COURSE SYLLABUS

COURSE INFORMATION

Course Number & Title:	ME 483 Mechanobiology
Course Credit Hours:	4 Credit Hours
Class Meeting Time:	15:00 – 16:50 Tuesday and Thursday
Class Meeting Location:	3100 LuMEB
Course Canvas Page:	https://canvas.illinois.edu/courses/55356
Prerequisites:	CHEM 103 and TAM 251

Course Instructor

Name of the instructor:	Professor Bumsoo Han
Office Location:	3050 LuMEB
Phone number:	(217) 300-0516
Email Address:	bumsooh@illinois.edu
Office hours:	15:00 – 16:00 Monday or by appointment

Teaching Assistant

Name of the TAr:	Mr. Ali Akalin
Office Location:	MEL 1420
Email Address:	aakalin2@illinois.edu
Office hours:	09:00 – 10:00 Tuesday and Friday

COURSE DESCRIPTION

ME 420 aims to provide a mechanics foundation on how force influences the behaviors of cells and tissues. Students are anticipated to acquire an in-depth understanding of the underlying principles governing mechanobiological responses and the mechanical components that determine how cells perceive their environment, adapt, and modify it. The course curriculum encompasses the following topics: Introduction to biological cells, Membrane transport, Extracellular matrix mechanics and transport, Cell-matrix interactions, Flow mechanics on cells, and Mechanobiology in wound healing, cancer, and inflammation

TEACHING PHILOSOPHY

My educational philosophy is centered around fostering student's capability of **critical thinking** and **interdisciplinary learning** capabilities to address contemporary technical and societal challenges effectively. To achieve this goal while establishing robust background in mechanobiology, students are expected to become critical thinkers, who can effectively **search out the necessary information**, **evaluate it**, and **apply it** to **create knowledge and solutions** for real-world technical problems. Consequently, I will adopt the inquiry-driven active learning methodology. Assignments may be distributed prior to lectures that cover the respective topics. Students are anticipated to actively seek, read, and evaluate pertinent information by themselves, and rectify their answers through in-class discussions and lectures.

LEARNING OUTCOMES

By the end of the course, you will be able to:

1. Enhance the understanding of mechanobiology and biomechanics
2. Strengthen analytical skills and the ability to cope with complex problems
3. Provide experience in analyzing and designing mechanobiology processes
4. Experience modern computational and experimental methods for mechanobiology and biomechanics

LEARNING RESOURCES

Required Textbook

No required textbook.

Reference Books

These references will be used for discussions on pertinent topics. Most of the books in this list are accessible via course reserve or e-Books through the University Library.

- *Introductory Biomechanics: From Cells to Organisms*, by Ethier and Simmons, *reserved*
- *Mechanobiology Handbook*, by Nagatomi and Ebong.
- *Mechanobiology: Exploitation for Medical Benefit*, by Rawlinson
- *Molecular and Cellular Mechanobiology*, by Chien et al.
- *Transport Phenomena in Biological Systems*, by Truskey et al.

COURSE LOGISTICS AND POLICIES

Course Grade

The course grade will be based on homework, short reports, and a final report according to the following tentative distribution. Details on these assignments, including grading rubrics will be posted on the course website.

- Homeworks (5 × 4 %) = 20 %
- Journal Club Report (5 × 6 %) = 30 %
- JC Presentation & Participation (5 × 4 %) = 20 %
- Final Report: NIH F31 Proposal = 30 %
  - Specific Aims (1 page)
  - Research Strategy (6 pages)
- Total Score = 100 %

Grading Scale

In this class grades reflect the sum of your achievement throughout the semester. You will accumulate points as described above. At the end of the semester, final grades will be calculated by translating these points into the following letters.

A+= 100 ~ 97,	A = 96 ~ 93,	A- = 92 ~ 90	
B+= 89 ~ 87,	B = 86 ~ 83,	B- = 82 ~ 80	
C+= 79 ~ 77,	C = 76 ~ 73,	C- = 72 ~ 70	
D+= 69 ~ 67,	D = 66 ~ 63,	D- = 62 ~ 60	F = Below 59

Attendance Policy

Classroom attendance is expected except in cases of illness, emergencies, or other special circumstances. In case of an absence, an email notice should be sent to the instructor before the lecture or as soon as possible. Upon return, the students will be responsible to get lecture notes, handouts and assignments of any missed lecture.

Course Etiquette

- Arrive before the class start time. Be seated and prepared to participate before the class begins. If late, be quiet as you enter and find a seat quickly and quietly. If a student has to leave before the class ends, exit the room quietly without distracting the class.
- During the regular class sessions, cell phones and other electronic devices are allowed only for your learning activities.

