HESC2451

Biomechanics

Course Outline

Term 1, 2023

School of Health Sciences

Faculty of Medicine & Health

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1. Staff

Position	Name	Email	Consultation times and locations	Contact Details
Course Convenor	Kirsty McDonald	kirsty.mcdonald@unsw.edu.au	By Appointment	Office: Rm 205, Wallace Wurth Building
Course Convenor	Rachel Ward	rachel.ward@unsw.edu.au	By Appointment	Office: Rm 203, Wallace Wurth Building
Tutors	Key Nahan John Kerr			

2. Course information

Units of credit: 6

Pre-requisite(s): N/A

Teaching times and locations: http://timetable.unsw.edu.au/2022/HESC2451.html

Lectures:	Online
Laboratories:	Thursday 12 PM – 2 PM (W2-5, 8-9)
	Thursday 3 PM – 5 PM (W2-5, 8-9)
	Friday 9 AM – 11 AM (W2-5, 9-10)
	Friday 11 AM – 1 PM (W2-5, 9-10)
	Friday 2 PM – 4 PM (W2-5, 9-10)
Tutorial:	Wednesday 2 PM – 4 PM

2.1. Course summary

Biomechanics is the study of the effects of all mechanical phenomena (forces, velocities, accelerations, energies, power, momenta, moments, friction, fatigue and failure) on biological systems (e.g., human bodies). It relies on an understanding of mechanics and applies the fundamentals of mechanics to the structure and function of the human body.

Knowledge of biomechanics is used in a diverse range of disciplines including biology, ergonomics, engineering, physiology, medicine, and exercise science. Many professionals—engineers, designers, physical therapists, exercise physiologists, oral and orthopaedic surgeons, cardiologists, and aerospace engineers—use practical applications of biomechanics.

Biomechanics has application in all areas of health care and medical problem solving which require physical manipulation. It may be the major area of concern in some instances (e.g., artificial joints, prosthetics and orthoses, mechanisms of physical injury) or it may be a vital adjunct to another area (e.g., development and evaluation of rehabilitation protocols).

HESC2451 is an introductory course and is organised to cover introductory information on human anatomy and fundamental mechanics. This knowledge will then be applied to the analysis of the human body as a system in order to understand the resultant impacts of motion or motions.

2.2. Course aims

The aims of this course are to:

- Introduce students to the fundamentals of biomechanics.
- Relate these to the mechanical actions of, by, and on the body by integrating the knowledge of anatomy and mechanics to develop a deeper understanding of the field of human movement science.

2.3. Course learning outcomes (CLO)

At the successful completion of this course you (the student) should be able to:

1. Explain how basic physical principles apply to human motion and the mechanical properties of musculoskeletal tissues.
2. Describe how biomechanics fits within the interdisciplinary context of movement science and can inform health and exercise science practice.
3. Demonstrate problem solving and critical thinking abilities in relation to human motion and effects of load on the musculoskeletal system.
4. Work collaboratively in a team to collect and interpret biomechanical data.

2.4. Relationship between course and program learning outcomes and assessments

Course Learning Outcome (CLO)	**LO Statement**	**Related Tasks & Assessment**
CLO 1	Explain how basic physical principles apply to human motion and the mechanical properties of musculoskeletal tissues.	Weekly Progress Marks Lab Assessments Test Exam
CLO 2	Describe how biomechanics fits within the interdisciplinary context of movement science and can inform health and exercise science practice.	Weekly Progress Marks Lab Assessments Test Exam
CLO 3	Demonstrate problem solving and critical thinking abilities in relation to human motion and effects of load on the musculoskeletal system.	Weekly Progress Marks Lab Assessments Test Exam

CLO 4	Work collaboratively in a team to collect and interpret biomechanical data.	Lab Assessments

3. Strategies and approaches to learning

3.1. Learning and teaching activities

Lectures will be delivered online and include concept development, problem solving and discussion elements. Laboratories are designed to demonstrate a practical application of lecture content. Classes will cover the theory supporting experimental methods and the practical research problems. Tutorials are designed to facilitate discussion about course content, address any student questions, and provide an opportunity for students to practice math-based problems. These strategies are intended to support students in attaining the learning outcomes. Content, including notes and videos, will be available via Moodle. Assessments and feedback on work will be provided to students regularly.

