

UNDERGRADUATE BIOMECHANICS

Biomechanical Basis of Movement

Department of Applied Physiology and Kinesiology
University of Florida

Course Description

Course Information

APK3220C (Section 10790)

Spring 2019: T 5-6 (11:45 AM-1:40 PM) R 6 (12:50-1:40)

Lecture Location: FLG 280

APK3220C (Section 10791)

Spring 2019: MWF 2 (8:30-9:20 AM)

Lecture Location: FLG 220

Instructor:

Matthew Terza Ph.D

Office: FLG 132-D

Email: mjt023@ufl.edu

Office Hours: T, W, R 1:55-2:55 (or by appointment)

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Teaching Assistants

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Section: TR 10791

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Section: MWF 10790

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General Purpose and Description

This course is designed to be a challenging milestone course that provides qualitative and quantitative understanding of mechanics as they apply to living organisms. Biomechanics utilizes multiple disciplines to understand the ways in which force provides a basis for movement of the human body.

Movement is a fundamental aspect of human life. In a qualitative way, we perform biomechanical analysis of ourselves and others through the interpretation of sensory information. In this course, we will focus on developing a solution process, a set of terminology, and associated methods for formally quantifying, understanding, and optimizing human movement. This course provides a basis for understanding health related problems of the musculoskeletal system from a biomechanical perspective. As clinicians and researchers this foundation can help us explain normal and abnormal mechanics of the body and make more informed decisions for the people we serve.

Prerequisite Knowledge and Skills

Prereq: junior or senior standing; APK 2100C and MAC 1140 with minimum grades of C; or PHY 2048 or PHY 2053 with minimum grade of C

Understanding of Physics 1 concepts will be very helpful in this course.

Course Objectives

- Learn terminology and concepts associated with the study of biomechanics.
 - Describe movement in anatomical planes and directions
 - Describe types of movement
 - Utilize terminology in conceptual mechanics
- Learn to apply principles of kinematics and kinetics to the human body.
 - Understand the relationship between position, velocity, and acceleration
 - Analyze projectile motion and instances of constant acceleration
 - Using Newton's law to calculate and analyze forces applied to the body
 - Understand and estimate center of mass and center of pressure for the human body
 - Calculate and balance torques for various basic lever systems.
- Conceptualize the mechanical architecture of the body
 - Understand the relationship between muscle fiber arrangement and force/torque generation
 - Understand the relationship between anatomical factors (joint morphology, muscle arrangement, muscle force generation factors) and mechanical features (torque generation, degrees of freedom, tissue stress and strain)
- Develop a solution process to analyze and evaluate real world situations from a biomechanical perspective.

Required Materials

Textbook: Hall. *Basic Biomechanics 7th Edition*. McGraw-Hill. 2015

Required Software

Microsoft Office 2016

Imagej (free image analysis software – simple to download and install)

Your Week Template

Weeks are broken up into 3 periods which are labeled sessions 1, 2, and 3. Sessions 1 and 2 are both on Tuesday for the T/R section.

Session 1: In-class lecture

Session 2: Problem set review

Session 3: (Variable day) Quiz + Review, In-Class Activity, In-class Lecture, or Exam

Additionally, each week you are responsible for watching the posted online lectures and for completing the problem set (which is not turned in for credit) for extra credit in class and as practice for quizzes and exams.

Quizzes (6 bi-weekly quizzes)

Your lowest quiz grade will be dropped.

Problem Sets and their Reviews

Problem sets are meant for you to practice the material. The problem set review days are extra credit opportunities in which you may earn extra points on Exams 1 and 2 for correctly working out problems for the class. Each week there will be a problem set that will have approximately 10 questions (or parts of questions) on it each is an extra credit opportunity. You may only receive extra credit once per exam. There are 6 problem sets exist for each exam. If no one volunteers then I will provide the solution and no extra credit will be awarded. You may receive up to 3% of extra credit on each exam.

Course Policies

Academic Honesty

Cheating will not be tolerated in this course. All students are required to abide by the Academic Honesty Guidelines and Honor Code, which have been accepted by the University. Cheating is defined as the improper taking or tendering of any information or material, which shall be used to determine academic credit. Violations of the Honor Code will be handled according to the guidelines set by Student Judicial Affairs. UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment."

The Honor Code <https://sccr.dso.ufl.edu/process/student-conduct-code/> specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with me.

