

# KIN 330 BIOMECHANICS OF PHYSICAL ACTIVITY

## Course Information

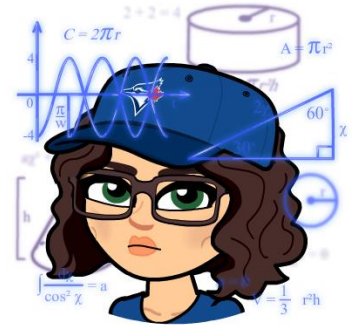
Term: Spring 2020

Section: 003

Credit Hours: 3

Course meeting days and time: MW 12:40-2:30PM 137 IM Circle

Online Resource: MSU Desire2Learn (<http://d2l.msu.edu>)



## Course Description

The course is designed to provide an introduction to concepts and principles related to biomechanics – with emphasis on understanding whole body movements. These concepts are meant to provide the basis of understanding the biomechanics of physical activity. A multidisciplinary approach will be used and will include elements from anatomy, physiology, physics and engineering. Applications of these concepts in fields such as athletic training, physical therapy, sports science, and human factors will be discussed.

## Instructor Information and Contact Hours

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Graduate Teaching Assistant

Department of Kinesiology

IM Sports Circle Rm 38

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Office hours: **Mondays 2:30-3:30pm or by appointment.** Please email ahead of time to let me know you're coming.

## Course Objectives

Upon completion of the course, it is expected that students should be able to:

- Understand the fundamental mechanical principles involved in human movement
- Be able to compute quantities such as displacements, velocities, forces etc. in different biomechanical contexts
- Perform basic 2D biomechanical analysis of different human movements from video
- Summarize and interpret findings from articles published in biomechanics journals

## Course Materials

### Textbook

The **required** course text is:

McGinnis, P. (2013). Biomechanics of Sport and Exercise With Web Resource and MaxTRAQ 2D Software Access (3rd ed.). Champaign, IL: Human Kinetics.

This text will cover almost all of the required reading.

This textbook is also on reserve at the library <https://libguides.lib.msu.edu/textbooks> which can be used for 2 hours at a time in the library.

### Recommended Additional Reading

- Hall, S. (2012). Basic Biomechanics (6th ed.). New York, NY: McGraw-Hill.  
Hamill, J., & Knutzen, K. (2008). Biomechanical Basis of Human Movement (3rd ed.). Philadelphia, PA: Lippincott Williams & Wilkins.  
Knudson, D. (2007). Fundamentals of Biomechanics (2nd ed.). New York, NY: Springer.  
Nordin, M., & Frankel, V. (2012). Basic Biomechanics of the Musculoskeletal System (4th ed.). Philadelphia, PA: Lippincott Williams & Wilkins.  
Ozkaya, N., Nordin, M., Goldsheyder, D., & Leger, D. Fundamentals of Biomechanics: Equilibrium, motion, and deformation (3<sup>rd</sup> ed). New York, NY: Springer.

### Hardware and Software Requirements

#### Hardware

- iClicker remote
- A computer with a reliable high-speed internet connection
- A video camera for recording videos for the MAP Project
  - A smartphone camera is usually sufficient
- A scanner/camera for attaching handwritten work in HW assignments
  - A smartphone camera is usually sufficient
- A scientific calculator for working out problems (nothing fancy – just need to be able to do basic arithmetic and trigonometry)

#### Software

- Tracker software for video analysis <http://physlets.org/tracker> (free download)
- Microsoft Office (Excel, Word and Powerpoint)

### Course components

#### In-class Quizzes

You will take several in-class quizzes during the course. The scope of the quiz is related to the assigned reading material and material covered in the class. These quizzes will be **open-book quizzes** but you cannot consult with your classmates. You will need an iClicker to answer the quizzes – so make sure you bring your iClicker to class.

Please note that using your iClicker will be the only way to earn points for the quizzes. I will provide a couple of test sessions in the first two weeks so that you can test if your iClicker works. After this, please bring your iClicker to class every day and come prepared with spare batteries etc. so that you do not lose points unnecessarily.

