BIOMECHANICAL BASIS OF MOVEMENT

Department of Applied Physiology and Kinesiology
University of Florida

Course Description

Course Information
APK3220C (Section 3824)
Spring 2018: T 5-6 (11:45 AM-1:40 PM) R 6 (12:50-1:40)
Lecture Location: FLG 280

Instructor:
Matthew Terza M.S.
Office: FLG 151
Email: mjt023@ufl.edu
Office Hours: W, R 1:55-2:55 (or by appointment)
Office Phone: 352-294-1774

General Purpose and Description
This course is designed to be 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.

We will learn the basics of framing a biomechanical inquiry. Using fundamental methods for applying engineering principles to our observations we will answer some of the basic questions about our body and its interactions with the world we live in. This is primarily a lecture based course, but we will take time for discussion based learning that generates ideas on how the concepts apply across a spectrum of situations and professions. 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.
    - Given information about a situation extract and use relevant quantities to answer a biomechanical inquiry.
    - Create biomechanical solutions for pathologic and performance optimization situations
        - Evaluate a sub-optimal biomechanical situation
        - Design solutions (via rehab, prosthetics, or movement strategies) to improve biomechanical function.

Required Materials

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

Online Lecture and In-Class Question Platform: Top Hat

If you do not have an existing account for other courses you will need to purchase a Top Hat account for class participation in this course. We will use this platform for lectures, participation questions, and discussion questions in this course. Throughout the semester you should contact Top Hat directly with any technical issues at support@tophat.com. Their technical staff is very helpful.

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 (http://www.dso.ufl.edu/sccr/process/student-conduct-honor-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.

Homework is intended to be individual work. Discussion regarding solution processes and understanding of the material is permitted but copying work is not. Additionally, file sharing is expressly 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

Student 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. Class participation counts as a significant portion of your final grade. Class participation credit requires attendance, participation in class discussions/assignments, and electronic responses to Top Hat questions. Below is the rubric for attendance and participation. Behavior that is less than preferred may result attendance and participation point reductions in accordance with this rubric.

Preferred (Full Points)	**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 10 min late No comments are made even when called upon. Sleeping, texting, disengaged	Absent Disruptive or rude comments are made Drawing others into disrespectful behaviors (showing texts, passing notes, etc.)

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/

For technical issues with Top Hat please contact them at:

- support@tophat.com

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 http://www.counseling.ufl.edu/cwc/Self-Help-Library.aspx

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/. Counseling and Wellness Center: http://www.counseling.ufl.edu/cwc/Default.aspx, 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies

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.

Course Assessment Methods

Exams and Assignments

There will be three semester exams (which are not explicitly comprehensive). However, the course material 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 (Trig Functions).** Homework will be assigned through Canvas. These assignments will be due by the start of class on the due date listed. Make-up exams will only be given for University Excused Absences. In class assignments may include Top Hat questions, group activity assignments, participation in class discussion, and quizzes.

Grading (There are no minus grades in this course. Grades will not be rounded)

Letter Grade

90.00% - 100% = A
87.00% - 89.99% = B+
80.00% - 86.99% = B
77.00% - 79.99% = C+
70.00% - 76.99% = C
67.00% - 69.99% = D+
60.00% - 66.99% = D
<60.00 = E

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/ugrad/current/regulations/info/grades.aspx

Assessment	Points
Exam 1	70 points
Exam 2	70 points
Exam 3	70 points
In Class: Top Hat, Participation, Assignments, Quizzes	70 points
Homework	120 points
Total	400 points

Please bring pencil, paper, scientific calculator and Laptop, Phone, or Tablet to class.
Homework and Reading Assignments will be due before class starts on the day they are due.
95% Score for in-class assignments and participation will result in the Full 70 pts towards your final grade (this is to account for potential excused or unexcused absences) as such make ups will not be given for in class participation.

Tentative Class Schedule

Week	Date	Lecture Topics	Reading/Assignments Due
1	1/9	Syllabus	Ch1
		Top Hat, What is biomechanics	
	1/11	Developing Solution Process, Trig Review	App A-C
2	1/16	Syllabus & Trig Quiz, Kinematic Concepts	Ch 2
	1/18	Setting Up Coordinate Systems	HW 1
3	1/23	Kinetic Concepts	Ch 3
	1/25	Biomechanics of Bones	Ch 4
4	1/30	Biomechanics of Joints	Ch 5
	2/1	Exam 1 Review	
5	2/6	**Exam 1**	HW2
		Exam 1	
	2/8	Biomechanics of Muscles	Ch 6
6	2/13	Biomechanics of Muscles (cont)	
	2/15	Linear Kinematics	Ch 7

7	2/20	Projectile Motion	Ch 8
		Angular Kinematics	
	2/22	Biomechanical Instrumentation and Digital Analysis	HW 3
8	2/27	Class Activity: Acroyoga	
	3/2	Biomechanics of the Upper Extremities	Ch 10
X	3/6	SPRING BREAK: NO CLASS	
	3/8		
9	3/13	Biomechanics of Lower Extremities	Ch 11
	3/15	Exam 2 Review	
10	3/20	**Exam 2**	HW 4
		Exam 2	
	3/22	Linear Kinetics	Ch 12
11	3/27	Angular Kinetics	Ch 14
	3/29	Equilibrium	Ch 13
12	4/3	Inverse Dynamics	
	4/5	Biomechanics of Gait	
13	4/10	Fluid Mechanics	Ch 15, HW 5
	4/12	Case Studies in Biomechanics	
14	4/17	Case Studies in Biomechanics	
	4/19	Exam 3 Review	
15	4/24	**Exam 3**	HW 6
		Exam 3	
	4/26	READING DAY: NO CLASS	

***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.**

This syllabus is intended to give the student guidance in what may be covered during the semester and will be followed as closely as possible. However the professor reserves the right to modify, supplement and make changes as the course needs arise. This includes exam dates and lecture topics that may change depending on class progress.

Other Information

Study Tips for Class Success in Biomechanics

- Read from the text BEFORE attending lecture.
- Snow-ball the lecture notes. Begin studying lecture material immediately after the first lecture. Then, after the second lecture, begin your studies with day one lecture material. Continue this all the way up to the exam.
- Study with friends!
- Re-write questions. Taking complex questions and breaking them down to identify exactly what the question is REALLY asking for is very helpful. It is also very helpful to look at incorrect answer choices and identify what makes those choices wrong. Ask yourself, "How could I make that statement correct?" You can practice this with the critical thinking questions at the end of each chapter.

General Success Tips For Biomechanics

- Do not fall behind. This course moves at a FAST pace…and you can easily get overwhelmed if you procrastinate. Avoid studying at the last minute. Complete the homework as you go.
- Stay organized. Keep track of all important due dates and move through each day in a uniform manner so that you are always aware of what you have done and what is left to be completed.
- Ask questions and participate in class discussions
- Check CANVAS announcements/emails daily…just pretend it is Facebook for school. Your course instructor will post important and helpful information (such as friendly reminders of due dates) as announcements.
- Utilize office hours. I ask that you make effort to attend my scheduled time slot but do not let a schedule conflict be the reason you fail to seek help in office hours. Schedule an appointment with me.
- Have a positive attitude! THIS STUFF IS COOL!