

**George Mason University**  
**College of Education and Human Development**  
Exercise, Fitness and Health Promotion

EFHP 613 - 001 Advanced Applied Biomechanics (3)  
Spring 2017  
Tuesday/Thursday: 12-1:15 pm  
249 Bull Run Hall – Science and Technology Campus

**Faculty**

Name: Dr. Joel Martin  
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**Prerequisites/Corequisites**

Full admission to EFHP graduate program. Introductory Biomechanics, Basic Human Anatomy, and Physics or permission of instructor.

**University Catalog Course Description**

Focuses on kinetic and kinematic concepts and how they apply to the qualitative and quantitative assessment of human movement. Designed for advanced study of motion analysis techniques.

**Course Overview**

This is a course to assist the human movement scientist (e.g., sports medicine clinician, exercise science, strength and conditioning) to enhance his/her ability to understand the nature of the structure and function of the human body through quantitative analysis of human motion. This course is intended to provide future clinicians/researchers with the necessary knowledge base to objectively evaluate human motion and to understand the theory, concepts and application of conducting analysis of human motion. The intent of this course is to provide students with an extensive knowledge concerning quantitative analysis of human motion and the concepts and equipment to collect objective quantifiable data to be used for clinical or research purposes. Lecture and laboratory concepts will be utilized to instruct students on the foundations of biomechanical data collection and major emphasis will be placed on using 2-D and 3-D motion analysis, force plates, and electromyography. As is the case in any biomechanical analysis of human motion instrumentation course, each student should expect to spend several additional hours each week in the laboratory over and above those scheduled as class time.

**Course Delivery Method**

This course is delivered through classroom instruction (face to face), and online assignments. A variety of teaching methods will be used. These include: lectures, class discussions, videos, demonstrations and in-class activities.

**Learner Outcomes or Objectives**

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

1. Demonstrate the knowledge set-up, collection, and interpretation of 2-D motion analysis.

2. Demonstrate the knowledge set-up, collection, and interpretation of 3-D motion analysis.
3. Demonstrate the knowledge set-up, collection, and interpretation of force plate analysis.
4. Demonstrate the knowledge set-up, collection, and interpretation of electromyography
5. Demonstrate the ability to communicate effectively the quantitative analysis of complex motor movements.
6. Demonstrate a comprehensive understanding of human movement through biomechanical analysis.
7. Demonstrate the ability objectively quantify and evaluate movement tasks relevant to human motion.

### **Required Texts**

McGinnis, Peter. Biomechanics of Sport and Exercise. 3<sup>rd</sup> Edition, Human Kinetics (2013)

*Software:*

MaxTraq: <http://www.motionanalysisproducts.com/Books/PM-BSE-R3.html>

### **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 and Final Exam**

- Each student will be required to complete two exams 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 Project**

- The research project provides experience in developing an in-depth understanding of a movement with application of neuromechanical / biomechanical concepts. It enhances communication (oral and written) skills, as it is important in the development of the professional student. It also stimulates critical thought process to develop the methodology of a study to assess that problem. Research project format will be distributed on blackboard.

##### **○ Research Project Presentation**

- The intent of this assignment is for you to share your research project with your colleagues via a 10-minute PowerPoint presentation. This assignment will allow you to gain experience in oral presentation skills. As part of the experience, your colleagues & I may ask questions about your study.

##### **○ Labs**

- There will be 7 labs with formal lab reports due during the semester. These are intended to give students hands-on, practical experience with concepts that are covered in class. The data will be collected in class. For each lab students will be required to write a formal lab report will be due approximately one week after

performing the lab. Lab reports must be typed and include a cover page.

○ **Exam Reviews**

- As time allows in class and depending on class progress in each unit, a review *may be* offered before each exam. At that time, students can ask any content question that they would like. If there are no questions related to the content of the unit, the review session will be ended. Whether or not a review is conducted in class depends of class progress through the material for each unit *and* class participation in previous reviews. If there is no time to have a formal review or, if review sessions are not being utilized, students will need to come to office hours to address any questions on class material.

○ **Attendance and Participation**

- Regularly attending class is mandatory and will count towards the final grade in the class. Participation during the activity labs is mandatory. Participation does not necessarily mean performing the physical activity – lab groups will need members to perform the physical activity, instruct the person performing the activity, take measurements, and record data.

