

**The University of British Columbia  
The School of Kinesiology**

**KIN 216  
Biomechanics I**

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**Instructor**      Dr. Paul Kennedy (he/him/his)

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I would like to begin by acknowledging that the land on which we gather is the traditional, ancestral, and unceded territory of the xwməθkwəy'əm (Musqueam) People. UBC's other Vancouver operations are also situated within traditional territory best regarded as shared by the Musqueam, Squamish and Tsleil-Waututh.

Let's take a moment to appreciate the meaning behind the words we use; *traditional* recognizes lands traditionally used and/or occupied by the Musqueam people or other First Nations in other parts of the country; *ancestral* recognizes land that is handed down from generation to generation; *unceded* refers to land that was not turned over to the Crown (government) by a treaty or other agreement.

As you continue your journey at UBC, take some time to learn about the history of this land and to honour its original inhabitants. Start here: <https://indigenous.ubc.ca/indigenous-engagement/musqueam-and-ubc/>

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## **1. ABOUT THE COURSE**

### **Course Description**

In this course the elementary principles of physics and math are applied to a quantitative analysis of human movement. Analysis will also focus on the development of forces within muscles and their effect on initiating and controlling motion.

### **Rationale**

Biomechanics, the study of the mechanical processes of human movement, is an aspect of the larger field of kinesiology. The specific focus of biomechanics is on how people move, what happens when movement goes wrong, and how injuries impact human movement. To examine these issues, researchers often borrow from other disciplines in kinesiology such as anatomy (KIN 110), physiology (KIN 131), and motor control (KIN 211). The results from biomechanical research can then be applied to other fields in kinesiology such as muscle mechanics (KIN 316), strength and conditioning (KIN 320), and rehabilitation science (KIN 420).

### **Aims and Outcomes**

There are many different types of jobs that utilize the principles of biomechanics. Physical education teachers and coaches, sports managers and equipment designers, and researchers and health care professionals all rely heavily on their knowledge about the mechanical aspects of human movement. Students who are interested in pursuing a career in biomechanics can broaden their understanding of the field by taking courses in kinesiology, mathematics, and engineering, as well as assisting with laboratory and field research with current biomechanics professionals.

## Learning Goals

Upon completion of this course, students will be able to:

- Identify the goals of sport biomechanics and the common tools used to achieve these goals
- Distinguish between linear, angular, and general forms of motion
- Describe the relationships among kinematic and kinetic variables
- **Understand and apply the steps of quantitative reasoning**
- Solve quantitative problems involving kinematic and kinetic quantities and the relationships between linear and angular variables
- Identify Newton's Laws of Motion and describe practical examples of the Laws
- Explain how forces create and affect movement
- List the steps involved in both qualitative and quantitative biomechanics analysis of human movement

## 2. WORKING TOGETHER

### Instructor's Expectations for Students

Summary of some of the key expectations for this course:

- **Download:** go to the course website and gather the materials you will need for each lecture. Read ahead, complete any tasks so that you are ready for class.
- **Attend:** it is important to come to class regularly. Class meetings give you another perspective on the material and you can ask questions.
- **Participate:** a course is much more rewarding if you fully participate. Get involved in the learning process and participate in activities and discussions.
- **Focus:** avoid using electronic devices for anything other than taking notes or following the lecture. If you need to use your phone, please step outside, and return shortly (if it can't wait).
- **Respect:** everyone must be treated with respect. Please be mindful of your interactions with others, whether meetings in-person or through online chats or email exchanges.
- **Check In:** you are responsible for all material covered in class and any information given whether in attendance or not. Contact me if you lose track of what's been covered.

### Student's Expectations for the Instructor

Here are some things you should expect from me:

- **Prepared:** will have a lesson plan, outline steps for effective learning, and ready to engage you in class.
- **Communicate:** effective communication is key. It helps to create connections, increases understanding, and promotes positive interactions. So, I will strive to be a good communicator.
- **Being non-judgmental:** there is no such thing as a stupid question, it's alright if I must go over a concept a second time, and I don't mind rephrasing an explanation. Please ask questions – it is my job to answer them in a non-critical manner.
- **Responsive:** questions through email are welcome. I check my email regularly during the week. I will do my best to respond within 24 hours (but not on weekends). Please include your first and last name and course code (KIN 216) in the subject line so that I can prioritize your questions.

