San José State University
Department of Mechanical Engineering
ME 267 Engineering Biomechanics, Section 01, Fall 2018

Course and Contact Information

Class Days/Time:	Mondays 6:00 PM – 8:45 PM Engineering
Classroom:	CL 324
Registration Code:	47411
Prerequisites:	Graduate standing and CE 112 or equivalent.
Instructor:	Meghedi (Meg) Babakhanian
Office Location:	CL 324
Email:	meghedi.babakhanian@sjsu.edu
Office Hours:	Monday 5:00 pm – 6:00 pm and by appointment

Course Format

This is a mixed-mode class, with both in-person and online components. Online components require use of the Canvas learning management system, accessed via https://sjsu.instructure.com/. Successful completion of assignments requires accessing the course website frequently, typically at least twice a week on a regular basis. Technical support for Canvas is available at http://www.sjsu.edu/at/ec/canvas/. Important communications regarding this class may be sent via Canvas or to student email addresses listed in MySJSU, and thus each student is expected to maintain up-to-date contact information in both systems.

Course Description http://info.sjsu.edu/web-dbgen/catalog/courses/ME267.html

Application of engineering mechanics to human body structure and function, involving 3-D kinematics, deformable bodies, viscoelastic behavior, and non-Newtonian fluids. Modeling of hard and soft tissues and analysis of response to loading conditions. Design considerations for biomedical and orthopedic devices.

Course Learning Outcomes

Upon successful completion of this course, students will be able to:

1. Apply engineering mechanics theory and modeling to the musculoskeletal system, as used for performing motor tasks such as locomotion and lifting.
2. Apply mechanics-of-materials theory and modeling to biological tissues, in particular the mechanical properties of bone, skeletal muscle, ligaments, tendons, and single cells.
3. Apply fluid mechanics theory and modeling to the circulatory system, including unique aspects of blood rheology and its interaction with the vasculature.
4. Use analytical models and computational tools to simulate biomechanical responses at cellular, tissue, and systems levels.
5. Conduct a focused literature review in engineering biomechanics, and synthesize the findings for effective sharing of knowledge.

Required Textbook and Reading

Textbook

C. Ross Ethier and Craig A. Simmons, Introductory Biomechanics - from Cells to Organisms, New York: Cambridge University Press, 2007 (ISBN: 9780521841122). Also available in eBook format (ISBN 9780511271175).

Other Readings

This class will also depend heavily on published research articles. Each student must be familiar with engineering literature search tools and library access to full-text articles. Tutorials are available at http://library.sjsu.edu/ and help is available from library staff.

Course Requirements and Assignments

According to the Office of Graduate and Undergraduate Programs http://www.sjsu.edu/gup/syllabusinfo/, "Success in this course is based on the expectation that students will spend, for each unit of credit, a minimum of 45 hours over the length of the course (normally 3 hours per unit per week with 1 of the hours used for lecture) for instruction or preparation/studying or course related activities including but not limited to internships, labs, clinical practica. Other course structures will have equivalent workload expectations as described in the syllabus."

In addition to textbook reading and class participation, course requirements and assignments are as follows:

- Participation Tasks: Throughout the semester there will be several participation tasks to promote active engagement. Possible examples include discussion posts, online quizzes or surveys, and peer review. Completed tasks will be tallied for credit according to deadlines and there are no make-up options. Tasks may be in-class or online, so it is important to attend class and to check Canvas regularly.
- Homework: Homework problems will be assigned corresponding to lecture topics and assigned reading. Some of the homework will be software-based. Students are encouraged to discuss general strategies collaboratively, but each student is expected to prepare and submit his or her own individual work. Raw copying, especially of figures or software code, is cheating and will be reported accordingly.
- Topic Review Paper: A short review paper will be written based on published scholarly literature. This assignment is intended to develop skills in lifelong learning, information literacy, critical thinking, and communication applied to biomechanics. The paper is to be written and submitted in teams of 2 or 3 authors. More specific requirements are defined in documentation to be distributed separately.
- Technical Poster (maybe): This is an opportunity to exercise and showcase open-ended problem solving, applied engineering analysis, use of modern tools, and teamwork. The poster is to be developed and presented in teams of 3 or 4 persons. More specific requirements are defined in documentation to be distributed separately.
- Exams: There is one midterm exam and one final exam. All students are expected to complete exams in class as scheduled. Special accommodations for disabilities must be coordinated through the Accessible Education Center http://www.sjsu.edu/aec/.

