how to assist you during the semester.*

For students having OA accommodations, all exams will be conducted at Testing Center located at Memorial Field House.

ACADEMIC POLICIES

Misconduct

Students may work together on homework problems or computer exercises, but must submit their own work.

The penalty for academic misconduct can range from receiving a failing grade in the course to suspension from the University. See [Policy Statement on Academic Dishonesty](#) or talk to the instructor if you have any questions.

COURSE EXPECTATIONS

Attendance: *Attendance does not count into your course grade.*

Make-up for Exams: *There is no make-up for missed oral and poster presentations, except in cases of illness (a physician's note covering the exam date will be required) or family emergency. If weather conditions cause you to miss a quiz or exam, contact me via voice mail or e-mail.*

Group Assignment: *Based on class enrollment, groups will be formed with 2 to 3 students. The experiments will be conducted as a group but HWs, laboratory notebooks, oral and poster presentations will be graded individually. The poster can be prepared with a group effort. Each group member needs to explain how much effort him/her put in oral and poster presentation.*

Late Submission: *There will be 5 points deduction for each day passed after the deadline.*

EXAMS and GRADING



Homework: Homework will be assigned frequently. They provide the best way of keeping up with the course material. HW due date is one week after the assignment date.

Laboratory (Lab) Notebook: Lab notebooks will be collected every four-five weeks and will be graded individually for each student.

Oral and Poster Presentations: There will be oral presentation and poster presentation for this class. The detail about these presentations will be posted at BB at Week 5.

Laboratory Skills: Mrs. Tammy Phares will grade this section based on student performance during the laboratory section.

Participation: Mrs. Tammy Phares and Dr. Kelly Marbaugh will grade this section based on student's participation effort in discussion during the lectures and laboratory period.

Manuscript: The materials and methods and results of cell proliferation experiment conducted at Week 11-12- and 13 will be compiled and presented as a journal quality manuscript format.

Grading Policy: The final grade will be based on a weighted average. The weights of graded elements are: **Homework 10%, Laboratory (Lab) Notebook 15%, Poster Presentation 15%, Oral Presentation 15%, Laboratory Skills 5%, Participation (lecture and lab) 5%, Manuscript 35%.**

Final letter grades will be assigned on a 100 points scale as shown below:

Letter Grade	Point Scale	Letter Grade	Point Scale
A	93 or higher	C	73-76.9
A-	90-92.9	C-	70-72.9
B+	87-89.9	D+	67-69.9
B	83-86.9	D	63-66.9
B-	80-82.9	D-	55-62.9
C+	77-79.9	F	Below 55

STUDENT SUPPORT SERVICES

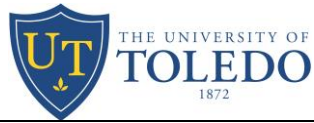
There will be recitations before the exams. Dr. Eda Yildirim-Ayan and/or TAs will conduct the recitations. The College of Engineering CASE Center in PL 2600 also offers tutoring services and group study rooms http://www.eng.utoledo.edu/coe/undergrad_studies/. All students have access to professional academic support services through the Learning Enhancement Center in the Carlson Library B0200 <http://www.utoledo.edu/success/lec/>.

COURSE SCHEDULE

Lecture Schedule and Important Date: Following is the lecture schedule and important date for the class.

Week 1	Lectures: Introduction and Aseptic Techniques in Mammalian Cell Culture
	Lab: Lab Tour and Introduction

Week 2	Lectures: Aseptic Techniques in Mammalian Cell Culture and Mammalian Cell Cultures
	Lab: Aseptic Techniques Exercises
Week 3	Lectures: Mammalian Cell Cultures
	Lab: Practicing Aseptic Techniques with Pipetting and Cell Culture Medium Preparation
Week 4	Lectures: Primary and Secondary Cell Cultures
	Lab: Thawing Cells and Start Mammalian Cell Culture
Week 5	Lectures: Growth Culture, Sub-culturing, and Cell counting Collecting Lab Notebook at Lecture 2
	Lab: Observing cells under Optical Microscope; Sub-culturing (if they are confluent); Cell counting (using Hemocytometer); Starting to populate cells for the standard curve
Week 6	Lectures: Discussion on Cell Counting Results, Cell Proliferation Assessment Methods (MTT Assay)
	Lab: Cell Counting and Preparing standard curve for MTT Assay
	Cell seeding for MTT proliferation assay Cell seeding for DNA extraction assay (for next week)
Week 7	Lectures: Cell Proliferation Assessment Methods –DNA counting (Picogreen assay) and Discussion on cell proliferation assay results
	Lab: Running DNA Extraction and Counting DNA Running MTT assay for cell proliferation at day- 7
Week 8	Lectures: Oral Presentations
	Lab: No Lab Collecting Lab Notebook at Lecture 2
Week 9	Lectures: Tissue Engineering Biomaterials and Tissue Scaffolds (Natural and Synthetic Biomaterials)
	Lab: Acellular Natural Biomaterial Preparation (Collagen) and Synthetic Biomaterial (Polycaprolactone) Preparation, Thaw cells for next week, Digesting collagen using collagenase.
Week 10	Lectures: Tissue Scaffolds Characterization (Surface Characterization)
	Lab: Scaffold Fixation for Scanning Electron Microscopy Sub-culturing cells for next week's in vitro experiment.
Week 11- Week 12, Week 13	Lectures: Tissue Scaffold-Cell Interaction and Experimental Design (Cell-encapsulation within the collagen) Collecting Lab Notebook at Lecture 2 at Week 11
	Lab: Preparing cell-encapsulated collagen scaffolds with various collagen concentration and run a week-long in vitro study, including . <ul style="list-style-type: none"> • Collect cell proliferation results using MTT assay at day 1 (next day of scaffold preparation) day 3 and day 7. • Fix cell-scaffold construct at day 7 for SEM • Measure the size change of the scaffolds over time. (Cell-mediated



	contraction) at day 1, day 3, and day 7.
Week 14	Preparation poster presentation (compiling data, discussion, if necessary completing missing parts in the experiment)
Week 15	Poster Presentation Collecting Lab Notebook at Lecture 2

Final Exam: Manuscript Submission on May 03, 2016 @ 10 am.

Disclaimer: *The instructor reserves the right to make necessary changes if the need arises.*