

KIN 330

Biomechanics of Physical Activity

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KIN 330 BIOMECHANICS OF PHYSICAL ACTIVITY

Course Information

Term: Summer 2020

Section: 731

Credit Hours: 3

Course meeting days and time: Online course – all materials and lectures will be on D2L

Online Resource: MSU Desire2Learn ([MSU D2L](#))

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

Amanda McGowan

Instructor (Fixed-Term)

Department of Kinesiology

Email: mcgowa78@msu.edu

Office hours: **Wednesdays 10-11am EST**

Student hours will be ‘virtual’ and handled through Zoom (see instructions at the end of the document on how to use Zoom).

If you cannot make this time but would like to set up an appointment at another time, please email me at least 2 days ahead of time with a list of available times.

Course Objectives

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

- Identify and apply the fundamental mechanical principles involved in human movement
- 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.

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* (3rd ed.). New York, NY: Springer.

Hardware and Software Requirements

Hardware

- 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 Lab 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)
- A webcam, speaker and microphone (Optional) for video participation – Although these are not essential, face-to-face interactions using Zoom can often be helpful in .

Software

- Tracker software for video analysis [Download Tracker](#) (free download)
- Microsoft Office (Excel, Word and Powerpoint)

Course components

Quizzes

Short Quizzes are provided at the end of each unit and will be based on the material covered in the video lectures (and the associated textbook readings). These quizzes will be multiple choice and focus on conceptual understanding. Each quiz can only be taken **once** – therefore it is in your best interest to go through the material prior to taking these quizzes. Each quiz has a total of 5 questions with a 20 minute time limit. Please remember that the 11:59pm deadline is for submitting the quiz (not starting it).

There are a total of 10 short quizzes in the course – only the best 8 will count for the grade.

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 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 6 labs in the course. Only the best 5 out of 6 scores will count for the grade.

Homework Assignments

There will be 2 homework assignments to review problem-solving skills and do hands-on analysis of human movements. There are a total of 2 homework assignments in the course. None will be dropped.

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:

Choose a topic

- 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 activities will be on D2L)

Data Analysis

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

Presentation and Written Report

- Write a short report (~10 pages – including figures).

Final Exam

The final exam will be **cumulative**. The final exam will be closed-book but students are allowed to use a one page “cheat sheet”. This cheat sheet has to be **handwritten** (max. 8.5” x 11”, both sides) – no photocopies, photographs or printouts. The use of a scientific calculator is the only permitted computing device.

The final exam will be in a multiple choice format, but with only question displayed at a time. This means that once you have answered a question, you cannot go “back” and fix your answers. **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).

Extra Credit

You can earn up to 4 points extra credit in the course. This can be done by writing a long-form abstract of a scientific paper. Each abstract is worth 2 points - so you will have to submit 2 abstracts to earn the full 4 points.

The long form abstract is a full description of the study (about 500-700 words) detailing the research question, the methodology used, the results and the implication of the results (this will have to be more detailed than the published abstract). **Do NOT use the same paper that you are using for the Motion Analysis Project.**

Please attach (a) the original abstract of the paper (you can cut and paste from the original paper), (b) the full citation, and (c) your long-form abstract for submission. Each abstract will be worth 1% and should also take about 60-90 minutes of your time. Double space your abstract and use APA style for citations. **Submit each abstract as a separate file on D2L dropbox.**

Please make sure that the paper that you select is **relevant** to the course. The goal is to select papers that look at physical activity (like walking, reaching, sports, physical therapy etc.), but also those that use biomechanical measures (measuring force, kinematics, EMG etc.) as the dependent variables. Examples of topics that would be relevant are papers that focus on gait biomechanics, sports biomechanics, biomechanical changes with rehabilitation etc. Examples of topics that would NOT be relevant are papers that focus on physiology/metabolism, cellular/organ biomechanics or papers that simply use surveys (rather than measuring biomechanical variables)

The last date for submitting extra credit abstracts will be **Aug 11, 2020 at 11:59pm**. Please remember that there will be no further opportunities for extra credit after this point. Many students end up 1 or 2 points shy of the next higher GPA – so please make use of the extra credit in advance so that you don't have to regret this later.