Grading Information

The course grade is calculated from a weighted sum of all graded components as follows:
10% for Participation Tasks
20% for Homework
20% for Topic Review Paper
20% for Midterm Exam
30% for Final Exam
% will be allocated for Technical Poster if time allows for a technical poster.

Percentage points for grades assignments and exams correspond to letter grade as follows:
93.0-100 A | 90.0-92.9 A- | 87.0-89.9 B+ | 83.0-86.9 B | 80.0-82.9 B-
77.0-79.9 C+ | 73.0-76.9 C | 70.0-72.9 C- | 67.0-69.9 D+ | 63.0-66.9 D | 60.0-62.9 D- | 0-59.9 F

Team Assignments and Peer Grading: Team assignments will be used for some portions of the course, and some assignments may involve peer grading. Alternative options will be considered for compelling reasons, but arrangements must be pre-approved in writing with ample time before corresponding deadlines (i.e. several days or even weeks in advance).

Late Policy: Unless otherwise specified for a particular assignment, work that is submitted late will be accepted with reduced credit accordingly:

- One day late: -10%
- Two days late: -25%
- Three days late: -50%

No submission will be accepted later than three days after the deadline. Please note that this late submission policy only applies to the term paper assignment.

Exceptions: Any grading appeals or petitions must be communicated promptly in writing (or email). Exceptions will normally be evaluated at the very end of the semester in context with overall semester track record and all other exceptions class-wide. Special consideration for truly unavoidable and extenuating circumstances will depend on timeliness and strength of supporting documentation (e.g., doctor's note, police report, military orders).

Classroom Protocol

Although University Policy F15-12 at http://www.sjsu.edu/senate/docs/F15-12.pdf states that "Attendance shall not be used as a criterion for grading", the policy also states, "Students are expected to attend all meetings for the courses in which they are enrolled as they are responsible for material discussed therein" and furthermore, "Participation may be used as a criterion for grading when the parameters and their evaluation are clearly defined in the course syllabus and the percentage of the overall grade is stated."

University Policies

Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on Office of Graduate and Undergraduate Programs' Syllabus Information web page at http://www.sjsu.edu/gup/syllabusinfo/ .

ME 267 Engineering Biomechanics Course Schedule

This schedule is subject to change with fair notice via announcement in class or notification via Canvas.

Week	Dates	Topics and Textbook Reading Sections	Assignments and Approximate Deadlines
1	8/27	Introduction to course Review of vector fundamentals	
2	9/10	Statics for musculoskeletal biomechanics Statics (constrained optimization)	HW1 (vectors)
3	9/17	Reference frames and 3-D vector differentiation Kinematics for musculoskeletal biomechanics	HW2 (statics)
4	9/24	Kinematics (continued) Mass, moments of inertia, products of inertia	HW3 (kinematics)
5	10/1	Dynamics for musculoskeletal biomechanics Dynamics (continued)	
6	10/8	Introduction to computational dynamics software Review	HW4 (kinetics)
7	10/15	Structural mechanics of bone	
8	10/22	**Midterm Exam** on Monday, Oct 15th in class	Topic Review Paper draft due 10/24
9	10/29	Application of finite element analysis software	HW5 (inverse dynamics)
10	11/5	Hemodynamics and vasculature	HW6 (structural mechanics)
11	11/19	Application of fluid-structure interaction software	Topic Review Paper due
12	11/26	Viscoelasticity, cells, and soft tissues	HW7 (hemodynamics)
13	12/3	Application of lumped-parameter modeling software	Topic Review Paper Peer Review due
14	12/10	Course review and Final Exam preparation	HW8 (viscoelasticity)
15	12/17	Final Exam	

The **Final Exam** will be held on Monday, December 17 from 17:15 PM to 19:30 PM in the regular classroom.