Missing a quiz will result in a 0 for that quiz. **Only the best 8 quizzes** count for the grade. There will be a total of 11 quizzes.

## Labs

In addition to the exams, there will be lab assignments to review basic concepts and do-hands on analysis of human movements. Lab activities will generally involve the use of “Tracker” – a free software designed to analyze movements on video. The link to download Tracker is provided in the materials required section.

There are a total of 10 labs in the course. Only the best 8 will count for the grade.

## Motion Analysis Project (MAP)

Biomechanics is a subject where you learn far more by doing rather than simply reading about it. Therefore in order to be a good biomechanist, it is important to have the experience of being able to do a biomechanical analysis from scratch. Having the skill to assess and analyze movements will also be an asset if you are looking for jobs related to studying human performance. It involves the following steps:

### Forming a Group and choosing a topic

- Form a team (4 students/group) and identify a physical activity of interest
- Find and summarize at least 1 published research paper in a *peer-reviewed journal* that is relevant to your question (a list of journals is specified in the first lecture handout)
- Identify a research question related to the activity

### Data Collection

- Film the activity using a video camera. (Instructions on how to film a video for analysis will be given in class).

### Data Analysis

- Use Tracker to perform 2D biomechanical analyses from the video that is relevant to your research question

### Presentation and Written Report

- Share your exciting results in class (typically 8-mins total including time for questions). All presentations should be uploaded on the first day of presentations.
- Write a short report (~10 pages – including figures).

### Teamwork & Documentation

This project is meant to both reflect the knowledge you have gathered in the class as well as your ability to work in a team. However, each individual in a group is responsible for data collection and analysis of at least one video clip. If members of a group feel that there is not sufficient teamwork, they should contact me as early as possible. In such cases, some individuals may receive lower points for the project than the rest of the group. So please make sure you document your contribution throughout the project.

## Midterm and Final Exam

There will be two exams – one midterm and a final

Both exams will be closed-book exams but students are allowed to bring a one page “cheat sheet” (max. 8.5” x 11”) of **hand-written notes** (both sides allowed). Photocopies/printouts etc. are NOT allowed. Cheat sheets will not be returned after the exam – so please make a photocopy if you want to keep for your reference.

In addition to your cheat sheet, please bring: (a) a pencil and (b) a scientific calculator to the mid-term and final exams for numerical computations. No other computing device (e.g., cell phone, tablet, computer etc.) will be allowed.

When an exam has bonus questions, the score received for the exam cannot exceed the maximum point total allotted for that exam (i.e. 50 points).

### Evaluation & Determination of Final Grade

The final grade for this course will be based on the total number of points accumulated during the different components of the course.

	Component Score	Contribution to Total Score
In class Quizzes (best 8 out of 11)	8 x 2.5 = 20 points	20 points
Labs (best 8 out of 10)	8 x 10 = 80 points	80 points
Motion Analysis Project	50 points	50 points
Midterm exam	50 points	50 points
Final	50 points	50 points
<b>Total Score</b>		<b>250 points</b>

The following table will be used to determine the final grade:

Total Score in Course (max. 250)	Grade
233 and above	4.0
215-232	3.5
200-214	3.0
187-199	2.5
175-186	2.0
163-174	1.5
150-162	1.0
<150	0.0

No changes to the final grade will be made unless it is due to numerical error. Grades **are NOT curved**. Any activities for extra-credit points are at the discretion of the instructor and will be announced in class.

### Academic Honesty

Article 2.3.3 of the [Academic Freedom Report](#) states that "The student shares with the faculty the responsibility for maintaining the integrity of scholarship, grades, and professional standards." In addition, the Department of Kinesiology adheres to the policies on academic honesty as specified in General Student Regulations 1.0, Protection of Scholarship and Grades; the all-University Policy on Integrity of Scholarship and Grades; and Ordinance 17.00, Examinations. (See [Spartan Life: Student Handbook and Resource Guide](#) and/or the MSU Web site: [www.msu.edu](http://www.msu.edu).)

