

George Mason University
College of Education and Human Development
Master in Kinesiology

KINE 603.003 – Applied Biomechanics

3 Credits, Fall 2024

T, R: Noon – 1:15PM Colgan Hall Room 302 – SciTech Campus

Faculty

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Prerequisites/Corequisites

Admission to the Kinesiology MS graduate program or approval of course instructor.

University Catalog Course Description

Examines biomechanical theory and the application of mechanics to understand human movement across the lifespan and ability level.

Course Overview

This course will provide advanced knowledge in kinetics, kinematics and mechanical properties of tissues in order to provide an understanding of the function of the human body. Current scientific literature will be used to teach evidence-based approaches to perform data collection, analysis and interpretation for clinical or research biomechanical purposes. Throughout the course an emphasis will be placed on motion analysis, ground reaction forces, and electromyography.

Course Delivery Method

This course will be delivered using lecture, lab, seminar formats and hybrid online formats.

Learning Outcomes

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

1. Describe and explain concepts and theory from kinetics, kinematics and mechanical properties of tissues as it relates to human movement.
2. Apply laws relating forces, inertial properties of the body and motion to common human movements.
3. Quantify human motion using methods common in the field of biomechanics.
4. Analyze and evaluate human movement data, collected from kinematic, kinetic and electromyographic analysis.
5. Evaluate current research in the field of biomechanics.

Required Texts

Biomechanics and motor control of human movement. 5th ed. Hoboken, N.J.: Wiley; 2023.
ISBN: 978-1-119-82702-3

Additional article readings:

TBD – as assigned by instructor.

Optional/Suggested Texts:

Foundational Knowledge – McGinnis, Peter. Biomechanics of Sport and Exercise. 4th Edition, Human Kinetics (2021): ISBN 13: 9781492571407

Advanced Concepts -

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

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).

- **Research Article Presentation** - The intent of this assignment is to develop your presentation skills and ability to relate course content to existing body of literature. Students will select an original article from a list provided and present relevant information to the class during a 10-12 minutes presentation session.

- **Assignments** – Throughout the semester assignments will be required to be completed prior to class. These will assist you in reviewing key concepts, preparing for class and studying for the final exam.
 - **Mid-Term and Final Exam**
 - Each student will be required to complete a mid-term exam and a final exam. The final exam will be cumulative. The format for all exams will be multiple choice, true/false, short essays, and problem-solving questions. Examinations represent inquiries regarding student knowledge of fact regarding course content. Examinations demonstrate that the student can remember and apply facts as well as demonstrate a hierarchy of knowledge information.
 - **Research Article Presentation**
 - The intent of this assignment is to develop your presentation skills and ability to relate course content to existing body of literature. Students will select an original article from a list provided and present relevant information to the class during a 10-12 minute presentation session.
 - **Labs**

be reported to the Honor Committee. Student assignments may be put through plagiarism detecting software.

○ **Written Assignments**

- All assignments must be typed in Microsoft Word, and formatted as follows (*unless otherwise specified*): double spaced, 12 point Times New Roman font, 1 inch margins, your name and title in the running header at top left had corner, continuous line numbers on left margin, and page numbers centered in footer. Failure to comply with any or all parts of this format will result in an unacceptable assignment, which corresponds to zero (0) points.
- Pay close attention to spelling and grammar as these will count towards your grade on written assignments. American Medical Association Manual (AMA) of Style (10th edition) format must be used for all written work in this class (e.g., in referencing, creation of tables, and formatting headers for paper sections).
- Assignments must be turned in on Blackboard/MyMason Portal by the beginning of class on the specified date due (*unless otherwise specified*). No late assignments will be accepted. It is recommended that students keep copies of all submitted work.

○ **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. Additionally, no laptop computers (e.g., netbooks, notebooks, etc.) will be permitted for use during class time unless with permission from the instructor.

○ **E-mail Correspondence**

- Only messages that originate from a George Mason University address will be accepted. Please address the subject line for all email pertaining to this course as: *KINE 603: Last Name – purpose of email*. The following is an appropriate professional format:

Subject: KINE 603: Help with (fill in the blank)

Dear Dr. Eddo, (*Introductory salutation*)

I have a question regarding one of the assignments. (*Text body*)

Regards, (*Ending Salutation*)

Mr. / Mrs. Student (*Your name*)

Note: All email will be responded to in the order in which it is received. Students should allow 48 hours for a response.

○ **Facilities**

- We are very fortunate to have our own human motion analysis equipment in the Sports Medicine Assessment Research & Testing (SMART) Laboratory. It is imperative that all people who utilize the labs treat the facilities and equipment with respect and care.
 - 1. All laboratory equipment is highly sensitive and quite expensive. No horseplay will be allowed in the laboratory
 - 2. If you are working with a piece of equipment and it breaks or something is not working properly, please notify one of the instructors immediately so it can be fixed.
 - 3. Please make sure to turn off all equipment when you are finished even if it was on when you started. Lab doors should be locked and lights should be turned off when you exit the lab.
 - 4. Computer data is highly sensitive to viruses, thus all disks must be “clean” and checked for viruses prior to utilization for laboratory experiments. It is each student’s responsibility to prevent computer malfunctions from occurring.
 - 5. Eating, drinking, chewing gum and smoking are not permitted in the testing section of the laboratory.

