Course Syllabus

Course Information

Course Title: Mechanobiology for Engineers
Course Section: BMEN 6378
Term: Fall 2020 (Aug. 17 – Dec 8)
Credit Hours: 3 Credits
Days and Times: Tuesday & Thursday from 1:00 - 2:15 pm
Location: Either access the pre-recorded lectures online via eLearning or watch presentations virtually via this link:
https://teams.microsoft.com/l/meetup-join/19%3ameeting_NjZkNTBkMTgtNzMzMS00OGE5LTk0YWYtOWE2YWIyZjVhZDA5%40thread.v2/0?context=%7b%22Tid%22%3a%228d281d1d-9c4d-4bf7-b16e-032d15de9f6c%22%2c%22Oid%22%3a%227a21f60c-e421-4e60-82ba-4999a220d73c%22%7d

Professor's Contact Information

Professor: Heather Hayenga
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Office Hours: Thursday 2:30-3:30 pm and by appointment
Office Location: virtually via Microsoft Teams. Please email/call me if you would like to meet. Click this link to enter:
https://teams.microsoft.com/l/meetup-join/19%3ameeting_MzgwNGM4NzQtNTVlNC00YWNjLTg0NGYtZTFkNjIxMjMxYTFk%40thread.v2/0?context=%7b%22Tid%22%3a%228d281d1d-9c4d-4bf7-b16e-032d15de9f6c%22%2c%22Oid%22%3a%227a21f60c-e421-4e60-82ba-4999a220d73c%22%7d

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Syllabus Contents

Course Modality and Expectations

Instructional Mode	This course will consist of a combination of virtual and online modes. The synchronic live **virtual** mode is recommended for presentations to enable real-time discussion. That is everyone should try to log-in at the designated class time. Otherwise the lectures will be pre-recorded and posted **online** in eLearning for asynchronous viewing. Description of the instructional modes can be found using this link: https://www.utdallas.edu/fall-2020/fall-2020-registration-information/
Course Platform	Classes that will be given live/virtually or online are noted in the calendar below. Prerecorded lectures and presentations will be posted on eLearning after the classtime. To view the presentations live use this link: https://teams.microsoft.com/l/meetup-join/19%3ameeting_NjZkNTBkMTgtNzMzMS00OGE5LTk0YWYtOWE2YWIyZjVhZDA5%40thread.v2/0?context=%7b%22Tid%22%3a%228d281d1d-9c4d-4bf7-b16e-032d15de9f6c%22%2c%22Oid%22%3a%227a21f60c-e421-4e60-82ba-4999a220d73c%22%7d
Expectations	All presentations and lectures will be posted on eLearning for asynchronous (i.e., does not happen at the same time) viewing. However, it is recommended to log-in at the same time for the presentations labelled "live" on the calander. Participation via comments and questions after the presentations is encouraged and will be part of your participation grade.
Asynchronous Learning Guidelines	FAQ and answers about asynchronous learning are provided here: https://www.utdallas.edu/fall-2020/asynchronous-access-for-fall-2020/

COVID-19 Guidelines and Resources

The information contained in the link lists the University's COVID-19 resources for students and instructors of record. Please see http://go.utdallas.edu/syllabus-policies

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Course Pre-requisites, Co-requisites, and/or Other Restrictions

Biomechanics (BMEN 3301), Biology (Biol 2311) or Graduate level standing

Course Description

This course will introduce principles by which mechanical forces regulate biological processes in cells and tissues in healthy and diseased states. In order to understand mechanobiology from an engineering perspective, this course will review aspects of solid and fluid mechanics, cell biology, intracellular polymer mechanics, cellular mechanics and mechanotransduction, disease mechanisms, biological modeling and research methodology. In addition, the impact of mechanobiology in bone, arteries and various cell types will be discussed.

Student Learning Objectives/Outcomes

After completing this course you should know:

1) Basic scientific tools for research in mechanobiology including
    a. Fundamentals of solid and fluid mechanics
    b. Fundamentals of cell biology
    c. Cellular and Intracellular polymer mechanics
    d. Mechanotransduction – i.e. how mechanical stimuli is translated into cellular and tissue level phenomena
    e. Ability to create a model of cellular biomechanical behavior using Matlab
    f. Current analytical research methodology in the field of mechanobiology
2) The impact of mechanobiology in multiple systems including
    a. Cardiovascular
    b. Musculoskeletal and
    c. Various other organ systems

Mechanobiology is at the intersection of engineering and physiology. Learning not only the cause and effect but also the mechanisms by which mechanical signals alter cellular, and ultimately tissue and organism, behavior is crucial to pursuing a career in biomedical engineering. The knowledge, intuition and critical thinking skills garnered from this course are translatable to many areas of focus within biomedical engineering.

