

Syllabus for ME 643: Biomechanical Design Project (Option C)

Course Information

The Biomechanics Design Project Option is an undergraduate biomechanics course that provides hands-on experience in biomedical device design, rehabilitation and assistive device design, and work place design for improved ergonomics. Background in musculoskeletal anatomy and principles of biomechanics are required. Prerequisites: ME 501, ME 550, ME 612, ME 628, and ME 633.

Class Meeting Times

Tuesdays and Thursday: 1:00 - 2:30 PM, Learned Hall 2032

Instructor Office Hours

Mondays 1-2 PM, Tuesdays 1-3 PM - Noon, and Thursday: 2:30 – 3:30 PM, Learned Hall 3011

Course Description

Design and development of a mechanical system related to biomechanics that has been investigated in ME 633 – Tissue Mechanics and Basic Biodynamics. An individual or group report that includes designs, analysis/testing, drawings and/or schematics is required. Establishment of specifications and consideration of realistic constraints such as safety, economic factors, design impact, aesthetics and reliability are required. A working prototype is strongly encouraged. Course format will include weekly reports and team meetings, design reviews, mid-term and final design presentations.

Course Rationale

Students learn to apply their engineering skills to open-ended design problems in biomechanics. The course is especially valuable for students considering/seeking industrial positions in the biomedical and biotechnology fields. They will improve options for careers as design engineers in medical device companies and exercise equipment companies, as laboratory/testing technician in research facilities, and as a clinical engineer in the hospital environment. The course also brings the students into contact with companies that can offer such positions. The class will enhance project planning and execution skills for students considering medical school and for those planning to attend graduate school in biomedical engineering. This course is appropriate for people on any of these career paths. The course will provide the student a realistic design experience with the normal constraints of time, people, materials, cost and safety.

Course Requirements and Grading

All assignments (reports/presentations) are due *at the beginning of class/meeting time* on the due date. Late assignments will receive a 25% reduction in assignment grade. *Attendance and tardiness will also affect your grade* (see Attendance Policy). All presenters/participants deserve your promptness and full attention, and it is your *professional* responsibility to be fully prepared by the meeting time.

Weekly Meetings & Progress Reports	5% (individual authors and participation)
Design Review	10% (author), 5% (group members)
Progress Presentation #1	10% (author), 5% (group members)
Progress Presentation #2	10% (author), 5% (group members)
Mid-Term Progress Report (written)	10% (author), 5% (group members)
Final Formal Design Presentation	20% (group, 15% instructor evaluation, 5% based on audience evaluations)
Final Design Report	20% (group, 15% instructor evaluation, 5% based on sponsor evaluations)
Self and Group Member-Evaluations	10% (individual)
Group Design Notebook	5% (group)
Individual Logbooks	5% (individual)
Instructor Evaluation of Contribution	10% (individual)

A value-score based system will be used for final grade assignment.

A for score ≥ 90 assigned to *clearly outstanding* design process, resulting design and prototype that *greatly exceeds* many aspects of *design criteria* and expectations.

B for score ≥ 80 assigned to “above average” in one or more areas of design process, resulting design and prototype that *clearly exceeds* some aspects of *design criteria* and expectations.

C for score ≥ 70 assigned to *acceptable* design process and/or resulting design and/or prototype of reasonable quality that meets design criteria, with *unacceptable performance in one area*.

D for score $\geq 60\%$ assigned to work with either acceptable design process or resulting design or prototype, with *unacceptable performance in two areas*.

F for score $< 60\%$ assigned to *unacceptable* design process and *unacceptable* resulting design and *unacceptable* prototype that does not meet design criteria and/or expectations.

The instructor reserves the right to alter the grade assignment algorithm in a systematic manner.

Course Learning Objectives

After active participation in this course and an effort to learn the material, students will be able to:

1. integrate and apply knowledge from the various branches of mechanical engineering including biomechanics to achieve the design of a complex mechanical system.
2. systematically analyze and solve open-ended problems in design and/or research.

