George Mason University
College of Education and Human Development
Kinesiology

EFHP 813.001 — Musculoskeletal Biomechanics in Human Movement
3 Credits, Spring 2021
Friday: 10:30 AM – 1:10 PM, ONLINE

Faculty

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Prerequisites/Corequisites
Graduate Standing or Permission of Instructor

University Catalog Course Description
Advanced study of the biomechanical analysis of the musculoskeletal system, including collecting, interpreting, and modeling biomechanical data.

Course Delivery Method
This course will be delivered online (76% or more) using a synchronous and asynchronous format via Blackboard Learning Management system (LMS) housed in the MyMason portal. You will log in to the Blackboard (Bb) course site using your Mason email name (everything before @masonlive.gmu.edu) and email password. The course site will be available on January 25, 2020.
Overall, this will be a highly interactive class and students will be encouraged to participate.

Under no circumstances, may students participate in online class sessions (either by phone or Internet) while operating motor vehicles. Further, as expected in a face-to-face class meeting, such online participation requires undivided attention to course content and communication.

Technical Requirements

To participate in this course, students will need to satisfy the following technical requirements:

- High-speed Internet access with standard up-to-date browsers. To get a list of Blackboard's supported browsers see: https://help.blackboard.com/Learn/Student/Getting_Started/Browser_Support#supported-browsers

To get a list of supported operation systems on different devices see: https://help.blackboard.com/Learn/Student/Getting_Started/Browser_Support#tested-devices-and-operating-systems

- Students must maintain consistent and reliable access to their GMU email and Blackboard, as these are the official methods of communication for this course.
- Students may be asked to create logins and passwords on supplemental websites and/or to download trial software to their computer or tablet as part of course requirements.
- The following software plug-ins for PCs and Macs, respectively, are available for free download:
    - Adobe Acrobat Reader: https://get.adobe.com/reader/
    - Windows Media Player: https://support.microsoft.com/en-us/help/14209/get-windows-media-player
    - Apple Quick Time Player: www.apple.com/quicktime/download/

Expectations

- Course Week: Our course week will begin on Mondays and finish on Sundays.
- Log-in Frequency:
  Students must actively check the course Blackboard site and their GMU email for communications from the instructor, class discussions, and/or access to course materials at least 4 times per week. In addition, students must log-in for all scheduled online synchronous meetings.
- Participation:
  Students are expected to actively engage in all course activities throughout the semester, which includes viewing all course materials, completing course activities and assignments, and participating in course discussions and group interactions.
- Technical Competence:
  Students are expected to demonstrate competence in the use of all course technology. Students who are struggling with technical components of the course are expected to seek assistance from the instructor and/or College or University technical services.
- Technical Issues:
  Students should anticipate some technical difficulties during the semester and should, therefore, budget their time accordingly. Late work will not be accepted based on individual technical issues.
- Workload:
  Please be aware that this course is **not** self-paced. Students are expected to meet *specific deadlines* and *due dates* listed in the **Class Schedule** section of this syllabus. It is the student's responsibility to keep track of the weekly course schedule of topics, readings, activities and assignments due.
- Instructor Support:

Students may schedule a one-on-one meeting to discuss course requirements, content or other course-related issues. Those unable to come to a Mason campus can meet with the instructor via telephone or web conference. Students should email the instructor to schedule a one-on-one session, including their preferred meeting method and suggested dates/times.

- Netiquette:
  The course environment is a collaborative space. Experience shows that even an innocent remark typed in the online environment can be misconstrued. Students must always re-read their responses carefully before posting them, so as others do not consider them as personal offenses. *Be positive in your approach with others and diplomatic in selecting your words*. Remember that you are not competing with classmates, but sharing information and learning from others. All faculty are similarly expected to be respectful in all communications.
- Accommodations:
  Online learners who require effective accommodations to insure accessibility must be registered with George Mason University Disability Services.

Learner Outcomes or Objectives

This course is designed to enable students to do the following:

1. Critically understand the musculoskeletal biomechanical concepts.
2. Integrate motion capture, electromyography, wearable technologies, and modeling techniques for the assessment of musculoskeletal system.
3. Design an experiment utilizing musculoskeletal biomechanical concepts.
4. Simulate musculoskeletal motion utilizing data-driven biomechanical models.

