EMEC 440/540: Biomechanics of Human Movement  
Spring Semester, 2019

**Instructor:** Scott Monfort  
**E-mail:** scott.monfort@montana.edu  
**Office Hours Location:** TBD  
**Office Hours Times:** TBD, or by appointment  
**Class Meetings:** TBD  
**Class Location:** TBD  
**Course Notes:** Posted on course website  
**Course Website:** Brightspace (D2L)

**Catalog Description:** 3 Cr., LEC 3: Applications of mechanics to the human body. Overview of key problems and challenges in musculoskeletal biomechanics. Topics include: biological tissue form and function, generation of movement, kinematics, and inverse dynamics.


**Additional Texts for Biomechanics Enthusiasts:**

**PREREQUISITE:** Undergraduates: EGEN 202, 203, 205; M 274; or consent of instructor. Graduate students: good standing within your academic program.

**Functional Prerequisites:** You should be comfortable with:
- Mechanics of materials (stress, strain, Young’s modulus, etc.)
- Statics and Dynamics (free body diagrams, solving for reaction forces and moments, equations of motion for multi-segment systems)
- Linear Algebra (matrix multiplication, cross and dot products)
- Differential Equations (how to solve 1st and 2nd order systems)
- Programming (MATLAB)

**Course Learning Objective:** This course is an introduction to interdisciplinary biomechanics theory and problems with a focus on human movement. Lectures, homework, journal article reviews, a project, and exams will be used to facilitate and evaluate students’ obtainment of the course learning objectives. After completing this course, students will be able to:
- Understand and effectively communicate using anatomic terminology
- Describe the properties and mechanical behavior of bones, ligaments, tendons, meniscus, and cartilage
- Describe biological, mechanical, and neurological aspects of human movement
- Apply kinematics and dynamics theory to characterize human movement
- Describe common measurement techniques for biomechanics research

**Simultaneous Undergraduate and Graduate Course Offering:** This course will co-convene undergraduate and graduate students. Undergraduate students should be enrolled in EMEC 440, while graduate students should enroll in EMEC 540. Graduate students will have additional expectations including creating and leading lessons that use scientific journal articles to extend lecture content. Additional work will also be required of students during exams and the course project.

**Computer Resources and Usage:** MATLAB and other software will be used throughout this course. Students are expected to learn the software packages, which will be aided by course lectures.
Grading:  
A  93-100  
A-  90-93  
B+  87-89.9  
B  83-86.9  
B-  80-82.9  
C+  77-79.9  
C  73-76.9  
C-  70-72.9  
D+  67-69.9  
D  60-66.9  
D-  50-59.9  
F  0-59.9

*Numbers in parentheses correspond to EMEC 540 grading policy.

**Homework:** Problem sets will be given throughout the semester that contain ill-defined problems. Office hours provide a great opportunity to ask questions about these problems to provide you with a better understanding of the topics.

**Journal Article Reviews (EMEC 440 only):** Undergraduate students will critically read journal articles that utilize various biomechanical research methods. The objective of these reviews is to provide students with the opportunity to learn about biomechanical methods in the context of real-world applications that align with their own interests.

**Journal Article-Based Lessons (EMEC 540 only):** Graduate students will select peer-reviewed journal articles that are relevant to previously covered concepts. Approval of the article must be obtained by the instructor in advance. Students will develop ~20-minute lessons that incorporate active learning concepts to discuss the journal article content and extend the class understanding of biomechanics concepts. Graduate students will lead two lessons each throughout the semester.

**Project:** The project provides an opportunity for you to apply the knowledge you learn from the course to a real situation in biomechanics. Similar to biomechanics practice (or the “real world”, in general), this project will be more open-ended and less structured than many of the engineering problems you are familiar with, forcing you to critically analyze and apply what you have learned. This project should take you longer to complete than a homework assignment, so plan accordingly. If you would like, you may choose to work with a partner on this assignment. The project is **due no later than 5pm on the last day of class, no exceptions.**

**Exams:** This course will have a midterm and a comprehensive final exam. Make up exams will only be given in the case of a documented medical absence (with a doctor's note on office letterhead), or for family/personal emergencies (with a note from the relevant MSU academic advisor). If you anticipate a conflict with the time of a scheduled exam, please contact me well in advance for alternate arrangements.

