Mechanical Behavior of Biological Tissues and Systems
BME 4931 Section 13AE
Class Periods: Tuesdays period 8, Thursdays periods 8-9
Location: 238 Weil Hall
Academic Term: Spring 2017

Instructor:
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Office Hours: Tuesday 4-5 pm

Course Description
This course will focus on understanding the mechanical behavior of biological tissues and systems. The course will begin by evaluating structure-function relationships, stress-strain relationships, and the mechanical complexity of biological systems. In addition, the basics of viscoelastic behavior will be introduced as it applies to biological tissues.

Course Pre-Requisites / Co-Requisites
BME3060: BME Fundamentals
EGM2511: Engineering Statics

Course Objectives
Students who complete this course will understand the following principles:
- Stress-strain relationships and energy storage in elastic solids
- Common mechanical properties and the mechanical characterization of elastic solids (metals, ceramics, and some polymers)
- Stress-strain relationships and energy dissipation in viscoelastic solids
- Mechanical properties and the mechanical characterization of viscoelastic solids (polymers and tissues)
- Structure-function relationships in engineering materials and tissues
- Modeling mechanical behavior in biological systems

Professional Component (ABET):
E, G, K

Relation to Program Outcomes (ABET):

Outcome	**Coverage***
a. Apply knowledge	High
b1. Conduct experiments	
b2. Statistical design of experiments	
c. Design	
d. Function on teams	
e. Solve problems	High
f. Professional and ethical responsibility	
g. Communicate	High
h1. Economic impact	Low
h2. Global, societal, and environmental impact	Low
i. Lifelong learning	
j. Contemporary issues	
k. Techniques, skills, and tools for degree program	High

*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not part of the course.

Required Textbooks and Software
None

Course Schedule

Fundamentals of Solid Mechanics

Week 1: Stress, Strain, and Constitutive Relations
Week 2: Bending and Torsion
Week 3: 1-Dimensional Hooke's Law and Poisson's Relationship
Week 4: Stress-Strain Curve and Energy Storage
Week 5: Stress, Motion, and Constitutive Relations

Fundamentals of Elasticity

Week 6: 2-Dimensional Hooke's Law
Week 7: 3-Dimensional Hooke's Law
Week 8: Anisotropic, Transversely Isotropic, and Orthotropic Material and Tissue Properties
Week 9: Pressure Vessels – Lungs, Heart, and Blood Vessels
Week 10: Elastic Tissues – Bone and Enamel

Fundamentals of Viscoelasticity

Week 11: The Interface of Solids and Fluids
Week 12: Maxwell Fluid and Kelvin-Voight Solids
Week 13: Standard Linear Solid under Stress Relaxation and Creep
Week 14: Shock/Impact Absorption: Cartilage vs. Fibrocartilage
Week 15: Stretch and Contraction: Muscle and Tendon

Attendance Policy, Class Expectations, and Make-Up Policy

Attendance is mandatory but not monitored. Class notes will not be provided to absent students, unless they have excused absences. Excused absences are consistent with university policies in the undergraduate catalog (https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx) and require appropriate documentation. Computers, tablets, and cell phones have to be put away during class. 10 points will be taken off from an assignment grade for every day the submission is late.

Evaluation of Grades

Assignment	**Percentage of Final Grade**
Exam #1	25%
Exam #2	25%
Exam #3	25%
Homework	15%
Quizzes	10%
	100%

Grading Policy

A: 90-100	B+: 84-86	C+: 75-77	D+: 66-68	Fail: <60
A-: 87-89	B: 81-83	C: 72-74	D: 63-65	
	B-: 78-80	C-: 69-71	D-: 60-62	

For information on current UF grading policies for assigning grade points, please visit: https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx.

A C- will not be a qualifying grade for critical tracking courses. In order to graduate, students must have an overall GPA and an upper-division GPA of 2.0 or better (C or better). Note: A C- average is equivalent to a GPA of 1.67, and therefore, it does not satisfy this graduation requirement. More information on UF grading policy may be found at: https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx.

Students Requiring Accommodations

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, https://www.dso.ufl.edu/drc) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Course Evaluation
Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at https://evaluations.ufl.edu/evals. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at https://evaluations.ufl.edu/results/.

University Honesty Policy
UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Software Use
All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy
There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see:
http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html

Campus Resources:

Health and Wellness

U Matter, We Care:
If you or a friend is in distress, please contact umatter@ufl.edu or 352 392-1575 so that a team member can reach out to the student.

Counseling and Wellness Center: http://www.counseling.ufl.edu/cwc, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Assault Recovery Services (SARS)
Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or http://www.police.ufl.edu/.

Academic Resources

E-learning technical suppor*t*, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. https://www.crc.ufl.edu/.

Library Support, http://cms.uflib.ufl.edu/ask. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. https://teachingcenter.ufl.edu/.

Writing Studio, 302 Tigert Hall*,* 846-1138. Help brainstorming, formatting, and writing papers. https://writing.ufl.edu/writing-studio/.

Student Complaints Campus*:* https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf.

On-Line Students Complaints*:* http://www.distance.ufl.edu/student-complaint-process.