Required Texts:

Winter DA. *Biomechanics and motor control of human movement.* 4th ed. Hoboken, N.J.: Wiley; 2009. ISBN-13: 978-0-470-39818-0

*Note this textbook will be used in EFHP 815 & EFHP 825

Additional article readings:

TBD – as assigned by instructor

Optional/Suggested Texts:

Foundational Knowledge –

McGinnis, Peter. Biomechanics of Sport and Exercise, 3rd Edition, Human Kinetics. Champaign, Illinois, 2013.

Advanced Concepts -

Robertson G, Caldwell G, Hamill J, Kamen G, Whittlesey S. *Research methods in biomechanics, 2E.* Human Kinetics; 2013.

Zatsiorsky V. Kinematics of Human Motion, Human Kinetics, Champaign, Illinois, 1997.

Zatsiorsky V. Kinetics of Human Motion, Human Kinetics, Champaign, Illinois, 2002.

Zatsiorsky V, Prilutsky B. Biomechanics of Skeletal Muscles, Human Kinetics, Champaign, Illinois, 2012.

Supplementary materials
Supplementary materials will be used in class and posted on BlackBoard/MyMason Portal. Please print these materials and bring them to class so that you have access to them when needed.

Course Performance Evaluation
Students are expected to submit all assignments on time in the manner outlined by the instructor (e.g., Blackboard, Tk20, hard copy).

- **Assignments and Examinations**
  - **Mid-term Exams –** Each student will be required to complete 2 mid-term exams. The format will be multiple choice, true/false, short essays, and problem-solving questions. Demonstration of ability to critically understand the musculoskeletal biomechanical concepts and integration of the various equipment will be assessed.

  - **Article Presentations –** Each student will be required to present and lead a discussion of a 2 articles on a specific topic within the field of biomechanics. The articles will be approved by the instructor. Detailed instructions will be provided to students.

  - **OpenSim Module** – The modeling software OpenSim will be utilized to provide experience modeling musculoskeletal mechanics from kinematic, kinetic and EMG data. Students will work through a series of guided activities to gain an understanding of mechanical properties of muscles, tendons and ligaments. The activities will illustrate several clinical applications of modeling biomechanical data. Detailed instructions will be provided to students.

  - **HW Assignments and Quizzes**– Throughout the semester HW assignments will be required to be completed prior to class on Blackboard. These will assist you in reviewing key concepts, preparing for class and studying for exams. Quizzes will be

utilized to assess understanding of readings and articles. The quizzes **will not** be announced in advance of class.

- **Other Requirements**
  - **Email Correspondence**
    - Only messages that originate from a George Mason University email address will be accepted. ***Emails with no subject or no text in the body will not be acknowledged.*** All email will be responded to in the order in which it is received. Students should allow 48 hours for a response.
  - **Technology Use During Class**
    - As per GMU policy, all sound emitting technology is required to be turned off during the class meeting time. No sound emitting technology (e.g., cell phones, smart phones, iPads, Tablets, pagers, etc.) is allowed at any time during the class period. Students who are observed using any form of technology inappropriately (e.g., sending text messages from cell phones, visiting social networking sites from laptops, etc.) will be dismissed from class for the day, counted as an absence, and not permitted to make up missed assignments.

- **Course Performance Evaluation Weighting**

This course will be graded on a point system, with a total of 100 possible points.

Assignment	**Points**
Mid-term Exams	40 (20 each)
Article Presentations	20
OpenSim Module	20
HW Assignments and Quizzes	20
Total	**100**

Notes:
1) Although a B- is a satisfactory grade for a course, students must maintain a 3.00 average in their degree program and present a 3.00 GPA on the courses listed on the graduation application.

Grading Policies

The student's final letter grade will be earned based on the following scale:

Grade	**Percentage**
A	94 – 100%
A-	90 – 93%
B+	88 – 89%

B	84 – 87%
B-	80 – 83%
C	70 – 79%
F	0 – 69%

Note: Although a B- is a satisfactory grade for a course, students must maintain a 3.00 average in their degree program.