### Approach to Teaching

Students come to this course from various backgrounds and have different levels of preparation. Students that have taken math and physics recently will find that mechanical concepts are reviewed throughout. Others that

haven't taken those courses or may not have studied them for two to three years, may be overwhelmed at the thought of taking a course about the principles of mechanics. It is important to stress that it doesn't matter what your background is coming into this course. This is an introductory course in biomechanics. My job, as the instructor, is to provide every student with the foundational knowledge necessary to understand the application of mechanics.

### Office Hours

Office hours are times when we can meet up to discuss course material or issues that are on your mind. You can ask for extra help, clarify misunderstandings, or review assessments. Feel free to stop by my office. If that time doesn't work for you, send me an email and we can find another date and time that works for the two of us.

## 3. CLASS ACTIVITIES

### Class Delivery

This course will consist of two 80-minute seminars each week. Each seminar will include lecturing, class discussions, and group activities. It is important to be prepared for these activities. So, you will be asked to attend class regularly, complete homework assignments, and prepare for discussions by reading the relevant chapter(s). Some of the course material will be placed on-line using a flexible learning approach. Flexible Learning is understood to be the ability to be able to deliver course content and learning activities in a manner that enables students to manage their learning in terms of time and place more autonomously. It also enables instructors to deliver course content using a variety of methods in addition to the traditional lecture format. A flexible learning approach will also help to better integrate the course concepts into classroom discussions.

### Class Materials

The following text is recommended for this course and is available for purchase from the UBC Bookstore.

Basic Biomechanics, 9<sup>th</sup> Edition (Custom Edition) *Publisher:* McGraw-Hill

Similar texts that may be helpful as references on occasion and have been placed on reserve at the Library

Class notes will be made available in PPT file-format through the course website. Students are encouraged to bring these notes along with paper and pen to class. Notes will be posted 24-hours prior to each class. Please keep in mind that these notes provide an overview of what will be covered and do not contain information related to discussions, in-class assignments, or detailed examples, which will be covered in class. **The instructor will not make a full set of notes available online.** This information can be accessed at the following address: <http://canvas.ubc.ca>

### Class Content and Schedule

Topics and assigned readings for each class are listed below, although, this may be subject to change. If you have questions about what was covered in class, please don't hesitate to contact me.

Day	Month	Date	Topic	Readings (Chapter)
Th	Sept	5	Course Overview	--
T	Sept	10	Introduction to Biomechanics	1
Th	Sept	12	Defining Force	3, 13
T	Sept	17	Describing Linear Movements	2, 10
Th	Sept	19	Projectile Motion	2, 10
T	Sept	24	Quantitative Reasoning	1, 2, 10
<b>Th</b>	<b>Sept</b>	<b>26</b>	<b>Linear Kinematics Quiz</b>	<b>Quiz on Chapters 2, 10</b>
T	Oct	1	Defining Torque	3, 13

Day	Month	Date	Topic	Readings (Chapter)
Th	Oct	3	Describing Angular Motion	2, 11
T	Oct	8	General Motion	2, 11
<b>Th</b>	<b>Oct</b>	<b>10</b>	<b>Angular Kinematics Quiz</b>	<b>Quiz on Chapters 2, 11</b>
T	Oct	15	Quantitative Analysis	1, 2
<b>Th</b>	<b>Oct</b>	<b>17</b>	<b>Midterm Test</b>	<b>Test on Chapters 1, 2, 3, 10, 11, 13</b>
T	Oct	22	Momentum and Impulses	3, 12
Th	Oct	24	Work, Power, Energy	3, 12
T	Oct	29	Free Body Diagrams	3, 12
<b>Th</b>	<b>Oct</b>	<b>31</b>	<b>Linear Kinetics Quiz</b>	<b>Quiz on Chapters 3, 12</b>
T	Nov	5	Midterm Review	
Th	Nov	7	Revisiting Newton's Laws	3, 13, 14
T	Nov	12	Midterm Break	No Class
Th	Nov	14	Balance and Stability	3, 13, 14
T	Nov	19	Angular Kinetic Problems	3, 13, 14
<b>Th</b>	<b>Nov</b>	<b>21</b>	<b>Angular Kinetics Quiz</b>	<b>Quiz on Chapters 3, 13, 14</b>
T	Nov	26	Biomechanics of the Body	
Th	Nov	28	Electromyography	3, 4, 6
T	Dec	3	Biomechanical Applications	3
Th	Dec	5	Course Review and Exam Preparation	
<b>December Exam Period</b>			<b>Final Exam (Cumulative)</b>	<b>Test on all notes and readings</b>