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.

Table 1. Graded course activities points breakdown:

Item	Maximum Component Score	Contribution to Final Score
Quizzes (best 8 out of 10)	8 x 2 = 16 points	16 points
Homework Assignments (2 out of 2)	2 x 20 = 40 points	40 points
Labs (best 5 out of 6)	5 x 10 = 50 points	50 points
Motion Analysis Project	50 points	50 points
Final	50 points	50 points
Extra credit		4 points
		210 points

Table 2. Grading scale for determining final grade in KIN330:

Final Score in Course (max. 210)	Grade
192 and above	4.0
177-191	3.5
165-176	3.0
154-164	2.5
144-153	2.0
134-143	1.5
124-133	1.0
124 or below	0.0

No changes to the final grade will be made unless it is due to numerical error. Grades **are NOT curved**

Course Policies

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 website](#).)

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 any external web sites 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"

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. 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.

Late assignments and Make-up Policy

Late assignments.

Late quizzes will automatically receive a score of zero.

Other late assignments (homework, labs and MAP) will be penalized by 30% (of the maximum possible points for that assignment) for each day the assignment is late. Assignments submitted beyond 1 day of the deadline will receive a score of zero. I will provide a 5 minute grace period for the deadline.

For example: If a homework assignment is worth 10 points and is due Sunday at 10:00 pm, Assignments submitted between Sunday 10:05pm – Monday 10:05 pm will receive a 3 point penalty, Assignments submitted after Monday 10:06pm will receive a score of zero.

Make-up Policy.

Because of the online nature of the course, there will be no make-up labs, quizzes or homework assignments in general regardless of the reason for the absence. However, I understand that there may be genuine reasons for absences – so I will drop the lowest score in each of these components for the final grade (check the Evaluation and Determination of Final grade section).

However, if you have already missed one score for a component, and there are **exceptional circumstances** (such as a medical or a family emergency) that will cause you to miss another score, please let me know ASAP. In this case, you will have to provide **documentation** to support your absence. This will have to be done no later than 24 hours from the absence. A grief absence form has to be filled out for family related emergencies.

Exceptional circumstances generally include cases when you are out for at least 3 or more consecutive days in the week (e.g. surgery). Travel of any kind (whether for personal or professional reasons) does not count as exceptional circumstances – in these cases, make sure you plan ahead.

According to the [University Final Exam Policy](#), 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.

Asking for Help

Being an online course, it is especially easy for students to sometimes feel overwhelmed with the material. So I encourage all students to ask for help during the course. However, my ability to help you is directly related to how much time there is left before the deadline. **So ask for help early!**

Below are ways in which to ask for help:

Virtual classroom (D2L discussion board)

There is a discussion board on D2L where students can post question “threads”. Other students and I can reply to those threads.

I recommend this as the first option to ask for clarification because:

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

I will reply to Discussion threads usually within 24 hours (weekends not included) – so please post your questions a minimum of 3 days before the deadline (the earlier the better in case you want further clarification).

Email

I will be available to answer questions over email. 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. If it is a question whose answer will also benefit other students, consider posting the question on the Discussion forum on D2L.
3. 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.
4. Please use a proper salutation (usually Dr. McGowan, Professor etc.). If you want to be informal you can use my first name, but do not be too casual.
5. Sign your full name at the end – especially if you are using your mobile device.
6. Please use **descriptive filenames** for sending attachments or uploading assignments on D2L so that I can easily identify your submission. A filename such as “JaneSmith_KIN330_MAP FinalProjectReport.docx” is much more helpful than “paper.docx”

I will reply to email usually within 24 hours (weekends not included). So please plan ahead - asking a question on Friday/Saturday for Sunday’s deadline will not be particularly helpful.

