BIOMEDE 474: INTRODUCTION TO TISSUE ENGINEERING- Lecture and Laboratory
FALL 2015, 3 credits

Description: This is an introductory course in tissue engineering that covers fundamental topics in the field and includes four laboratory hands-on sessions. Both components of the course will focus on how engineering principles can be applied to design and fabricate functional tissues and organs. Key principles of tissue engineering will be highlighted using examples from a range of tissue types, and then practiced in the lab. Main topics include: tissue components, biomaterials for tissue engineering, cell-matrix interactions, regenerative processes, engineering of specific tissues, recent advances in tissue engineering. The class will use examples from the current scientific literature and will rely on interactive in-class discussions.

Instructor: Prof. Ariella Shikanov (shikanov@umich.edu)
GSI: Tuğba Topal (tugba@umich.edu)

Office Hours:
M/W after the class in the LBME atrium.

Class Schedule: M/W 12:10-1:30 pm, 1121 LBME;
Laboratory schedule: We offer three sessions every week and students chose to participate in one session per week that fits their schedule: **M** 10:30am-1:30 pm, **M** 6:30-9:30pm, **W** 4-7pm 1220 LBME

Prerequisites: This course is intended for senior undergraduates and SGUS/graduate students. There are no formal prerequisites, but students are advised to have completed a rudimentary course in biomaterials (BIOMEDE 410), a first course in mechanics or biomechanics, as well as an introductory course in transport phenomena (momentum, heat, and mass transfer). Students should also have a rudimentary knowledge of cell biology and protein structure.

Textbook: There is no required textbook.
All the lecture notes will be available via CANVAS. Assignments will be posted in Perusall.com
Students are asked NOT to share the course materials with anyone who is not registered in BME474.

Logistics: This year I will be adopting a variety of engaged learning techniques developed by Prof. Eric Mazur (MIT) and Prof. Steve Yalisove (UMich, MSE). You are invited (and encouraged) to visit their website and learn more about Engaged Learning: http://java.engin.umich.edu/220f14
We will be using new software called **Perusall (http://perusall.com),** where I will upload all the required reading material. Please, create your personal student account using the access code SHIKANOV-2716.

Learning Objectives:
By the end of the term, students will:

1. be able to apply knowledge of mathematics, science, and engineering to problems in tissue engineering (ABET Outcome 1).
2. be able to identify, formulate, and solve problems in tissue engineering (ABET Outcome 5)

3. understand the professional and ethical issues in tissue engineering (ABET Outcome 6)
4. gain the knowledge of contemporary issues and the state of the field of tissue engineering (ABET Outcome 10)
5. gain the knowledge of biology and physiology as it relates to tissue engineering (ABET Outcome 12).

Grading criteria:
30% Midterm
30% Final Exam
20% Comments submitted for discussion (Insightful reading of the assigned material). You will be graded on the quality, quantity, timeliness and completeness of your annotations to the posted text. Assignments submitted after the deadline will lose 50% of the grade.
20% Laboratory

General Course Policies:
Attendance at the lectures is not mandatory, but attendance and participation will be considered in assigning letter grades in borderline cases.

Students who must reschedule exams and or assignments due to religious observances or other personal matters should notify the instructor in advance. Students with disabilities who require special accommodations during classes or examinations should contact the Office of Services to Students with Disabilities to ensure that appropriate arrangements are made.

Assignments and examinations will be graded and returned to students as soon as possible after being handed in. Students should check the grading carefully. Any grade appeals must be made within one week of the return of the assignment or exam.

All students in this class are bound by the College of Engineering Honor Code (see below). You may not seek to gain an unfair advantage over your fellow students;

Honor Code. http://www.engin.umich.edu/students/honorcode/brochure.pdf
All students are presumed to be decent and honorable, and all students in the class are bound by the College of Engineering Honor Code. You may not seek to gain an unfair advantage over your fellow students. You may not consult, look at, or possess the unpublished work of another without their permission; and you must appropriately acknowledge your use of another's work. Any violation of the honor policies appropriate to each piece of course work will be reported to the Honor Council, and if guilt is established penalties may be imposed by the Honor Council and Faculty Committee on Discipline. Such penalties can include, but are not limited to, letter grade deductions or expulsion from the University. Collaboration policies on individual assignments will be described in the assignment handout. If you have any questions about the policies in this course, please consult the course instructor. Note that creating an unfair advantage for another student is an Honor Code violation. Login in under someone else username is a violation of the Honor Code. Sharing the course material without a written permission from the instructor with students NOT registered for the class is will be considered a violation of the policy. According to the Family Educational Rights and Privacy Act (FERPA) students are only allowed to pick up their own work, and not the work of friends or classmates (even if they have a written approval from their classmates).

Week	Date	Topic	Lecturer
1	9/7/16	Class Overview; History of Tissue Engineering Sources of cells and cell culture techniques	Shikanov
2	9/12/16	Extracellular Signaling, Extracellular Matrix (ECM), and the Regulation of Cell Fate	Shikanov
	9/14/16	Cell Migration and Invasion in Tissue Engineering and Cancer	Shikanov
3	9/19/16	Biomaterial Scaffolds as ECM Analogs - Natural Materials	Shikanov
	9/21/16	Biomaterial Scaffolds as ECM Analogs - Synthetic Polymers	Shikanov
4	9/26/16	iPS Cells and Direct Lineage Reprogramming	Topal
	9/28/16	Stem cells in tissue engineering	Topal
5	10/3/16	Mass Transport, Therapeutic and Pathologic Angiogenesis	Shikanov
	10/5/16	Scafoldless tissue engineering	Larkin
6	10/10/16	Biocompatibility, Immunology, and Wound Healing	Shikanov
	10/12/16	Engineering Gene and Protein Delivery Strategies	Shikanov
		(**Lab groups choices are due**)	
7	10/17/16	**Fall Break**	
	10/19/16	**Midterm**	
8	10/24/16	Case study #1: Neural Engineering	Dumont
	10/26/16	Case study #2: Islet transplantation	Tadas
		(**OSEH certificates are due**)	
9	10/31/16	Preparation for LAB 1	Shikanov
	11/2/16	Case Study #3: Cartilage**/ LAB 1**	Coleman
10	11/7/16	**LAB** 1	Shikanov
	11/9/16	Preparation for LAB 2 / **LAB 2**	Shikanov
11	11/14/16	**LAB 2**	Shikanov
	11/16/16	Preparation for LAB 3 / **LAB 3**	Shikanov
12	11/21/16	**LAB 3**	Shikanov
	11/23/16	Paper Perusall as preparation for LAB 4	Shikanov
13	11/28/16	**LAB 4**	Shikanov
	11/30/16	Case Study #4: Vascularization/ **LAB 4**	Ramkumar
14	12/5/16	Case Study #5: Follicles	Shikanov
	12/7/16	Case study #6: Male reproduction	Shikanov
Final	12/12/16	Immunoisolation/tumor engineering/ Review	Shikanov
	12/15/16	Final	