#### 4. ASSESSMENT

Your final grade will be determined based on your marks from the following assessments. There are **no opportunities to earn extra credits**. So, please pay attention to the dates and deadlines so that you are prepared to complete the following. And if something arises, please bring this to my attention as soon as possible.

Individual Unit Quizzes (4 x 5% each)	20%	See Schedule
Team Unit Quizzes (4 x 5% each)	20%	See Schedule
Midterm	20%	Thursday, October 17
Peer Evaluation	5%	Due Tuesday, December 3
Final Exam	35%	December Exam Period

It's important that you're planning, organizing your time, and being proactive with your assessments. I am not able to help you because of poor planning.

The midterm will not be rescheduled for any reason other than a medical issue or family emergency.

Quizzes (group activities) unfortunately cannot be rescheduled. **Please speak with me to transfer the weight of the quizzes to the final exam.** If you do not contact me, you will be given a score of zero on the evaluation.

### Calculating Your Grade

Questions about grades or details about scores on evaluations will not be provided through email. So, please use this form to track your progress throughout the semester.

	<i>Mark</i>		<i>Total</i>		<i>%</i>		<i>Weight</i>		<i>Mark</i>
<b>Q1 (i)</b>	_____ ÷		_____ =		_____ x		5 =		_____
<b>Q1 (t)</b>	_____ ÷		_____ =		_____ x		5 =		_____
<b>Q2 (i)</b>	_____ ÷		_____ =		_____ x		5 =		_____
<b>Q2 (t)</b>	_____ ÷		_____ =		_____ x		5 =		_____
<b>Midterm</b>	_____ ÷		_____ =		_____ x		20 =		_____
<b>Q3 (i)</b>	_____ ÷		_____ =		_____ x		5 =		_____
<b>Q3 (t)</b>	_____ ÷		_____ =		_____ x		5 =		_____
<b>Q4 (i)</b>	_____ ÷		_____ =		_____ x		5 =		_____
<b>Q4 (t)</b>	_____ ÷		_____ =		_____ x		5 =		_____
<b>Peer</b>	_____ ÷		_____ =		_____ x		5 =		_____

Add up the marks to determine your term mark

	<i>Final Mark</i>		<i>Term Mark</i>		<i>Exam Mark</i>
Calculate your exam mark using the term mark	_____ -		_____ =		_____

## 5. EQUITY AND INCLUSION

### My Commitment to Equity and Inclusion

My job is to create a supportive, inclusive environment for all participants. This is something that I am working to achieve and am constantly looking for ways to improve my practice. If you have concerns about the ways that I conduct the class or how I interact with students, I encourage you to bring this to my attention. If you do not feel comfortable addressing me directly, you can always share your thoughts with one of the course teaching assistants or speak to a member of our KIN Advising Team. I expect students to be respectful during classroom and laboratory sessions. I will not tolerate any disparaging or harmful statements to be made in class. One way that we can create a strong, positive, collaborative classroom culture is to call out harassment when we see it and look for better ways to express our opinions.

My pronouns are he/him/his. Please feel welcome to e-mail me your name and pronouns and how you would like these to be used.

### The School of Kinesiology's Inclusivity Statement

Education is a multidisciplinary field that brings together faculty, students, and others from diverse academic and personal backgrounds. The School of Kinesiology is committed to creating a respectful workplace and learning environment that supports inclusion based on the principles of equity, diversity, and social justice to create an environment that supports its community members' full participation.

