University of Southern California – Department of Biological Sciences
HBIO-408L* –Biomechanics (4 Units) Fall 2017
http://hbio408biomechanics.usc.edu/lab/lab.html

Instructors: Jill McNitt-Gray, Ph.D. mcnitt@usc.edu
Lecture: **VKC102** M/W 2:00 – 3:20 P.M; Comprehensive Final
Office Hours: MON / WED, 3:20-4:20 PM (Bring lab notebook to office hour meetings).

Laboratory: 3 hours/week	2:00 – 4:50 T	PED B16
	5:00 – 7:50 T	PED B16
	2:00 – 4:50 Th	PED B16

***Course includes project-based capstone experience**
Kinematic and kinetic analysis of human motion; emphasis on performance enhancement and injury prevention. Concepts from high school algebra (word problems and solving for an unknown) and the use of sine, cosine, and tangent concepts from trigonometry. Calculus is not required. **Prerequisite:** EXSC 301L and 1 from (MATH 108 or MATH 125) and 1 from (PHYS 135a or PHYS 151)

Required Texts and Supplies:
1. Web-Based Lecture Notes
2. Selected Literature Readings available through PubMed@usc through USC Library
3. Electronic Storage Device (back up and store homework, labs, and project content)

Course Reader *(Optional)*

I. Objectives:
1. Develop critical thinking and analytical skills to solve meaningful problems; use Newton's Laws to understand cause-effect relationships governing human movement.
2. Improve oral, written, electronic information and communication skills.
3. Gain hands-on experience analyzing motion and quantifying and interpreting biomechanical information in scientific, ethical, social, and environment related contexts.

II. Grading Procedures:
1. Exam 1 - 20%
2. Exam 2 - 20%
3. Comprehensive Final - 25%
4. Lab - 20%
5. Project - 15%

Lab Grading:
1. Pre/Post Lab Reports, Demonstrations, - 50%
2. Weekly Lab Quizzes - 25%
3. Practical - 25%

Grading Scale: >90%=A,> 80%=B, >70%=C, >65%=D, otherwise =F

III. Laboratory Component

Undergraduate Lab Director: Emi Embler, Ph.D.
Email: eembler@usc.edu

Teaching Assistants:
Marisa Papp (mpapp@usc.edu) Office hours PED B9
Casey Wiens (cwiens@usc.edu) Office hours PED B9

IV. Expectations

1. Come prepared for class and labs (lecture pop quizzes).
2. Sincere Personal Investment in independent discovery and lab activities.
3. USC conduct code (you must do your own work!) - Refer to **SCampus** Academic Integrity Section.
4. Excused absences require written notification *one week in advance.*
5. Honor due dates in lab and lecture **(anything turned in after due date = zero points).**
6. Email and class participation.

VI. Project Overview and Grading

Project: Identify significant problem (compare/contrast), generate a meaningful hypothesis, design and conduct a biomechanical experiment to test hypothesis (limitation of analysis: two 2D planar movements).

Project Grade:

1. Background/Significance (10%) *Problem? known/unknown in peer reviewed literature?*
2. Kinematics (angle-angle) (25%) *kinematic context for muscle force generation*
3. Kinetics (whole body: imp/mom (25%); joint kinetics (25%) *cause/effect at joint &CM levels*
4. Presentation and hand-in materials (15%); *all comparisons specific to research question*
   a) 3 related scientific journal articles (.pdf emailed to TA prior to presentation)
   b) hand written Free Body Diagrams and associated calculations (show all work)
   c) Paper copy of presentation (must be able to read all text on all figures)
   d) Peer evaluation (emailed to TA prior to presentation)

Statement on Academic Conduct and Support Systems

Academic Conduct

Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Section 11, *Behavior Violating University Standards* https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, http://policy.usc.edu/scientific-misconduct.

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the *Office of Equity and Diversity* http://equity.usc.edu or to the *Department of Public Safety* http://adminopsnet.usc.edu/department/department-public-safety. This is important for the safety of the whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. *The Center for Women and Men* http://www.usc.edu/student-affairs/cwm/ provides 24/7 confidential support, and the sexual assault resource center webpage http://sarc.usc.edu describes reporting options and other resources.