Assignment Policy and Due Dates

Collaboration on and discussion of all assignments is encouraged, but each student must submit **his or her own work**. All assignments should be uploaded at the **Gradescope** of the course web site **by 11:59pm of the due dates**, unless mentioned otherwise. **No late submission will be accepted or graded**.

Academic Integrity
Academic integrity (see the UIUC Student Code, Article 1, Part 4) is one of the highest values that the University holds. All submitted work must be the result of an individual's own effort. Any violations of this policy breach the standard of academic integrity that is vital to the mission of the university. Note that plagiarism is "copying or imitating the language, ideas, and thoughts of other authors and passing off the same as one's original work" (Barnhart, 1968) and is a violation of academic integrity. Any student detected of cheating on assignments will receive a failing grade in the course, and a report will also be filed at Faculty Academic Integrity Report (FAIR) portal, recommending termination from the University.

Instructor's Email Availability and Policy
Unless announced differently, the instructor and/or TA will be available via email daily, and try to respond within 48 hours, if not traveling nor during weekend/holidays. When emailing the instructor and/or TA, please make your subject line **starting with "[ME 483]" and the topic (e.g., [ME 483] Assignment 2 Question)**.

Emergency Protocol
- If we hear **a fire alarm**, we will immediately evacuate the building and proceed to the **west side grass of Transportation Building**.
- If we are notified of a Shelter in Place requirement for a tornado warning, we will shelter in **the hallway of the basement level of this building**.
- In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances. Information about changes will be available via: Canvas web page or E-mail and phone inquiries to the Instructor and Teaching Assistant.

Students with Disabilities
If students anticipate or experience physical or academic barriers based on disability, the students inform the instructor and discuss alternative options.

Diversity and Inclusion Statement
We are committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach own potential. In pursuit of its goal of academic excellence, we seek to develop and nurture diversity.

Disclaimer
This syllabus is subject to change throughout the semester. Any changes will be announced by email and/or at the course Canvas site.

Sale of Class Materials or Notes
Among the materials that may be protected by copyright law are the lectures, notes, and other material presented in class or as part of the course. Always assume the materials presented by an instructor are protected by copyright unless the instructor has stated otherwise. Students enrolled in the courses are permitted to take notes, which they may use for individual/ group study or for other non-commercial purposes. Notes taken in class are, however, generally considered to be "derivative works" of the instructor's presentations and materials, and they are thus subject to the instructor's copyright. No individual is permitted to sell or otherwise barter notes, either to other students or to any commercial concern, for a course without the express written permission of the course instructor.

CLASS SCHEDULE

Weeks	Lectures	Topics	Assignments
1	1/21	Introduction to the field of mechanobiology	
	1/23	Journal Club #0: How to search and read a paper	
2	1/28	Biology 101: Structure & function of cells & tissues	
	1/30	Osmotic pressure and membrane transport	
3	2/4	Extracellular matrix as biomaterials	HW #1
	2/6	**Journal Club #1**	
4	2/11	Diffusion and advection	JC Report #1
	2/13	ECM mechanics and transport: Poroelasticty	
5	2/18	Cell-matrix interaction: Matrix stiffness effects	HW #2
	2/20	**Journal Club #2**	
6	2/25	Mechanics of wound healing: Extravascular coagulation	JC Report #2
	2/27	Mechanics of wound healing: Directed cell migration	
7	3/4	**MechSE Seminar (Wendy Crone from UW)**	
	3/6	**Journal Club #3**	
8	3/11	Mechanics of cryopreservation of engineered tissues	HW #3
	3/13	Mechanics of cryopreservation of cells	
9		**Spring Break**	
		Spring Break	
10	3/25	Cancer Biology 101	JC Report #3
	3/27	**Journal Club #4**	
11	4/1	Mechanics of tumorigenesis and invasion	JC Report #4
	4/3	Mechanics of drug resistance of cancer	
12	4/8	Mechanics of cancer metastasis	HW #4
	4/10	**Journal Club #5**	
13	4/15	Fluid mechanics of microvasculature	JC Report #5
	4/17	Inflammation and immune cell infiltration	
14	4/22	**MechSE Seminar (David Odde from UMN)**	
	4/24	Microscopy techniques for mechanobiology	
15	4/29	Microengineering techniques for mechanobiology	HW #5
	5/1	Semester Review	
16	5/6	No Class	Proposal Due

* Schedule and due dates may be subject to change depending the course progress.