Virtual Student hours

Student hours will be available every week for students to ask questions or clarifications online. Whenever possible, we will be using the video chat inside Zoom so that there is some face-to-face contact. If for some reason there are issues with video or audio, we will rely on a “text-based” chat interface inside Zoom.

Student hours will generally be held virtually Wednesdays from 10am-11am EST
The Zoom URL for Office hours is: <https://msu.zoom.us/j/95952853829>
Meeting ID: 959-5285-3829
Password: KIN330_701

If you would like to schedule a one-on-one appointment, please email me at least 2 days in advance with a list of available times.

Technical Support

In case of any technical issues with D2L (for example during a quiz or exam), please contact:

MSU DLS help desk
(517) 432-6200
[D2L Helpdesk Website](#)

The helpdesk is available **24 x 7**. Make sure you log any issue with the Helpdesk **before** contacting me.

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:

- ✓ **Read this syllabus and mark upcoming deadlines on your calendar.** Missing deadlines (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.
 - Estimate about 4 hours for each homework or lab assignment (not including time for watching lectures).
 - The MAP in total will take about 15-20 hours (from video capture to analysis to write-up).
- ✓ **Check for announcements and Discussion Boards on D2L at least once a day.** Given that there are not scheduled class hours, please check D2L/email regularly (at least once a day) for any announcements/updates regarding the course. Also check the virtual classroom to (a) post a question, or (b) see if you can reply to someone else's question.
- ✓ **Adopt a “distributed” plan for study.** Biomechanics is a course which tests your ability to “apply concepts” rather than whether you simply can memorize material. So distribute the 10-12 hours of work over at least 2-3 days during the week – this gives the opportunity to let the concepts “sink in” and gives you the time to ask me questions if things are not clear. Attempting to study for 8 hours on Sunday evening to turn in the assignments before 11:59pm is not a good strategy.
- ✓ **Adopt a “1-day ahead” internal deadline.** Murphy's law states that “anything that can go wrong will go wrong”. Given that this is an online course, you will almost certainly face issues such as computer freeze ups, internet connection problems, power outages etc. So plan to submit materials at least 1 day earlier than the actual deadline. That way, if there are any glitches, you will still have time to fix it. Aiming to submit at the last minute is a very high-risk strategy which will give you a lot of stress.
- ✓ **Actively participate in the “Virtual” Classroom.** One of the downsides of an online course is the lack of real-time interaction that is possible in a face-to-face lecture. Therefore, use the online discussion forum actively to post questions and comments (that you would make if you were in class). This intent of this “virtual classroom” is not only to clarify your questions, but also help you feel connected to the other students in the course.

While collaboration is encouraged (i.e. exchange of ideas/suggestions etc.) in the class, please make sure **you submit your own work**. For example, giving the idea of “you can find the forces if you draw the free body diagram first” on a discussion board is acceptable as collaboration, but sharing a copy of the worked out solution would be considered academic misconduct. If you are in doubt, ASK!

- ✓ **Save your “dropped scores” for unanticipated situations.** Many students look at the fact that I drop the lowest lab score or homework assignment and miss the first ones right away. Remember that life is not very predictable – there may be times later in the course where you may not be able to complete an assignment. So please save the “dropped lab/homework assignment” for these unanticipated situations. Besides, if you finish all the assignments, then you really get to drop the lowest score, which gives you a better chance at a higher grade.
- ✓ **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 “watching” or “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**.

- ✓ **BACKUP YOUR WORK!** : I highly recommend using a cloud backup solution to save your work (such as Google Drive, Dropbox, OneDrive) for rare (but potentially devastating) issues such as hard drive crashes. Having an online backup of your work not only saves your work but allows you to get to your work from another computer if needed.

Google Drive is available for MSU students here - [Link to MSU Google Drive](#)

- ✓ **Ask for help early.** Biomechanics is a course requiring conceptual understanding (not memorization or finding things from the textbook). So if the first time you look at an assignment is 1 or 2 days before the deadline, you will almost certainly feel overwhelmed. So the best strategy is to get an early start and that way, you have time to ask for help or clarifications.