Support Systems

A number of USC's schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the *American Language Institute* http://dornsife.usc.edu/ali, which sponsors courses and workshops specifically for international graduate students. *The Office of Disability Services and Programs* http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, *USC Emergency Information http://emergency.usc.edu* will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.

STATEMENT FOR STUDENTS WITH DISABILITIES

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. **Website for DSP** and contact information: (213) 740-0776 (Phone), (213) 740-6948 (TDD only), (213) 740-8216 (FAX) **ability@usc.edu**.

STATEMENT ON ACADEMIC INTEGRITY

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. **SCampus**, the Student Guidebook, contains the University Student Conduct Code (see University Governance, Section 11.00), while the recommended sanctions are located in Appendix A.

EMERGENCY PREPAREDNESS/COURSE CONTINUITY IN A CRISIS

In case of a declared emergency if travel to campus is not feasible, USC executive leadership will announce an electronic way for instructors to teach students in their residence halls or homes using a combination of Blackboard, teleconferencing, and other technologies. See the university's site on **Campus Safety and Emergency Preparedness**.

Week* *may change	*Syllabus may be modified as needed Monday	Wednesday	Practice with problem solving Homework	Lab Exercises	Project Progression*: Understanding Cause-Effect *Integrate knowledge each week
1 8/21	Motionanalysi events/phases	IndependentField Study: Mechanical objectives?	Trig, linear motion	introduction/ computer skills, FBD	Microsoft Excel, Kinovea (PC), Tracker (Mac) * develop tool proficiency
2	Mechanical Object.FBD	Kinematic Context Multijoint control	Center of mass	linear kinematics & TBCM (video clips)	** clarify real world problems & critical questions that are meaningful to you!!
3 9/4	***Labor Day***	Linear Impulse, Change in momentum	linear impulse, proj motion	angular kinematics	** finalize movements of interest and begin extensive research on topic- **what? how?**
4	Angular Impulse, FBD	Projectile motion	angular impulse	linear impulse & momentum	** critically read literature, pilot, develop hypotheses and experimental design - **why?**
5	Integration of Concepts,FBD	Review	ang kine/imp	angular impulse & momentum	** methods, variables to test hypothesis Thought experiments? **If .. then? So what?**
6 9/25	**EXAM 1**	**Project Planning**	Motion Analysis	total body kinetics	** collection plan, movement analysis plan, time table, responsibilities, milestones
7	Joint level FBD	Muscle contribution to Joint Kinetics	Joint kinetics	**LAB PRACTICAL**	** Practice the experiment, movements need to be performed in a realistic context
8	Joint Level Kinetics	Applications in Rehab engineering -STS	joint kinetics	**PROJECT COLLECTION**	**REVIEW QUANTITATIVE SKILLS MAP out Project Time line within group**
9	Rehab Engineering Ergonomics	Ergonomics Clinical Applications	project: assimilate research literature	joint kinetics	** title, significance, expected results from compare and contrast analysis
10 10/23	Multijoint Kinetics	Multijoint kinetics	project: intro/methods	project: kinematics	** analyze multijoint control using joint and segment kinematics
11	Multijoint Kinetics	Multijoint Kinetics Whole Body Mechanics	project: hypothesis (related to each var)	project: impulse/ momentum	** analyze net impulse/change in momentum relationships (lin or ang)
12	Review	**EXAM 2**	project: results & discussion	project: joint kinetics	**analyze upper extremity or lower extremity joint kinetics
13 11/13	Project discussion	Translation into practice	project: FINALIZE results & discussion	project: interpretation **PRESENT TO LAB TA**	** compare results to the literature, data makes sense? What makes quantities big and small? Cause-effect? Significance?
14	Natural History	***Thanksgiving***	project: discussion	Final report .ppt/prezi	** assimilate results, communicate results
15 11/27	Applications	Review for Final Exam **FINAL: Friday 12/8 2-4 PM**	Project take-home message	**ORAL PROJECT PRESENTATIONS-**	**** 10 min, 5 min questions, hand written FBD/ joint kinetics turned in before, literature .pdf emailed**