You are expected to develop original work for this course; therefore, you may not submit course work you completed for another course to satisfy the requirements for this course. Also, you are not authorized to use the [www.allmsu.com](http://www.allmsu.com) web site to complete any course work in this course.

Examples of academic dishonesty include (but are not limited to): (From the [Academic Integrity](#) webpage)

- Claiming or submit the academic work of another as one's own
- Procure, provide, accept or use any materials containing questions or answers to any examination or assignment without proper authorization.
- Complete or attempt to complete any assignment or examination for another individual without proper authorization
- Allow any examination or assignment to be completed for oneself, in part or in total, by another without proper authorization

#### **SPARTAN CODE OF HONOR ACADEMIC PLEDGE**

"As a Spartan, I will strive to uphold values of the highest ethical standard. I will practice honesty in my work, foster honesty in my peers, and take pride in knowing that honor in ownership is worth more than grades. I will carry these values beyond my time as a student at Michigan State University, continuing the endeavor to build personal integrity in all that I do"

#### **Academic Honesty when using iClicker**

iClicker use in this class constitutes part of the grade. Therefore you are permitted to use only your iClicker. Using someone else's iClicker, or having someone else use yours, are both considered academic misconduct. Anyone found doing so will be considered in violation of academic integrity principles at will be with MSU academic integrity rules, and will receive a penalty grade (which may include a failing grade in the class). So please be honest!

#### **Use of Turnitin**

Consistent with MSU's efforts to enhance student learning, foster honesty, and maintain integrity in our academic processes, instructors may use a tool called Turnitin to compare a student's work with multiple sources. The tool compares each student's work with an extensive database of prior publications and papers, providing links to possible matches and a "similarity score." The tool does not determine whether plagiarism has occurred or not. Instead, the instructor must make a complete assessment and judge the originality of the student's work. All submissions to this course may be checked using this tool.

Students should submit papers to Turnitin Dropboxes without identifying information included in the paper (e.g., name or student number), the system will automatically show this information to faculty in your course when viewing the submission, but the information will not be retained by Turnitin.

Unless authorized by your instructor, you are expected to complete all course assignments, including homework, labs, quizzes, tests and exams, **without assistance** from any source. Please remember that **providing unauthorized assistance** is also considered cheating.

Students who violate MSU academic integrity rules may receive a penalty grade, including a failing grade on the assignment or in the course. Contact your instructor if you are unsure about the appropriateness of your course work. (See also the [Academic Integrity](#) webpage.)

As members of a learning community, students are expected to respect the intellectual property of the course instructor. All course materials presented to students are the copyrighted property of the course instructor and are subject to the following conditions of use:

- Students may not record lectures or any other classroom activities
- Students may not post course materials online or distribute them to anyone not enrolled in the class without the advance written permission of the course instructor.

#### Accommodations for Students with Disabilities

(from the Resource Center for Persons with Disabilities (RCPD))  
Michigan State University is committed to providing equal opportunity for participation in all programs, services and activities. Requests for accommodations by persons with disabilities may be made by contacting the Resource Center for Persons with Disabilities at 517-884-RCPD or on the web at [rcpd.msu.edu](http://rcpd.msu.edu). Once your eligibility for an accommodation has been determined, you will be issued a Verified Individual Services Accommodation ("VISA") form. **Please present this form to me at the start of the term and/or two weeks prior to the accommodation date (test, project, etc.).** Requests received after this date may not be honored.

#### Makeup Exams & Late Policy

Makeup exams will be given only under the following circumstances: (i) a valid, written medical excuse is presented and verified with your physician, or (ii) notification of a conflict with a religious observance or scheduled class field trip or intercollegiate athletic participation is provided at least 2 weeks in advance of the date. In the case of illness or some other unforeseen circumstance, you must notify the instructor **BEFORE** the exam takes place that you are ill/cannot be present and will not be taking the exam (**best method to reach me is through email**). In ANY case, documentation is required. Any makeup that is given must be taken within 48 hours of the normally scheduled exam. Also, **do not assume I have received your email unless I have got back to you (usually within 24 hours).**

According to the University Final Exam Policy (<http://www.reg.msu.edu/AcademicPrograms/Text.asp?Section=112#s499>), students unable to take a final examination because of illness or other reason over which they have no control should notify the associate deans of their colleges immediately.