Course Materials

- 1) Fundamentals of Biomechanics: Equilibrium, Motion, and Deformation, by Ozkaya and Nordin, 2nd Edition
- 2) Melloni's Illustrated Medical Dictionary, by Dox, Melloni, and Eisner, 4th Edition.
- 3) The Mechanical Design Process, by David Ullman, McGraw-Hill, 1997

Use of Facilities

Space will be provided in ME labs for working on the projects and storing of materials, tools, etc. These spaces will typically be allocated or arranged for the following areas: B-12, B-12a, B-15, B-16, 1055, and 1055a. It will be the Groups' responsibilities to maintain a clean orderly work environment, not to interfere in any way with other Groups' activities. Do not take or use others' tools, materials or work space. Tools may be checked out from the Machine Shop, but must be returned in the time specified upon checkout. Otherwise, the individual and Group will be charged for the items not returned. Access to the rooms or labs will be provided through keys (checked out by the ME office), keypad codes, and combination lock codes - - these must be protected against all unauthorized use. Machines/systems/rooms are not to be used unless trained and/or permitted by authorized personnel. Each member of each Group is expected to sign a Controlled Access Agreement and abide by that Agreement as well as the specific rules posted or provided for each machine/system/room. Violation of any part of the Agreement can result in loss of privileges for the individual and/or the Group.

Purchasing Materials

In order to purchase materials of any kind, the Group Leader and the Instructor must approve purchases. This authorization will be provided by use of Purchase Order forms, which can be obtained from Ms. Penny Hodge in the ME office. Personal reimbursement purchases are strongly discouraged; but if this is necessary, a PO must also be obtained for such purchases. Improper use of the Purchase Order system can result in loss of purchasing privileges for the individual and/or Group.

Course Policies (Attendance)

Class/meeting attendance is required. Students who miss class/meetings without *prior notification* of and permission from *the team leader and course instructor* will **lose one half point from the final course score** for each occurrence. Students who miss design reviews presentations without *prior notification* of and permission from *the team leader and course instructor* will **lose two full points from the final course score** for each occurrence. Students who *arrive late* for design reviews and presentations will **lose one full point from the final course score** for each occurrence.

Course Policies (Academic Integrity)

Students in this course will be expected to comply with the University of Kansas Policy on Academic Integrity. Any student suspected of violating this obligation for any reason during the semester will be required to participate in the procedural process, initiated at the instructor level, as outlined in the University Guidelines on Academic Integrity. This may include, but is not limited to, the confiscation of the examination of any individual suspected of violating University Policy. Furthermore, no student may bring any unauthorized materials to an examination, including dictionaries and programmable calculators.

In the context of this project course, academic integrity includes maintaining high ethical standards throughout the project period. Such standards include respect for team members, other design teams and both university owned and project-specific equipment. Respect for others includes maintaining a clean and safe working environment. Any unethical actions or misconduct will be taken very seriously and dealt with severely. Anyone who obviously does not carry his/her share of the project load in a group fails to respect the group members, the project sponsor, and the instructor, and will, therefore, receive a considerably reduced (proportionate to lack of performance) grade for the course, regardless of the success of the group/project as a whole!

Course Policies (Disabilities)

Any student at the University of Kansas who has a disability that may prevent him/her from fully demonstrating his/her abilities should contact the instructor and the office of Services for Students with Disabilities (SSD) as soon as possible, so we can discuss accommodations necessary to ensure full participation in this course and your college experience.

Note that students must self-identify to SSD and the faculty, the SSD staff will collect documentation and evaluate eligibility. SSD will provide a letter to notify faculty of appropriate accommodations. Faculty have no obligation to provide accommodations without a letter from SSD, and there is no requirement for retroactive consideration. It is the student's responsibility to follow up with faculty on implementation of the accommodations in the SSD letter.