Assignments unless otherwise stated by the course instructor are intended to be individual work. Discussion regarding solution processes and understanding of the material is permitted but copying work is not. Additionally, file sharing for any assignment that is not explicitly group work is expressly prohibited. Sharing files between groups is also prohibited. Turning in files that are not your original work is also prohibited. It is the student's responsibility to seek clarification on policies or application of policies for specific assignments if necessary.

Class Attendance and Participation Policy

Students are expected to attend all classes (including those during Drop/Add week) and to be appropriately prepared for class. Students are responsible for all material covered during lectures either spoken or written. Failure to attend class does not absolve students of the responsibility of learning the material covered. University excused absences will be treated in accordance with University of Florida policy. Attendance will not count directly towards your grade, but it will behoove you to be present for all sessions. Being unprepared, disruptive, late, or disrespectful in class can be counted against you according to the rubric below. **Students must be present to receive credit for in class activities/assignments.**

Here is the link for UF attendance policies:

<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

Preferred (0)	Acceptable (-0.5 pts)	Won't ask you to leave (-1 pts)	May ask you to leave (-2 pts)	Will ask you to leave (-3 pts)
Arrives on time Comments are relevant and reflect understanding and good preparation Clear enthusiasm	Arrives no more than 5 min late Comments are mostly relevant, but understanding may be slightly lacking Not overly enthusiastic, but positive	Arrives no more than 10 min late Comments are minimal ("yeah", "uh huh") and demonstrate poor preparation Demeanor is sluggish	Arrives more than 20 min late No comments are made even when called upon. Sleeping, texting, disengaged, internet surfing	Disruptive or rude comments are made Drawing others into disrespectful behaviors (showing texts, passing notes, etc.) Not participating in group activity.

Personal Conduct Policy

You are expected to treat your fellow classmates, TAs, and the instructor with respect and politeness. Things that will not be tolerated include (1) inappropriate use of technology during class or lab (e.g. texting), (2) disrespectful language or actions (e.g. cursing), (3) honor code violations, and (4) personal conversations unrelated to the classroom discussions. Academic honesty and integrity are fundamental values of the University community. Students should be sure that they understand the UF Student Honor Code at <https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>. Cell phones are only to be used for Top Hat questions or other in-class assignment related activity. **Any use, access, or handling of technology (e.g., a cell phone) during an assessment will result in an honor code violation and the potential of a failing grade.**

Exam Make-Up Policy

*Unexcused missed assessments will result in a zero on the assessment (this includes contacting the instructor **after** the assessment if you are ill). Make-up assessments will be given at the discretion of the instructor. To schedule a make-up assessment, please fill out the **make-up exam request form** posted in CANVAS and submit it to your course instructor as soon as possible. Documentation will be required. If you have a serious emergency or life event, please contact the Dean of Students Office (www.dso.ufl.edu) and they will contact your instructor so that you do not have to provide documentation of the emergency/death in order to get a make-up assessment. Requirements for class attendance and make-up exams, assignments, and other work are consistent with the university policies that can be found at <https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>.*

Getting Help

For issues with technical difficulties for CANVAS, please contact the UF Help Desk at:

- helpdesk@ufl.edu

- (352) 392-HELP - select option 2
- <https://request.it.ufl.edu/>

Any requests for make-ups due to technical issues MUST be accompanied by the ticket number received from Helpdesk when the problem was reported to them. The ticket number will document the time and date of the problem. You MUST e-mail your instructor within 24 hours of the technical difficulty if you wish to request a make-up.

Other resources are also available for you:

- Library Help Desk: <http://guides.uflib.ufl.edu/content.php?pid=86973&sid=686381>
- Counseling and Wellness: <https://counseling.ufl.edu/>

Accommodations for students with disabilities

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, www.dso.ufl.edu/drc/) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Accommodation of Special Needs

In accordance with university policy, I make every effort to accommodate unique and special needs of students with respect to speech, hearing, vision, seating, or other disabilities. Please notify the Office of Disability Services to register for services.

Online course evaluation process

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results/>.

The University of Florida has enacted a policy of allowing NO food or drink of any kind in any campus classroom. This policy will be enforced during the meeting times of this course.

Recording Lectures

No photos, pictures, audio recordings, or video recordings may be taken during lectures.

The content of this course may not be used for any commercial purpose.

Students found in violation of these policies may be subject to discipline under the University's Conduct Code.