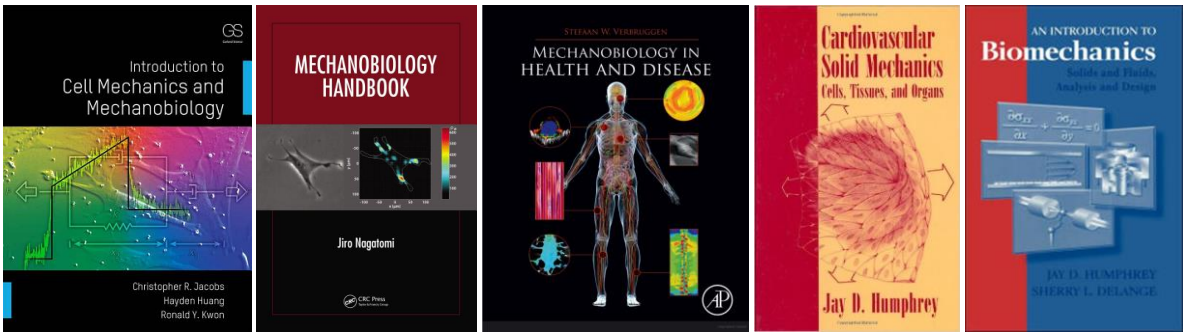
Specifically for the Biomedical Engineering program outcomes:

COURSE LEARNING OUTCOMES MAPPED TO PROGRAM OUTCOMES
Graduate – BIOMEDICAL ENGINEERING
A. **Broad knowledge of biomedical engineering**: Students will demonstrate a broad knowledge of biomedical engineering. This knowledge includes regulatory affairs, industry standard and ethical considerations.
B. **Solve advanced engineering problems:** Students will apply mathematical techniques and engineering tools to create effective and novel solutions to practical biomedical engineering problems.
C. **Communicate effectively and work collaboratively:** Students will communicate clearly and concisely both in oral and in written form and be able to work collaboratively.
D. **Demonstrate the ability to perform independent scientific research**: Design, perform, analyze and present independent scientific research both in oral and written form.

Course	**Course Learning Outcomes**	**Student Outcomes**			
BMEN 6378	Mechanobiology for Engineers	**A**	**B**	**C**	**D**
	1. Broad knowledge of biomedical engineering, specifically the mechanical and physiological impacts of pharmaceuticals and biomedical devices.	**X**			
	2. Ability to apply knowledge of mechanobiology to predict how parts of the body will respond to perturbations in the mechanical environment.		**X**		
	3. Ability to perform independent scientific research, including the ability to review, analyze, write and orally present on the current topics related to mechanobiology.				**X**

Suggested Textbooks and Materials

1. Jacobs CR, Huang H, Kwon RY. Introduction to Cellular Mechanics and Mechanobiology. New York: Garland Science, 2012. Print.
2. Nagatomi J. Mechanobiology Handbook. Florida: CRC Press, 2011. Print.
3. Verbruggen, SW. Mechanobiology in health and disease. Academic Press. 2018. Print.
4. Humphrey JD. Cardiovascular Solid Mechanics. NY. Springer, 2002. Print.
5. Humphrey JD, DeLange S. An Introduction to Biomechanics. NY. Springer. 2004. Print.



Purchase or Rent options: Amazon Kindle Print Replica E-Book; Vitalsource; Barnes & Noble/Yuzu; Follett/Brytewave; Google Play; Course smart

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Assignments & Academic Calendar

Date	Topic	Mode	Assignments
Week 1: Aug 18 & 20	Introduction to Mechanobiology	Live & Online	HW 1 assigned Project list provided
Week 2: Aug 25 & 27	Solid Mechanics	Online	
Week 3: Sep 1 & 3	Fluid Mechanics	Online	HW 1 due, HW 2 assigned
Week 4: Sep 8 & 10	Mechanotransduction	Online	
Week 5: Sep 15 & 17	Current Methodology	Online	HW 2 due, HW 3 assigned
Week 6: Sep 22 & 24	Modeling Cellular and Biomechanical Behavior	Online	
Week 7: Sep 29 & Oct 1	Impact/Examples of Mechanobiology	Online	HW 3 due
Week 8: Oct 6 & 8	Review & Midterm	Live & Online	Students should have declared projects
Week 9: Oct 13 & 15	Cancer Migration: Dr. Ferruzzi Cartilage Mechanobiology: Dr. Hernandez	Live	
Week 10: Oct 20 & 22	Lung Morphogenesis: Dr. Varner Presentations & Discussion	Live	
Week 11: Oct 27 & 29	Presentations & Discussion	Live	
Week 12: Nov 3 & 5	Presentations & Discussion	Live	
Week 13: Nov 10 & 12	Presentations & Discussion	Live	
Week 14: Nov 17 & 19	Presentations & Discussion	Live	
Week 15: Nov 24	Presentations & Discussion	Live	All reports are due
Week 16: Dec 2-8	Final Exam	Online	