The School of Kinesiology is committed to providing accessible, usable, and welcoming spaces for faculty, staff, students, and visitors who have disabilities, are members of racialized communities, Indigenous, transgender, two-spirit, and gender-diverse people, regardless of their age, sexual orientation, social status, religion, ethno-linguistic, nationality and/or citizenship status.

Kinesiology courses take place in learning environments that are inclusive of gender identity, gender expression, sex, race, ethnicity, class, sexual orientation, ability, age, etc. Learners and educators expect to be always treated respectfully and in all interactions. Non-sexist, non-racist, non-homophobic, non-transphobic and non-heterosexist language is expected in Kinesiology classes, course content, discussions, and assignments.

### **Student Guidelines for Respectful Conduct**

Adapted from <https://equity.ubc.ca/resources/student-guidelines-for-respectful-online-conduct/>

Everyone must work together to create a respectful learning environment where we can all excel. To accomplish this we must:

- ***Be Mindful.*** Think about how you communicate with others. Be mindful that way your say or write may be interpreted differently by others, particularly when communicating online.
- ***Be Generous.*** Life can be demanding. We have a lot of different responsibilities to manage such as school, family, friendships, homework, work, volunteering, etc. Our focus (and productivity) will vary from time to time. So, be patient with others. Avoid imposing further expectations or judgements on friends and classmates.
- ***Be Curious.*** Discussions can generate different or opposing points of view. Try to take a minute or two to organize your thoughts, use direct language, and remove any emotions from your response. Focus on the ideas, experiences, and points that are being expressed by others. Response with language that is generous, inviting, and leads to a conversation.
- ***Be Respectful.*** All students have the right to study and work in an environment where they feel safe. Avoid gossip and any conversations that may be considered discriminatory or bullying. If others around you are being disrespectful, speak up and address the situation directly (if it is safe to do so). Most importantly, be willing to evolve and admit mistakes.
- ***Ask for Help.*** Getting support is important. When issues arise, don't let matter fester. Instead, turn to a trusted friend. Having someone listen to you can be helpful. If your concerns are related to a particular course, the course instructor may be able to provide support and insight as you seek to find productive ways to address your situation.

Human Rights Advisors in the Equity & Inclusion Office are available to provide confidential, impartial, and accessible consultation, information, and referrals for students who may have concerns about hate, discrimination, harassment, or bullying. If you need more support with mental health, accessibility, and other matters, please check out the following resources: <https://equity.ubc.ca/resources/connection-support/connection-support-students/>

## **6. ACADEMIC INTEGRITY**

The following text was taken from the Academic Integrity at UBC. Click on the following link for more information: <https://academicintegrity.ubc.ca>

### ***What is academic integrity?***

The academic enterprise is founded on honesty, civility, and integrity. As members of this enterprise, all students are expected to know, understand, and follow the codes of conduct regarding academic integrity. At the most basic level, this means submitting only original work done by you and acknowledging all sources of information or ideas and attributing them to others as required. This also means you should not cheat, copy, or

mislead others about what is your work; nor should you help others to do the same. For example, it is prohibited to share your past assignments and answers with other students; work with other students on an assignment when an instructor has not expressly given permission; or spread information through word of mouth, social media, websites, or other channels that subverts the fair evaluation of a class exercise, or assessment.

### ***Why is academic integrity important?***

Your instructor and teaching assistants, UBC, and the scholarly community at large share an understanding of the ethical ways that we use to produce knowledge. A core practice of this shared value of academic integrity is that we acknowledge the contributions of others to our own work, but it also means we produce our own contributions that add to the scholarly conversation: we don't buy or copy papers or exams or have someone else edit them. We also don't falsify data or sources, or hand in the same work in more than one course.

