UNIVERSITY OF CALIFORNIA AT BERKELEY
DEPARTMENT OF MECHANICAL ENGINEERING

SAMPLE SYLLABUS
ME C214 / BIOE C214
ADVANCED TISSUE MECHANICS (3 units)

Lecture	**Tuesdays and Thursdays, 12:30–2:00 PM**
Location	**14 Haviland Hall**
CC#	**ME: 56103; BIOE: 07498**

BRIEF DESCRIPTION

The goal of this course is to provide a foundation for long-term learning, research, and applications related to the mechanical behavior of load-bearing biological tissues. A variety of mechanics topics will be introduced, including anisotropic elasticity and failure, cellular solid micro-mechanical theory, biphasic theory, and quasi-linear viscoelasticity (QLV) theory. Building from this theoretical basis, we will explore the constitutive behavior of a wide variety of biological tissues through a series of student-led class lectures on applications. As a course project, students will prepare a research proposal addressing some mechanical aspect of a tissue of their choice. Peer review of these proposals will further develop critical thinking. After taking this course, students should have sufficient background to independently study the mechanical behavior of any biological tissue.

EXPANDED DESCRIPTION

Knowledge of the biomechanical behavior — the mechanical behavior and its relation to the surrounding biological environment — of load-bearing biological tissues is prerequisite to understanding the causes of, and providing treatments and replacements for, various tissue injuries and pathologies. To enable students to study the mechanical behavior of any biological tissue, the approach here is to study first a number of advanced mechanics topics of general applicability — anisotropy, cellular solid theory, biphasic theory, and quasi-linear viscoelasticity (QLV) theory — and then apply these theories to a variety of tissues. To develop critical thinking skills and reflect the students' particular interests, each student will present a lecture to the class on a published literature paper addressing some aspect of constitutive behavior of a tissue of their choice. Further, the final project will consist of preparation of an NIH-style proposal for study of a biological tissue of the student's choice and a peer-reviewed critical analysis of these proposals by the students. A key characteristic of this course will be the active participation of students, emphasizing self-learning and critical thinking — all pertaining to tissue mechanics.

PREREQUISITES

ME 176, ME 185; graduate standing or permission of instructor. Knowledge of MATLAB or equivalent.

REQUIRED TEXT

None. Miscellaneous *ad hoc* handouts

SECTION LIMIT

30

COURSE OFFERED

Spring

INSTRUCTORS

Instructor:	Professor Tony M. Keaveny; 6175 Etcheverry Hall; tmk@me.berkeley.edu Office Hours; Tuesday 10:00–11:30 AM, Wednesday 4:00 – 5:30 PM

GRADING POLICY

Homeworks (4 @10% each); student lecture (20%); final project and peer review (40%).

SYLLABUS

We will first study four general topics that will provide a theoretical foundation from which to describe and understand the mechanical behavior of a variety of biological tissues. One set of homework problems will be assigned for each topic, with at least one assignment requiring numerical analysis of real experimental data.

During the course of the semester, each student will deliver a 40-minute class lecture on applications related to the theory presented in class but on a topic of their choice (subject to approval of the Instructor). Depending on enrollment, these may be team lectures of up to two students. The term project consists of an NIH-style research written proposal on a topic of each student's choice related to constitute behavior of biological tissues. Each proposal will be briefly presented (10-15 min) in class and will then be reviewed and scored by the entire class using an NIH-style peer-review process, held over the last two weeks of the course. There are no exams.

Date		**Topic**
Tue	Thur	
1/19		**Introduction**
	1/21	**Elastic anisotropy and multiaxial failure ***
1/26	**1/28**	
2/2	**2/4**	[Review of continuum mechanics and linear viscoelasticity]
2/9	2/11	**Micromechanics and cellular solid theory ***
2/16	2/18	[Student lectures on applications]
2/23	2/25	**Large deformations and non-linear viscoelasticity; QLV theory ***
3/2	3/4	[Student lectures on applications]
3/9	3/11	**Biphasic theory ***
3/16	3/18	[Student lectures on applications]
3/23	3/25	SPRING BREAK
3/30	4/1	**Workshop on proposal writing and peer-review**
4/6	4/8	**Proposal presentations**
4/13	**4/15**	
4/20	4/22	**Proposal peer-review ****
4/27	4/29	
5/4	5/6	**Reading / Review / Recitation**

* Homework for each of the first four sections is due at start of lecture of next section.

** All proposals must be submitted in *.pdf* format to Professor Keaveny by noon, 4/15.