Class schedule

Week	Date	Topic	Due
Week 1	Jan 25 – 31	Course Introduction: 1) Kinematics, 2) Kinetics and 3) Musculoskeletal Mechanics	**Background Knowledge Check Quizzes – Due Midnight January 28;** Winter Chapter 1; Article and video on Blackboard
Module 1: Kinematics			
Week 2	Feb 1 – 7	Fundamental Concepts in Kinematics	Review Kinematics Materials on BB; Winter Chapter 3 pp 45-47; 75-78, 176-187; Knudson Chapter 5
Week 3	Feb 8 – 14	Advanced Concepts in Kinematics	**Kinematics Equation Sheet Due by 5 pm Feb 11**; Winter Chapter 7 pp 176-187; Article(s) on Blackboard
Week 4	Feb 15 – 21	Topic: Kinematics Chains and Biomechanical Analysis	Article(s) on Blackboard; **Article Selections Due by Midnight February 21**
Week 5	Feb 22 – 28	Topic: Gait and Jumping Kinematics	Article(s) on Blackboard
Week 6	Mar 1 – 7	Topic: Motion analysis techniques – past, present and future	**Kinematic Problem Set Due Midnight Feb 20;** Article(s) on Blackboard

Week 7	Mar 8 – 14	Article Presentations / Review	**Mid-term Exam 1 Due Midnight March 14**
Module 2: Kinetics			
Week 8	Mar 15 – 21	Topic: Fundamental Concepts in Kinetics	Review Kinetics Materials on BB; Winter Chapter 5 & 6, Chapter 7 pp 188-198; Knudson Chapter 6, 7 & 8
Week 9	Mar 22 – 28	Topic: Gait and Jumping Kinetics	**Kinetics Equation Sheet Due by 5 pm March 25**;Article(s) on Blackboard
Week 10	Mar 29 – Apr 4	Topic: Inverse Dynamics & Joint Moments	**Kinetic Problem Set Due Midnight April 4;** Article(s) on Blackboard
Week 11	April 5 – 11	Topic: Biomechanical Assessment of Balance	Winter Chapter 11; Article(s) on Blackboard
Module 3: Musculoskeletal Biomechanics & Modeling			
Week 12	April 12 – 18	Fundamental Concepts in Tissue Mechanics	Review Mechanics of Tissues Material on BB**;** Winter Chapter 4 & 9; Knudson Chapter 4; Readings on Blackboard
Week 13	April 19 – 25	Topic: Musculoskeletal Modeling Introduction to OpenSim	Winter Chapter 8; Article(s) on Blackboard
Week 14	April 26 – May 2	Topic: Advanced topics in Tissue Mechanics / Review for Mid-term 2	Article(s) on Blackboard; **Mid-**

			term Exam 2 Due Midnight May 2
Finals Week	May 7	Work on OpenSim Modules	**OpenSim Modules Due by Midnight May 7**

Note:
1) The instructor reserves the right to make changes to the course syllabus and/or schedule at any time. Students will always be informed of any changes made

Core Values Commitment

The College of Education and Human Development is committed to collaboration, ethical leadership, innovation, research-based practice, and social justice. Students are expected to adhere to these principles: http://cehd.gmu.edu/values/.

GMU Policies and Resources for Students

Policies

- Students must adhere to the guidelines of the Mason Honor Code (see https://catalog.gmu.edu/policies/honor-code-system/).
- Students must follow the university policy for Responsible Use of Computing (see https://universitypolicy.gmu.edu/policies/responsible-use-of-computing/).
- Students are responsible for the content of university communications sent to their Mason email account and are required to activate their account and check it regularly. All communication from the university, college, school, and program will be sent to students **solely** through their Mason email account.
- Students with disabilities who seek accommodations in a course must be registered with George Mason University Disability Services. Approved accommodations will begin at the time the written letter from Disability Services is received by the instructor (see https://ds.gmu.edu/).
- Students must silence all sound emitting devices during class unless otherwise authorized by the instructor.

Campus Resources

- Support for submission of assignments to Tk20 should be directed to tk20help@gmu.edu or https://cehd.gmu.edu/aero/tk20. Questions or concerns regarding use of Blackboard should be directed to https://its.gmu.edu/knowledge-base/blackboard-instructional-technology-support-for-students/.
- For information on student support resources on campus, see https://ctfe.gmu.edu/teaching/student-support-resources-on-campus

Notice of mandatory reporting of sexual assault, interpersonal violence, and stalking:

As a faculty member, I am designated as a "Responsible Employee," and must report all disclosures of sexual assault, interpersonal violence, and stalking to Mason's Title IX Coordinator per University Policy 1202. If you wish to speak with someone confidentially, please contact one of Mason's confidential resources, such as Student Support and Advocacy Center (SSAC) at 703-380-1434 or Counseling and Psychological Services (CAPS) at 703-993-2380. You may also seek assistance from Mason's Title IX Coordinator by calling 703-993-8730, or emailing titleix@gmu.edu.

For additional information on the College of Education and Human Development, please visit our website https://cehd.gmu.edu/students/