As a student your number one task is to learn new things. Just like your professors, however, you are a member of a university scholarly community. As a part of this community, you are responsible for engaging with existing knowledge and contributing ideas of your own. Academics (including you) build knowledge through rigorous research that expands on the contributions of others, both in the faraway past and around the world today. This is called scholarship. Academic integrity, in short, means being an honest, diligent, and responsible scholar. This includes (but is not limited to):

- Accurately reporting the results of your research (when collecting data in a lab or fieldwork setting).
- Taking exams without cheating.
- Completing assignments independently or acknowledging collaboration when appropriate. Collaboration through group work is an effective way to learn. I will clearly indicate when you should collaborate, for example during in-class group work and on some online homework assignments.
- Creating and expressing your own original ideas.
- Engaging with the ideas of others, both past and present, in a variety of scholarly platforms such as research journals, books by academics, lectures, etc.
- Explicitly acknowledging the sources of your knowledge, especially through accurate citation practices.

### ***What should I know about sharing course materials?***

Your instructor is working hard to provide all the materials you need to succeed in this course. In return, please respect this work. All assignment instructions, quiz questions and answers, discussion questions, announcements, PowerPoint slides, audio/video recordings, Canvas modules, and any other materials provided to you by your instructor or in the textbook are for use in this course by students currently enrolled. It is unacceptable to share any of these materials beyond our course, including by posting on file-sharing websites (e.g., CourseHero, Google Docs). It is unacceptable to copy and paste sentences from the textbook (e.g., definitions) into for-profit software (e.g., Quizlet) for use in studying. Respect your instructor and textbook authors' intellectual property and follow copyright law.

### ***What happens when academic integrity is breached?***

Violations of academic integrity (i.e., misconduct) lead to the breakdown of the academic enterprise, and therefore serious consequences arise and harsh sanctions are imposed. For example, incidences of plagiarism or cheating may result in a mark of zero on the assignment or exam and more serious consequences may apply if the matter is referred for consideration for academic discipline. Careful records are kept to monitor and prevent recurrences. Any instance of cheating or taking credit for someone else's work, whether intentionally or unintentionally, can and often will result in at minimum a grade of zero for the assessment, and these cases will be reported to the Associate Director of Undergraduate Affairs in the School of Kinesiology.

### ***What support is available?***

Feel free to ask me about academic integrity. Part of my job is to guide your growth as a scholar, and I would much rather you ask for clarification than unintentionally engage in academic misconduct, which has serious consequences. If you are unsure about what constitutes academic misconduct, please reach out to me. I can address these questions after class, via email, or during scheduled meetings.

Sometimes students who are experiencing a lot of stress feel the only way to deal with a situation is to cheat. Please do not do this. Talk to me, and I am sure we can work something out together.

To help you learn your responsibilities as a scholar, please read and understand UBC's expectations for academic honesty in the UBC Calendar: "[Academic Honesty](#)," "[Academic Misconduct](#)," and "[Disciplinary Measures](#),". Read and reflect on the [Student Declaration and Responsibility](#). There are resources to help you meet these expectations, for example the Chapman Learning Commons "[Understand Academic Integrity](#)".

For written assignments and help with plagiarism and citation, see the [Centre for Writing and Scholarly Communication](#).

Additional resources for learning with integrity can be found on the UBC [Academic Integrity Website](#).

## 7. RESOURCES TO SUPPORT STUDENT SUCCESS

UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence. UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom. UBC provides appropriate accommodation for students with disabilities and for religious observances. UBC values academic honesty and students are expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all their actions.

Details of the policies and how to access support are available on the UBC Senate website.  
<https://senate.ubc.ca/vancouver/policies-resources-support-student-success/>

### **Academic Accommodation for Students with Disabilities or Ongoing Medical Conditions**

The University of British Columbia recognizes its moral and legal duty to provide academic accommodation. The University must remove barriers and provide opportunities to students with a disability, enabling them to access university services, programs, and facilities and to be welcomed as participating members of the University community. The University's goal is to ensure fair and consistent treatment of all students, including students with a disability, in accordance with their distinct needs and in a manner consistent with academic principles.

Students with a disability who wish to have an academic accommodation should contact Centre for Accessibility without delay.  
<https://students.ubc.ca/about-student-services/centre-for-accessibility>