This course requires students to understand the lecture material and then apply the knowledge to basic biomechanical applications. It is important that students learn the fundamental concepts as soon as possible and ask for help as required. Students are expected to review lecture notes and read all material that is suggested. Class participation through attendance at exercises and group work is expected and will allow for alternative methods of absorbing the relevant information.

3.2. Expectations of students

Students are reminded that UNSW recommends that a 6 units-of-credit course should involve about 150 hours of study and learning activities. The formal learning activities total approximately 50 hours throughout the term and students are expected (and strongly recommended) to do at least the same number of hours of additional study.

Students are expected to complete the online lectures (self-paced) by the end of each week. Attendance at tutorials is highly recommended, though not compulsory. Students who do not attend the live class (online) should watch the recording of the teacher-led component of the class on Moodle.

We expect and keep record of mandatory attendance for all practical/laboratory classes. Attendance at class is a mandatory part of many professional body accreditations (these are the groups that oversee and approve your ability to practice in your profession, i.e., exercise science, exercise physiology). Failure to attend mandatory classes may result in a failing grade for the course.

Lab Assessments I and II depend on data collected in class. Students who are unable to attend their assigned lab class should apply for Special Consideration. Only if this is granted will course staff liaise with the student to share the appropriate data for the assessment and answer questions related to the missed class content.

4. Course schedule and structure

This course consists of 2-4 hours of class contact per week.

Week	Lectures *Self-paced*	Laboratory classes *In-person classes*	Tutorial classes *Online/in-person classes*	Assessment* *See Assessment section for more information*
1	Welcome Math revision Linear kinematics		Linear kinematics	WPM Quiz (2%)
2	Angular kinematics	Linear kinematics	Angular kinematics	WPM Quiz (2%)
3	Linear kinetics	Angular kinematics	Linear kinetics	WPM Quiz (2%)
4	Static equilibrium	Linear kinetics	Static equilibrium	WPM Quiz (2%) **Lab Assessment I (12%)**
5	Angular kinetics	Static equilibrium	Angular kinetics	WPM Quiz (2%)
6				
7	Impulse and momentum		Impulse and momentum	WPM Quiz (2%) **Test (18%)**
8	Tissue mechanics	Impulse and momentum *Thursday class only*	Tissue mechanics	WPM Quiz (2%)
9	Work, energy and power	Tissue mechanics *Thursday class only* Impulse and momentum *Friday class only*	Work, energy and power	WPM Quiz (2%)
10	Fluid mechanics	Tissue mechanics *Friday class only*	Fluid mechanics	WPM Quiz (2%) **Lab Assessment II (12%)**
Exam Period				**Exam (40%)**

*WPM = Weekly Progress Marks

Exam Period: 28 April – 11 May

5. Assessment

5.1. Assessment tasks

All assessments in this course are individual assessments.

The Weekly Progress Marks are designed to encourage students to engage with the online lecture modules. They ensure students progress through the course in a timely manner. Nine short quizzes, each worth 2%, will assess content from the corresponding weekly lecture. Students will have one attempt to complete the quiz with no time limit on the attempt prior to the deadline. Feedback on questions is generated automatically and provided to students after the quiz deadline has passed.

The Lab Assessment requires students to compile and submit their responses to a series of questions from the lab classes. Lab classes provide an opportunity for students to apply their theoretical knowledge of biomechanics to a practical scenario. By conducting lab-based experiments in small groups, students also gain experience in collecting, processing and analysing data. While students may collaborate to collect data, and discuss their approaches to the assessment questions, all submitted answers must be entirely the work of the individual student. These assessments require students to present and discuss their findings from a small sample of lab classes (e.g., Assessment I will cover content from the Linear Kinematics and Angular Kinematics lab classes, and Assessment II will cover content from the Linear Kinetics, Static Equilibrium and Impulse and Momentum lab classes). Students will receive feedback in the form of a grading rubric, with additional comments provided where applicable.

Students will take a written Test approximately halfway through the term. Assessment content will include lectures, laboratories and tutorials. Similar to the format of the Final Exam, the Test provides an opportunity for students to apply their knowledge and problem-solving skills to answer biomechanics-based questions. A grade will be provided for each question and specific written feedback will be included where applicable.

The written Exam will be undertaken during the UNSW exam period. All course content can be assessed. The Exam provides an opportunity for students to apply their knowledge and problem-solving skills to answer biomechanics-based questions.