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

Week 1 (May 11- May 17): Introduction

Readings

1. Syllabus (**Please Read Carefully!**)
2. Introduction Chapter
3. Chapter 1 (Vector addition: Pg. 26-38)

Modules to be Completed

Course Welcome and Orientation

- Course Welcome
 - D2L orientation
 - Navigating the Syllabus
1. Introduction to Biomechanics
 2. Math and Physics Review
 3. Getting Started with Tracker

Due (5/17)

1. Quiz 1

Week 2 (May 18- May 24): Vectors and Linear Kinematics

Readings

1. Chapter 2

Modules to be Completed

4. Problems in Math Physics Review
5. Linear Kinematics
6. Problems in Linear Kinematics

Due (5/24)

1. Quiz 2
2. Lab 1 – Introduction to Tracker

Week 3 (May 25-May 31): Angular Kinematics

Readings

1. Chapter 6

Modules to be Completed

7. Angular Kinematics
8. Problems in Angular Kinematics

Due (5/31)

1. Quiz 3
2. Lab 2 – Linear Kinematics

Week 4 (Jun 1 – Jun 7): Review Week

Due (6/9)

1. Lab 3 – Angular Kinematics

Week 5 (Jun 8- Jun 14): Linear Kinetics

Readings

1. Chapter 1 (Except Pg. 27-36)
2. Chapter 3

Modules to be Completed

9. Linear Kinetics
10. Problems in Linear Kinetics

Due (6/16)

1. Quiz 4
2. HW1

Week 6 (Jun 15- Jun 21): Angular Kinetics I

Readings

1. Chapter 5

Modules to be Completed

11. Angular Kinetics I

Due (6/23)

1. Quiz 5
2. Lab 4 – Linear Kinetics

Week 7 (Jun 22- Jun 28): Angular Kinetics II

Readings

1. Chapter 7

Modules to be Completed

12. Angular Kinetics II
13. Problems in Angular Kinetics

Due (6/30)

1. Quiz 6
2. Lab 5 – Angular Kinetics

Week 8 (Jun 29- Jul 5): Work Power and Energy

Readings

1. Chapter 4

Modules to be Completed

14. Work Power Energy
15. Problems in Work Power Energy

Due (7/7)

1. Quiz 7
2. Lab 6 – Gait analysis

Week 9 (Jul 6- Jul 12): Review Week

Due (7/12)

1. Homework 2

Week 10 (Jul 13- Jul 19): Biomechanics of musculoskeletal system

Readings

1. Chapter 10
2. Chapter 11

Modules to be Completed

16. Musculoskeletal System

Due (7/19)

1. Quiz 8
2. MAP 1-pg description and trial run

Week 11 (Jul 20- Jul 26): Technology

Readings

1. Chapter 16

Modules to be Completed

17. Technology in Biomechanics

Due (7/26)

1. Quiz 9

Week 12 (Jul 27- Aug 2): Biomechanical Applications

Readings

1. Chapter 13

Modules to be Completed

18. Using Biomechanical Principles

Due (8/2)

1. Quiz 10
2. Complete filming MAP videos

Week 13 (Aug 3- Aug 9): MAP Week

Due (8/9)

1. MAP Written Report

Week 14 (Aug 10- Aug 13): Finals Week

Due

1. Extra Credit Abstracts (due **Aug 11** – 11:59pm)
2. Final Exam: Take the exam anytime between 8am Wednesday (8/12) and 10pm Thursday (8/13)

Deadlines

All materials listed under the “Due” section each week (with the exception of the extra credit abstracts and Final Exam in Week 14) are due **Sunday of that week at 11:59pm. (US Eastern Time Zone).**

For example in Week 1 (May 11-17), the deadline for Quiz 1 will be Sun May 17 at 11:59pm

Late assignments will be subject to penalties (see course policy section)