• **Grading**

• Assignment	Points
Mid-Term Exam #1	20
Final Exam	25
Research Article Presentation	15
Labs	30
Attendance and Participation	10
Total	100

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 and present a 3.00 GPA on the courses listed on the graduation application.

Use of Generative AI

Any text generated by an artificial intelligence (AI) text-generation tool (such as ChatGPT) is not accepted in this class as “the student’s own work,” and so will be considered similarly to text published on paper or online or text composed or significantly edited/altered by another person. The use of such text without proper attribution is a violation of academic integrity.

Professional Dispositions (CEHD Student Guide)

Throughout study in the College of Education and Human Development, students are expected to demonstrate behaviors that reflect the positive dispositions of a professional. See <https://cehd.gmu.edu/current-students/cehd-student-guide>.

Class Schedule

Week	Date	Topic	Due
Introductory Module			
Week 1	Aug 27	Course Overview and Introduction	
	Aug 29	Introduction Musculoskeletal Biomechanics	Winter Chapter 1 Biomechanics Inventory Quiz - Due Midnight Aug 31
Module 1: Anthropometry			
Week 2	Sept 3	Anthropometry Body segment parameters	Winter Chapter 4 Article(s) on Blackboard Prior to Class
	Sept 5		Date and Topic Selection
Week 3	Sept 10	Calculations	Article(s) on Blackboard Prior to Class
	Sept 12	Lab 1	
Week 4	Sept 17	Lab 2	

	Sept 19	Article Presentations (3)	Lab 1 Due
Module 2: Kinematics			
Week 5	Sept 24	Linear Kinematics	Lab 2 Due Winter Chapter 3
	Sept 26	Linear Kinematics	Article(s) on Blackboard Prior to Class
Week 6	Oct 1	Angular Kinematics	
	Oct 3	Angular Kinematics	
Week 7	Oct 8	Lab 3	
	Oct 10	Article Presentations (3)	Exam 1
Module 3: Kinetics			
Week 8	Oct 15	Linear Kinetics	Lab 3 Due
	Oct 17		Article(s) on Blackboard Prior to Class
Week 9	Oct 22	Angular Kinetics	
	Oct 24		
Week 10	Oct 29	Lab 4	
	Oct 31	Article Presentations (3)	
Module 4: Musculoskeletal Biomechanics & Modeling			
Week 11	Nov 5*	No class	Lab 4 Due Winter Chapter 5
	Nov 7	Inverse Dynamics	Article(s) on Blackboard Prior to Class
Week 12	Nov 12	Inverse Dynamics	
	Nov 14	Calculations	
Week 13	Nov 19	Article Presentations (3)	

	Nov 21	Forward Dynamics	
Week 14	Nov 26	Forward Dynamics	Winter Chapter 10 Article(s) on Blackboard Prior to Class
	Nov 28*	No class - Thanksgiving	
Week 15	Dec 3	Forward Dynamics : Opensim Lab 5	
	Dec 5	Article Presentations (3)	
Final	Dec 12	FINAL EXAM	OpenSim Modules Due by Midnight Dec 7

Note: Faculty reserves the right to alter the schedule as necessary, with notification to students.

CEHD Commitments

The College of Education and Human Development is committed to fostering collaboration and community, promoting justice and equity, and advancing research-informed practice. Students are expected to adhere to, and contribute to, these commitments, the CEHD Mission, and Core Values of George Mason University. More information can be found here:

<https://cehd.gmu.edu/about/culture/>

GMU Policies and Resources for Students

Policies

- Students must adhere to Mason's Academic Standards (see <https://catalog.gmu.edu/policies/academic-standards/>)
- 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 VIA should be directed to viahelp@gmu.edu or <https://cehd.gmu.edu/aero/assessments>.
- Questions or concerns regarding use of your LMS should be directed to:
 - Blackboard Learn: <https://its.gmu.edu/knowledge-base/blackboard-instructional-technology-support-for-students/>
 - Canvas: <https://its.gmu.edu/service/canvas/>
- For information on student support resources on campus, see: <https://ctfe.gmu.edu/teaching/student-support-resources-on-campus>
 - TimelyCare: <https://caps.gmu.edu/timelycare-services/>
 - Writing Center: <https://writingcenter.gmu.edu/>
- For additional information on the College of Education and Human Development's Student Success Resources, please visit: <https://cehd.gmu.edu/students/>.

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

As a faculty member, I am designated as a “Non-Confidential Employee,” and must report all disclosures of sexual assault, sexual harassment, 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 or support measures from Mason’s Title IX Coordinator by calling 703-993-8730, or emailing titleix@gmu.edu.