○ **Final Grades:**

- Once your FINAL GRADE at the end of the semester is posted on mymasonportal/blackboard, you will have 24 hours to inquire about it. After that period, your grade will be posted as final. This course will be graded on a point system, with a total of 100 possible points.

● **Other Requirements**

○ **Attendance**

- Students are expected to be on time, attend all class meetings and be prepared for in class assignments and projects. Excused absences include the following: illness (must bring a receipt or note from a doctor), family death, athletic/academic event, and others at the discretion of the instructor. For known upcoming absences, students must contact the instructor at least one week in advance to the missed class to make up work. In the case of illness or some other unforeseen absence, the student must contact the instructor via e-mail or telephone. At the next attended class meeting the student will discuss material that is to be completed. It is the student's obligation to pursue any make-up work.

○ **Academic Load**

- Although many students must work to meet living expenses, employment and personal responsibilities are not acceptable reasons for late arrivals, missed classes, or incomplete assignments. Employment must not take priority over academic responsibilities. For additional information on this subject, please see the GMU Academic Catalog ([http://catalog.gmu.edu/content.php?catoid=5&navoid=104#Registration\\_attendance](http://catalog.gmu.edu/content.php?catoid=5&navoid=104#Registration_attendance)). Students failing to observe these guidelines should expect no special consideration for academic problems arising from the pressures of employment.

- **Honor Code**
  - Students are held to the standards of the George Mason University Honor Code (see <http://honorcode.gmu.edu> for details). Violations, including cheating and plagiarism, will 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 (10<sup>th</sup> 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: *EFHP 612: Last Name – purpose of email*. The following is an appropriate professional format:

Subject: EFHP 613

Dear Dr. Martin, (*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**

• <b>Assignment</b>	<b>Points</b>
Mid-Term Exam #1	15
Mid-Term Exam #2	15
Final Exam	20
Research Project	15
Research Project Presentation	10
Labs	20
Attendance and Participation	5
<b>Total</b>	<b>100</b>

Grade	Percentage	Quality Points	Grade	Percentage	Quality Points
A	93%	4.00	B-	80%	2.67*
A-	90%	3.67	C	73%	2.00
B+	87%	3.33	F	<73%	0.00
B	83%	3.00			

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.

## Professional Dispositions

Students are expected to exhibit professional behaviors and dispositions at all times.

## Class Schedule

Date	Topic	Chapter/Assignment Due Date
Jan 24 <sup>T</sup>	Introduction to EFHP 613 Introduction to course and labs Basic Terminology / Skeletal Considerations for Movement / Overview of Functional Anatomy / Movement Screens	Introduction Chapter, 10, 11 & 12
Jan 26 <sup>TH</sup>	Lab #1 – Math Review / Qualitative Movement Analysis <i>Location: 249 Bull Run Hall</i>	
Jan 31 <sup>T</sup>	<b>Online:</b> Mechanical Properties of Tissues	Chapter 9; Article on Blackboard
Feb 2 <sup>TH</sup>	Lab #2 – Biomaterials <i>Location: 249 Bull Run Hall</i>	<b>Lab report #1 is due</b> Article on Blackboard
Feb 7 <sup>T</sup>	Linear Kinematics	Chapter 2
Feb 9 <sup>TH</sup>	Lab #3 – Linear Kinematics & Projectile Motion <i>Location: 249 Bull Run Hall</i>	<b>Lab report #2 is due</b> Article on Blackboard
Feb 14 <sup>T</sup>	Angular Kinematics / Review for Exam I	Chapter 6
Feb 16 <sup>TH</sup>	<b>EXAM I</b>	<b>Lab report #3 is due</b>
Feb 21 <sup>T</sup>	<b>Online:</b> Linear Kinetics	
Feb 23 <sup>TH</sup>	Lab #4 – Video Analysis <i>Location: TBD</i>	Article on Blackboard
Feb 28 <sup>T</sup>	Linear Kinetics	Chapter 3
Mar 2 <sup>TH</sup>	3D Gait Analysis Demo <i>Location: Freedom Center SMART Lab</i>	<b>Lab report #4 is due</b> Article on Blackboard
Mar 7 <sup>T</sup>	<b>Online:</b> Angular Kinetics / Work, Power & Energy	Chapter 4 & 8 / Chapter 5 & 7
Mar 9 <sup>TH</sup>	Lab #5 – Work, Power & Energy <i>Location: SMART Lab - 9438 Innovation Loop</i>	Article on Blackboard
Mar 14 <sup>T</sup>	<b>No Class- Spring Break</b>	
Mar 16 <sup>TH</sup>	<b>No Class- Spring Break</b>	
Mar 21 <sup>T</sup>	Catch-up Day / Review for Exam II	<b>Lab report #5 is due</b>
Mar 23 <sup>TH</sup>	<b>EXAM II</b>	