Course Assessment Methods

Exams: There will be two semester exams (which are not explicitly comprehensive) and a FINAL EXAM that is COMPREHENSIVE. However, the course material for the first two exams builds on itself. The exams will evaluate conceptual knowledge, critical thinking, and biomechanical quantitative analysis skills. The exams will be primarily multiple choice and problem solving. **A scientific calculator will be needed for exams and quizzes (Trig Functions).** Make-up exams will only be given for University Excused Absences. In class assignments may include group activity assignments, participation in class discussion.

Quizzes: There will be 6 bi-weekly 25 minutes multiple choice quizzes that will test conceptual knowledge and quantitative skills covered over the previous two weeks. The lowest quiz grade will be dropped. The quiz will be followed by a 20 min review of the quiz after all quizzes have been turned in.

Assignments: In-class activities will have associated assignments. Other assignments may also be given.

Grading (Grades will not be rounded)

Grading Scale			
A	93.00	to	100.00
A-	90.00	to	92.99
B+	87.00	to	89.99
B	83.00	to	86.99
B-	80.00	to	82.99
C+	77.00	to	79.99
C	73.00	to	76.99
C-	70.00	to	72.99
D+	67.00	to	69.99
D	63.00	to	66.99
D-	60.00	to	62.99
E	<60.00		

Any requests for additional extra credit or special exceptions to these grading policies will be interpreted as an honor code violation (i.e., asking for preferential treatment) and will be handled accordingly.

Please use this link for the University Grades and Grading Policies

<https://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/>

<u>Assessment</u>	<u>Points</u>
Exam 1	100 points
Exam 2	100 points
Final Exam	100 points
Quizzes (5)	300 points
Assignments	200 points
Total	800 points

Please bring pencil, paper, scientific calculator and Laptop (on designated days).

Tentative Class Schedule

Module	Week	Session	Description	Topic	Online Lectures
Introduction to Biomechanics	Jan - 7	1	Lecture	Syllabus	Trig Review
		2	Lecture	What is biomechanics?	Law of Cosines
		3	Lecture	Motion Capture	Adding Components
	Jan - 14	1	Lecture (Profile Due)	Building a Solution	Degrees of Freedom
		2	Problem Set 1		Free Body Diagrams
		3	Quiz 1		Local and Global Coordinate Systems
	Jan - 21	1	Lecture	Using Excel and ImageJ	Coordinate Systems
		2	Problem Set 2		Right Hand Rule
		3	Introduction to Image Analysis		Vector Operations
Tissues and Joints	Jan - 28	1	Lecture	Loads and Bone	Hip Lectures
		2	Problem Set 3		Stress Strain Example
		3	Quiz 2		
	Feb - 4	1	Lecture	Muscles	Calculating Torque
		2	Problem Set 4		
		3	Lecture	Knee	
Kinematics	Feb - 11	1	Lecture	Projectile Motion	Introduction to Linear Kinematics
		2	Problem Set 5		Quadratic Projectile Motion Example
		3	Quiz 3		
	Feb - 18	1	Lecture	Angular Kinematics	Introduction to Angular Kinematics
		2	Problem Set 6		
		3	Exam 1		Centripetal Motion Example
Kinetics	Feb - 25	1	Acro		COM - Segmental Method
		2	Acro		COM - Segmental Method - Excel
		3	Lecture	Linear Kinetics	

	Mar - 4				
			Spring Break		
	Mar - 11	1	Lecture	Sum of Forces	Impulse and Momentum
		2	Problem Set 7		Work and Energy
		3	Quiz 4		Power
	Mar - 18	1	Lecture	Stability and Gait	Inverse Dynamics Ex 1
		2	Problem Set 8		
		3	Acro Analysis		
	Mar - 25	1	Lecture	Inverse Dynamics	
		2	Problem Set 9		Inverse Dynamic Ex:2
		3	Quiz 5		
	April - 1	1	Lecture	Angular Kinetics	
		2	Problem Set 10		
		3	TBD	TBD	
Fluid Mechanics	April - 8	1	Lecture	Fluid Mech. 1	Buoyancy Example
		2	Problem Set 11		
		3	Quiz 6		
	April - 15	1	Lecture	Fluid Mech. 2	Bernoulli Example
		2	Problem Set 12		
		3	Exam 2		
	April - 22	1	Review For Final		(none)
		2	Review For Final		
FINAL EXAM - MFW Section 10790 (Wednesday 5/1/2019 3-5 PM)					
FINAL EXAM - TR Section 10791 (Wednesday 5/1/2019 5:30-7:30 PM)					

***Please note that the instructor reserves the right to alter the syllabus/schedule if it is determined that such a change will benefit the course and the students.**