Course & Instructor Policies

Grading Policy
Your grade for this course will assigned based on your understanding of the material as demonstrated through exams, an individual project, homework, and participation. Homework's will be given on Thursday and due in 2 weeks on Thursday by the end of class. Your lowest homework grade will be dropped. The individual project will allow you to choose an area of research within mechanobiology. A list of review articles will be provided for suggestions. Your project grade will be based on a 30 minute presentation you give to the class and a brief report (3-5 pages single spaced). The presentation should apply concepts you learned in this class to an area you choose. After the presentation the class will be free to discus. The overall grade breakdown for this class is:

Midterm Exam: 20%
Final Exam: 20%
Project: 40%
Homework: 15%
Participation: 5%

You will be given a grade based on relative evaluation and the standard +/- grade scale.

Grade	Description	Cutoff	Grade points per semester hour
A+		97.0	4.00
A	Excellent	93.0	4.00
A-		90.0	3.67
B+		87.0	3.33
B	Good	83.0	3.00
B-		80.0	2.67
C+		77.0	2.33
C	Fair	73.0	2.00
C-		70.0	1.67
D+		67.0	1.33
D	Poor	60.0	1.00
D-		57.0	0.67
F	Failure	0.00	0.00
I	Incomplete		
CR	Credit		
NC	No Credit		

Late/Missed Work
Late or missed work will not be accepted unless approved by the instructor ahead of time.

Class Attendance
Regular class participation is expected regardless of course modality. Students who fail to participate in class regularly are inviting scholastic difficulty. General engagement in discussion sessions will be part of your participation grade.

Academic Integrity
The University of Texas at Dallas does not tolerate acts of academic dishonesty. This includes, but is not limited to, plagiarism (including using material taken from another class or the web), cheating, collaborating on individual assignments and lying.

Class Materials
The instructor will record and post all lectures, presentations, and meetings of this course to all students registered for this class as they are intended to supplement the classroom experience. These materials may be downloaded during the course, however, these materials are for registered students' use only. Students are expected to follow appropriate University policies and maintain the security of passwords used to access recorded lectures. Classroom materials may not be reproduced or shared with those not in class, or uploaded to other online environments except to implement an approved Office of Student Access Ability accommodation. Failure to comply with these University requirements is a violation of the Student Code of Conduct.

Incomplete Grade Option
At the end of the semester if you have unavoidably completed less than 70% of the course work you may choose and incomplete grade. The required course work must be completed within 8 weeks of the subsequent long semester. Failure to do so will result in the incomplete grade automatically changed to an F.

Disability Services
Disability services are offered to students who have or feel they may have a disability. Please visit the Student Access Ability at UTD (http://www.utdallas.edu/studentaccess/) to learn more about physical, mental or sensory disabilities and how to get documentation for special requests.

Navigating eLearning
The website for this course will be posted on eLearning and contain pertained information related to the course.

To log on:
1. Go to http://elearning.utdallas.edu
2. Click "Academic"
3. Click "Login" and enter your user name (University ID) and password (PIN)
4. Under the course listings click "BMEN 6378.001 – Mechanobiology for Engineers – F20"

Technical Support
If you experience any problems with your UTD account you may send an email to: assist@utdallas.edu or call the UTD Computer Helpdesk at 972-883-2911.

Academic Support Resources
The information contained in the following link lists the University's academic support resources for all students. Please go to http://go.utdallas.edu/academic-support-resources

Comet Creed
This creed was voted on by the UT Dallas student body in 2014. It is a standard that Comets choose to live by and encourage others to do the same:

"As a Comet, I pledge honesty, integrity, and service in all that I do."

UT Dallas Syllabus Policies and Procedures

The information contained in the following link constitutes the University's policies and procedures segment of the course syllabus.

Please go to http://go.utdallas.edu/syllabus-policies for these policies.

The descriptions and timelines contained in this syllabus are subject to change at the discretion of the Professor.