Assessment task	Length	Weight	Due date and time
Weekly Progress Mark Quizzes	Self-paced	2% each (18% total)	Friday at 4 PM* W1-5, 7-10
Lab Assessments	Self-paced	12% each (24% total)	Thursday at 4 PM W4, 10
Test	60 mins	18%	Thursday at 4 PM W7
Exam	2 hours 10 mins	40%	Exam period

*Except Week 8, which is due Tuesday April 11 at 4PM to account for Easter.

Further information

UNSW grading system: https://student.unsw.edu.au/grades

UNSW assessment policy: https://student.unsw.edu.au/assessment

5.2. Submission of assessment tasks

Late Submission

Late submissions will be penalized at 5% per day. Submissions received after 5 days (120 hours) will receive zero marks. Please note that late submission guidelines are only applicable to the Lab Assessments. If you are unable to complete the Weekly Progress Mark Quizzes, the Test or the Exam within the prescribed timeframes, you must apply for Special Consideration (see below). You should note that by starting the quiz/test/exam you are acknowledging that you are Fit to Sit/Submit and cannot apply for Special Consideration later.

Special Consideration

If you experience a short-term event beyond your control (exceptional circumstances) that impacts your ability to attend your assigned lab class, or your performance in a particular assessment task, you should apply for Special Considerations.

You must apply for Special Consideration **before** the start of your exam or due date for your assessment, except where your circumstances of illness or misadventure stop you from doing so.

If your circumstances stop you from applying before your scheduled lab class, or exam or assessment due date, you must **apply within 3 working days** of the assessment, or the period covered by your supporting documentation.

More information can be found on the Special Consideration website.

5.3. Feedback on assessment

Feedback for Weekly Progress Mark Quizzes is automatically generated based on the answers you provide. The correct solution will be displayed but you will not see the working. This is an opportunity for students to attempt the question as a form of revision for future assessments.

Feedback for Lab Assessments will occur via a marking rubric. Should students want to individually discuss their submission, they can also book an appointment to speak with course staff.

Students will receive a grade for their Test. Students are invited to review their Test and must do so by arranging an appointment with course staff.

No feedback will be available for the Exam, other than a final grade.

6. Academic integrity, referencing and plagiarism

Referencing is a way of acknowledging the sources of information that you use to research your assignments. You need to provide a reference whenever you draw on someone else's words, ideas or research. Not referencing other people's work can constitute plagiarism.

Further information about referencing styles can be located at https://student.unsw.edu.au/referencing

Academic integrity *is fundamental to success at university. Academic integrity can be defined as a commitment to six fundamental values in academic pursuits**:** honesty, trust, fairness, respect, responsibility and courage.*[1] *At UNSW, this means that your work must be your own, and others' ideas should be appropriately acknowledged. If you don't follow these rules, plagiarism may be detected in your work.*

Further information about academic integrity and ***plagiarism*** *can be located at:*

- *The Current Students site* https://student.unsw.edu.au/plagiarism*, and*
- *The ELISE training site* http://subjectguides.library.unsw.edu.au/elise/presenting

The Conduct and Integrity Unit provides further resources to assist you to understand your conduct obligations as a student: https://student.unsw.edu.au/conduct.

7. Readings and resources

Relevant Textbook**:** Hamill, J., Knutzen, K., Derrick, T., Biomechanical Basis of Human Movement, 4th Edition. Lippincott Williams and Wilkins, 2014.

8. Administrative matters

Student enquiries should be submitted via student portal https://portal.insight.unsw.edu.au/web-forms/

9. Additional support for students

- The Current Students Gateway: https://student.unsw.edu.au/
- Academic Skills and Support: https://student.unsw.edu.au/academic-skills
- *Student Wellbeing and Health* https://www.student.unsw.edu.au/wellbeing

[1] International Center for Academic Integrity, 'The Fundamental Values of Academic Integrity', T. Fishman (ed), Clemson University, 2013.

- UNSW IT Service Centre: https://www.myit.unsw.edu.au/services/students
- *UNSW Student Life Hub:* https://student.unsw.edu.au/hub#main-content
- *Student Support and Development:* https://student.unsw.edu.au/support
- *IT, eLearning and Apps:* https://student.unsw.edu.au/elearning
- *Student Support and Success Advisors:* https://student.unsw.edu.au/advisors
- *Equitable Learning Services (Formerly Disability Support Unit):* https://student.unsw.edu.au/els
- *Transitioning to Online Learning* https://www.covid19studyonline.unsw.edu.au/
- *Guide to Online Study* https://student.unsw.edu.au/online-study