There will be **no make-up labs or quizzes regardless of the nature of the absence** unless it is an extended absence due to exceptional circumstances (see next page). An absence during a quiz or lab activity will result in a score of zero (but do remember that you can drop a certain number of scores for the final grade calculation)

## Extended Absence due to Exceptional Circumstances

If there are exceptional circumstances (such as a medical or a family emergency) that will cause you to miss an extended period of time (typically 3 or more consecutive classes), please let me know ASAP. In this case, you will have to provide **documentation** to support your absence. You will have to notify me no later than 24 hours from the absence. A grief absence form has to be filled out for family related emergencies.

## Late assignments

Late assignments (labs and MAP) will be penalized by 30% (of the maximum possible points for that assignment) for the first 24hr beyond the due date. Assignments submitted beyond 24 hr of the deadline will receive a score of zero.

## Disruptive Behavior

Several articles of the Academic Freedom Report (AFR) for students at Michigan State University state "The student's behavior in the classroom shall be conducive to the teaching and learning process for all concerned," and "The student has a right to scholarly relationships with faculty based on mutual trust and civility." Also, "no student shall . . . interfere with the functions and services of the University (for example, such that the function or service is obstructed or disrupted)". Students whose conduct adversely affects the learning environment in this classroom may be subject to disciplinary action through the Student Faculty Judiciary process.

## Cell Phone/Computer Use

Please do not use your cell phone/computer in class for non-class related activities (texting, social media etc.). If you are caught doing so, you will be asked to leave the class. If you have to respond to an urgent call or text, please step outside the class and do so without interrupting the rest of the class.

## Office Hours/Asking for Help

### D2L Discussion board

There is a discussion board on D2L where students can post question threads. I recommend this as the first option to ask course-related questions because:

- your question may help others,
- other students can chime in with related questions/answers which fosters an environment for participation,
- you can look up these questions at a later point during the semester, and
- I can get a sense for how many students have responded to a question, which helps me restructure things if necessary

I will generally respond to Discussion threads within 24 hrs (except on weekends).

## Office Hours

As the instructor, I am happy to help students outside of class and during office hours. However, in return **I expect that students come well prepared** to these meetings. For example, if you did not understand how to do a particular problem, please show me what steps you tried. If you missed a

particular class, please go through the notes from a classmate before scheduling to meet me during office hours.

### Email and Email Etiquette

Please use emails only if you can't wait to ask the question in class or use the Discussion forum. When writing emails, please follow the suggestions below:

1. Please check the syllabus to see if the answer to your question is already in there
2. Have a subject starting with "KIN 330 (section number)" followed by a descriptive subject line. This will minimize the chance that your email lands in the Spam folder.
3. Please use a proper salutation - usually Amanda is fine.
4. Sign your full name at the end – especially if you are using your mobile device.
5. Please use descriptive filenames for sending attachments or uploading assignments on D2L so that I can easily identify your submission after I download it. A filename such as "JaneSmith\_KIN330\_MAP FinalProjectReport.docx" is much more helpful than "paper.docx"

### Strategies to do well in the course

Biomechanics is considered a hard class due to the conceptual and computational nature of the course material. Here are a few strategies to help you do well in the course:

- ✓ **Read this syllabus and mark upcoming deadlines on your calendar.** Failing to turn in assignments on time (either not noticing the deadlines or underestimating the time it takes to do assignments) is the biggest reason students do not do well in the course. As a rule of thumb,
  - Estimate about 4 hours for each homework or lab assignment
  - The MAP in total will take about 15-20 hours total (from video capture to analysis to write-up).
- ✓ **Come prepared to class and actively participate.** Your participation in class is critical to your learning – so attend class regularly, and do not be afraid of asking questions if something is not clear.
- ✓ **Practice, Practice, Practice.** In the same way you don't learn to drive a car by watching someone else drive, biomechanics is not a course you can master by "reading". The ability to understand concepts and solve problems comes only through practice – so try to solve problems without looking at the solution first, and then practice more problems (such as those in the back of the textbook). This is **especially critical for students who do not feel confident doing math and physics.**
- ✓ **Ask for help early.** If you are having issues or concerns, please approach me for help early. I am happy to help in any way I can as long as you let me know in advance.