**Re-grade Policy:** If you feel that an exam or assignment was graded incorrectly, please return the work along with a neatly written/typed note attached that clearly describes what you believe to be the grading error **within one week of receiving the original grade.** I will then look over the problem(s) that you believe have an error, as well as the rest of the assignment, and adjust your grade accordingly.

I reserve the right to make minor adjustments to a student's final average if I do not believe the average accurately reflects the student's overall performance in the class. Quality performance and class participation is necessary, but not sufficient, condition for this action to be taken.

**Disability Information:** Any student who feels that he/she may need an accommodation based on the impact of a disability should please contact the Office for Disability Services at 406-994-2824 in Rm 180, SUB.

**Collaboration:** University policy states that, unless otherwise specified by the instructor, students may not collaborate on graded material. However, this class will utilize team projects and assignments throughout the semester. It is required that all students will participate in assigned team activities. Any difficulties experienced
through the teaming process must be brought to the instructor immediately. Delayed complaints and issues on team assignments leave the instructor with little latitude for altering outcomes.

**Academic Integrity Expectations:** Students are reminded that academic misconduct is a violation of the MSU Student Code of Conduct (http://www2.montana.edu/policy/student_conduct/).

One of the most important values of an academic community is the balance between the free flow of ideas and the respect for the intellectual property of others. Researchers do not use one another's research without permission; scholars and students always use proper citations in papers; professors may not circulate or publish student papers without the writer's permission; and students may not circulate or post materials (handouts, exams, syllabi --any class materials) from their classes unless they have received prior written permission of the instructor. Any test, paper or report submitted by you and that bears your name is presumed to be your own original work that has not previously been submitted for credit in another course unless you obtain prior written approval to do so from your instructor. In all of your assignments, including your homework or drafts of papers, you may use words or ideas written by other individuals in publications, web sites, or other sources, but only with proper attribution. If you are not clear about academic integrity expectations for completing an assignment or taking a test or examination, be sure to seek clarification from your instructor or teaching assistant (TA) beforehand.

**Plagiarism**

Plagiarism (according to Meriam Webster) is “to steal and pass off the ideas or words of another as one's own.” Indeed, any sentences or paragraph taken verbatim from the writing of (or interviews with) any other person or persons, or from your own writing that has been published or submitted elsewhere, must be placed in quotation marks and their source must be clearly identified.

Changing the wording of a sentence or passage slightly does not evade the requirement for citation. More generally, whenever you are drawing an important argument or insight from someone else, even if you reword it into your own words, a reference to the source is required.

If you have any questions about using and citing sources, you are expected to ask for clarification. For further details, please see the Statement on Academic Writing and Student Responsibility: http://www.montana.edu/facultyexcellence/TLResources/StudentResponsibilityAcademicWriting.html.

Section 420 of the Student Conduct Code describes academic misconduct as including but not limited to plagiarism, cheating, multiple submissions, or facilitating others’ misconduct. Possible sanctions for academic misconduct range from an oral reprimand to expulsion from the university. Mechanical and Industrial Engineering Department policy mandates that course instructors report any and all cases of academic misconduct.

**Teaching Assistant** This class is fortunate to have the support of a graduate student teaching assistant (GTA) and/or several undergraduate teaching assistants (UG TAs) to assist and facilitate with student learning. These TAs should be treated with respect and all interactions should be professional. The MSU Student Code of Conduct (http://www.montana.edu/policy/student_conduct/#codeofconduct) requires this of all students. Violations of this policy with TAs (or anyone else) will not be tolerated and will be handled according to the procedures described in the policy. TAs have very specific assignments from the course instructor and therefore may not have comprehensive knowledge of all course requirements and content. If questions arise requiring clarification of class content or subject material, please direct them to the course instructor. In their instruction role, the TAs may be responsible for assigning grades. If a student disagrees with the decision made by the TA then they are to bring that concern directly to the course instructor and not challenge the TA regarding their decision.
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