HESC2451

Biomechanics

Course Outline

Term 2, 2024

School of Health Sciences

Table of Contents

1. Staff

Position	Name	Email	Consultation times and locations
Course Convenor	Mr Key Nahan	k.nahan@unsw.edu.au	By appointment
Lecturer	Dr Kirsty McDonald	N/A	N/A
Tutors	Mr John Kerr	N/A	N/A

2. Course information

Units of credit: 6

Pre-requisite(s): N/A

Teaching times and locations:

Lectures:	Online (self-paced)
Laboratories:	In person, Weeks 2-5, 8-9
	Tuesday: 9-11AM, Wallace Wurth 120
	Tuesday: 11AM-1PM, Wallace Wurth 120
	Thursday: 9-11AM, Wallace Wurth 116
	Thursday: 11am-1PM, Wallace Wurth 116
Tutorials:	Online (Monday 12-2PM)

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 and attendance requirements

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 are expected to attend all scheduled laboratory classes. An Unsatisfactory Fail (UF) may be recorded as the final grade for the course if students fail to meet the minimum requirement of 80% attendance for laboratory classes—to do this, students must attend at least five of the six laboratory classes scheduled throughout term. Course attendance expectations are determined by the requirements of the program accrediting body. Where a student is unable to attend, they are advised to inform the course convenor as soon as possible but no later than 3 days after the scheduled class and, where possible, provide written documentation (e.g. medical certificate) to support their absence.

Lab Assessments I and II depend on data collected in class. Students who are unable to attend their assigned lab class but have provided documentation should also request a dataset for the assessment from the Convenor.

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	Online Quiz*
2	Angular kinematics	Linear kinematics	Angular kinematics	Online Quiz*
3	Linear kinetics	Angular kinematics	Linear kinetics	Online Quiz*
4	Static equilibrium	Linear kinetics	Static equilibrium	Online Quiz*
5	Angular kinetics	Static equilibrium	Angular kinetics	Online Quiz* **Lab Assessment I (15%)**
6				
7	Impulse and momentum		Impulse and momentum	Online Quiz*
8	Tissue mechanics	Impulse and momentum	Tissue mechanics	Online Quiz*
9	Work, energy and power	Tissue mechanics	Work, energy and power	Online Quiz*
10	Fluid mechanics		Fluid mechanics	Online Quiz* **Lab Assessment II (15%)**
Exam Period				**Exam (40%)**

*Online quizzes are worth 3.33% each and are available via Moodle. Students must complete by Sunday at 9PM and should note that quizzes have an attempt and time limit that can be reviewed within Moodle.

Exam Period: 9 Aug - 22 Aug 2024
Supplementary Exam Period: 2 Sep – 6 Sep 2024

5. Assessment

5.1 Assessment tasks

All assessments in this course are individual assessments.

The Online Quizzes 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 3.33%, will assess content from the corresponding weekly lecture. Students will have one attempt to complete the quiz before the deadline, and a time limit on the attempt will be implemented (see Moodle). 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, Angular Kinematics and Linear Kinetics lab classes, and Assessment II will cover content from the Static Equilibrium, Impulse and Momentum and Tissue Mechanics lab classes). Students will receive feedback in the form of a grading rubric, with additional comments provided 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
Assessment 1: Online Quizzes	See Moodle	3.33% each, 30% total	Sunday at 9PM (W1-5, 7-10)
Assessment 2: Lab Assessments	Self-paced	15% each, 30% total	Friday at 9PM (W5, W10)
Assessment 3: Exam	2 hrs 10 min	40%	Exam period (see Moodle)

Further information

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

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

5.2 Assessment criteria and standards

More information is provided on Moodle.

For the Online Quizzes and Exam, it is prohibited to use any software or service to search for or generate information or answers. If such use is detected, it will be regarded as serious academic misconduct and subject to the standard penalties, which may include 00FL, suspension and exclusion.

For the Lab Assessments, you may use AI-based software to research and prepare prior to completing your assessment. You are permitted to use standard editing and referencing functions in word processing software (e.g., spelling and grammar checking) in the creation of your submission. You must not use any functions that generate or paraphrase passages of text, whether based on your own work or not. If your marker has concerns that your answer contains passages of AI-generated text you may be asked to explain your work. If you are unable to satisfactorily demonstrate your understanding of your submission you may be referred to UNSW Conduct & Integrity Office for investigation for academic misconduct and possible penalties.

5.3 Submission of assessment tasks

Late Submission

UNSW has standard late submission penalties as outlined in the UNSW Assessment Implementation Procedure, with no permitted variation. All late assignments (unless extension or exemption previously agreed) will be penalised by 5% of the maximum mark per day (including Saturday, Sunday, and public holidays). For example, if an assessment task is worth 30 marks, then 1.5 marks will be lost per day (5% of 30) for each day it is late. So, if the grade earnt is 24/30 and the task is two days late the student receives a grade of 24 – 3 marks = 21 marks.

Late submission is capped at 5 days (120 hours). This means that a student cannot submit an assessment more than 5 days (120 hours) after the due date for that assessment.

Short Extension

No short extensions are available in this course.

Special Consideration

In cases where short term events beyond your control (exceptional circumstances) will affect your performance in a specific assessment task, you may formally apply for Special Consideration through myUNSW.

UNSW has a Fit to Sit rule, which means that by sitting an examination on the scheduled date, you are declaring that you are fit to do so and cannot later apply for Special Consideration. Examinations include centrally timetabled examinations and scheduled, timed examinations, tests and practical assessments managed by your School.

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 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.

5.4. Feedback on assessment

Feedback for Online Quizzes is automatically generated based on the answers students provide. The correct solution will be displayed but students 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.

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.

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

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 https://subjectguides.library.unsw.edu.au/elise

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
- 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
- Current version of NSW Work and Health Safety regulation and Act