Mar 28 <sup>T</sup>	<b>Online:</b> Instrumentation / Electromyography	Chapter 13, 14, 15 & 16
Mar 30 <sup>TH</sup>	Lab #6 – EMG <i>Location: SMART Lab - 9438 Innovation Loop</i>	Article on Blackboard
April 4 <sup>T</sup>	Research Project Workday – Formulating the research question	
April 6 <sup>TH</sup>	Lab #7 – OpenSim <i>Location: 249 Bull Run Hall</i>	<b>Lab report #6 is due</b> Article on Blackboard
April 11 <sup>T</sup>	<b>Online:</b> Research Project Workday – Designing the study	
April 13 <sup>TH</sup>	Research Project Workday – Pilot testing <i>Location: SMART Lab - 9438 Innovation Loop</i>	<b>Lab report #7 is due</b>
April 18 <sup>T</sup>	Research Project Workday – Data Collection 1 <i>Location: SMART Lab - 9438 Innovation Loop</i>	
April 20 <sup>TH</sup>	Research Project Workday – Data Collection 2 <i>Location: SMART Lab - 9438 Innovation Loop</i>	
April 25 <sup>T</sup>	Research Project Workday – Analyzing the data <i>Location: SMART Lab - 9438 Innovation Loop</i>	
April 27 <sup>TH</sup>	Research Project Workday – Interpreting the data <i>Location: 249 Bull Run Hall</i>	
May 2 <sup>T</sup>	Research Project Workday – Presenting the data / Final Exam Review <i>Location: 249 Bull Run Hall</i>	
May 4 <sup>TH</sup>	<b>Final Exam</b>	
May 11 <sup>TH</sup>	<b>Research Project Presentations: 10:30 AM – 1:15 PM</b>	<b>Research Project Due</b>
<i>Note: 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.</i>		

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

## 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 <http://oai.gmu.edu/the-mason-honor-code/>).
- Students must follow the university policy for Responsible Use of Computing (see <http://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 <http://ods.gmu.edu/>).
- Students must follow the university policy stating that all sound emitting devices shall be silenced during class unless otherwise authorized by the instructor.

### *Campus Resources*

- Support for submission of assignments to Tk20 should be directed to [tk20help@gmu.edu](mailto:tk20help@gmu.edu) or <https://cehd.gmu.edu/aero/tk20>. Questions or concerns regarding use of Blackboard should be directed to <http://coursessupport.gmu.edu/>.
- The Writing Center provides a variety of resources and services (e.g., tutoring, workshops, writing guides, handbooks) intended to support students as they work to construct and share knowledge through writing (see <http://writingcenter.gmu.edu/>).
- The Counseling and Psychological Services (CAPS) staff consists of professional counseling and clinical psychologists, social workers, and counselors who offer a wide range of services (e.g., individual and group counseling, workshops and outreach programs) to enhance students' personal experience and academic performance (see <http://caps.gmu.edu/>).

- The Student Support & Advocacy Center staff helps students develop and maintain healthy lifestyles through confidential one-on-one support as well as through interactive programs and resources. Some of the topics they address are healthy relationships, stress management, nutrition, sexual assault, drug and alcohol use, and sexual health (see <http://ssac.gmu.edu/>). Students in need of these services may contact the office by phone at 703-993-3686. Concerned students, faculty and staff may also make a referral to express concern for the safety or well-being of a Mason student or the community by going to <http://ssac.gmu.edu/make-a-referral/>.

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