### Changes to the Syllabus

As the instructor, I reserve the right to make changes to this syllabus if deemed necessary. Any changes to the syllabus will be announced in class.



## Tentative Class Schedule

	Date	Topic	Lab Due Dates	Quiz	Reading
<b>1</b>	Mon. Jan. 6	Introduction (Video Lecture-NO CLASS)			
<b>2</b>	Wed. Jan. 8	Math and Physics Review (Video Lecture-NO CLASS)			
<b>3</b>	Mon. Jan. 13	Lab 1: Intro to Tracker		iClicker Test 1	
<b>4</b>	Wed. Jan. 15	Linear Kinematics		iClicker Test 2	Ch 2
<b>5</b>	Mon. Jan 20	MLK Day NO CLASS			
<b>6</b>	Wed. Jan. 22	Lab 2: Linear Kinematics (NO CLASS)	Lab 1		
<b>7</b>	Mon. Jan. 27	Angular Kinematics		Quiz 1	Ch 6
<b>8</b>	Wed. Jan. 29	Lab 3: Bicep curl	Lab 2		
<b>9</b>	Mon. Feb. 3	Linear Kinetics I		Quiz 2	Ch 1
<b>10</b>	Wed. Feb. 5	Lab 4: Gait Analysis	Lab 3		
<b>11</b>	Mon. Feb. 10	Linear Kinetics II		Quiz 3	Ch 3
<b>12</b>	Wed. Feb. 12	Lab 5: Vertical Jump	Lab 4		
<b>13</b>	Mon. Feb. 17	Angular Kinetics I		Quiz 4	Ch 5
<b>14</b>	Wed. Feb. 19	Review	Lab 5	Quiz 5	
<b>15</b>	Mon. Feb. 24	<b>MIDTERM</b>			
<b>16</b>	Wed. Feb. 26	Lab 6: CoG/Torque			
<b>17</b>	Mon. Mar. 2	Spring Break NO CLASS			
<b>18</b>	Wed. Mar. 4	Spring Break NO CLASS			
<b>19</b>	Mon. Mar. 9	Angular Kinetics II		Quiz 6	Ch 7
<b>20</b>	Wed. Mar. 11	Lab 7: Mini-MAP	Lab 6		
<b>21</b>	Mon. Mar. 16	Video Lecture Work, Power, Energy		Quiz 7	Ch 4
<b>22</b>	Wed. Mar. 18	Lab 8: Analyze mini-MAP	Lab 7		
<b>23</b>	Mon. Mar. 23	Video Lecture: Musculoskeletal system		Quiz 8	
<b>24</b>	Wed. Mar. 25	Lab 9: Technology	Lab 8		Ch 10,11
<b>25</b>	Mon. Mar. 30	Video Lectures: Applications I & II		Quiz 9	Ch 16
<b>26</b>	Wed. Apr. 1	Lab 10: Applications	Lab 9		
<b>27</b>	Mon. Apr. 6	Work period MAP		Quiz 10	
<b>28</b>	Wed. Apr. 8	Work period MAP	Lab 10		
<b>29</b>	Mon. Apr. 13	Work Period MAP		Quiz 11	
<b>30</b>	Wed. Apr. 15	No Lecture – Work through Review Materials Independently			
<b>31</b>	Mon. Apr. 20	NO CLASS	MAP PROJECT DUE		
<b>32</b>	Wed. Apr. 22	<b>FINAL EXAM (CUMULATIVE AND IN-CLASS)</b>			

## Deadlines

All assignments listed under the “Due” section each week are due **at the start of class that day – i.e. 12:40pm**. Late assignments will be subject to penalties (see course policy section)