Faculty of Engineering
Graduate School of Biomedical Engineering

Session 1, 2019
BIOM2451 Biomechanics for Sports Scientists

COURSE DETAILS

Units of Credit	6	
Contact hours	2 hours per week, plus an additional 1 hour/week in weeks 4, 7 and 11	
Lecture	Online via Moodle	
Tutorial/Laboratory	One of the following:	
	Mon 3 – 5pm (Wks 2-9,11)	SAM513
	Wed 10 – 12pm (Wks 2-10)	SAM513
	Wed 12 – 2pm (Wks 2-10)	SAM513
	Thurs 10 - 12pm (Wks 2-9), Tues 10-12pm (Wk 11)	SAM513
	Thurs 12 - 2pm (Wks 2-9), Tues 12-2 pm (Wk 11)	SAM513
Course Coordinator	Lucy Armitage email: **l.armitage@unsw.edu.au**	
Demonstrators	Paulo Pelicioni email: **p.pelicioni@neura.edu.au** Kieran Lau email: **kieran.lau@unsw.edu.au** Lauren Kark email: **lauren.kark@unsw.edu.au**	

INFORMATION ABOUT THE COURSE

Biomechanics is the study of the effects of all mechanical phenomena (forces, velocities, accelerations, energies, power, momenta, moments, friction, fatigue and failure) on 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 physiology. 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).

BIOM2451 is an introductory course and is organized to cover introductory information on human anatomy and fundamental mechanics followed by the application of this knowledge to the analysis of the human body as a system in order to understand the resultant impacts of motion or motions.

BIOM2451 is part of the suite of biomechanics courses offered by the Graduate School of Biomedical Engineering, which includes BIOM9510 Introductory Biomechanics, BIOM9541 Mechanics of the Human Body, BIOM9561 Mechanics of Biomaterials, BIOM9551 Biomechanics of Physical Rehabilitation and BIOM9701 Dynamics of the Cardiovascular System.

HANDBOOK DESCRIPTION

https://www.handbook.unsw.edu.au/undergraduate/courses/2019/biom2451/

OBJECTIVES

The aims of this course are to:

- Introduce you to the fundamentals of biomechanics; and
- 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.

On completion of this course, you should be able to:

- Explain how basic physical principles apply to human motion;
- Undertake simple analyses of human motion;
- Analyse the effects of loads applied to the musculoskeletal system;
- Describe the mechanical properties of the musculoskeletal system; and
- Explain how biomechanics can inform health and exercise science practice.

Graduate attributes developed in this course include:

- Understanding of their discipline in its interdisciplinary context
- Rigorous in their analysis, critique and reflection
- Able to apply their knowledge and skills to solving problems
- Collaborative team workers

TEACHING STRATEGIES

Private Study	• Review lecture material and textbook • Do set problems and assignments • Join Moodle discussions of problems • Reflect on class problems and assignments • Download materials from Moodle • Keep up with notices and find out marks via Moodle
Online Lectures	• Find out what you must learn • See methods that are not in the textbook • Follow worked examples • Hear announcements on course changes
Tutorials	• Be guided by demonstrators • Practice solving set problems • Ask questions
Assessments (multiple choice questions, quizzes, tests, examinations, assignments, hand-in tutorials, laboratory reports etc.)	• Demonstrate your knowledge and skills • Demonstrate higher understanding and problem solving
Laboratory Work	• Hands-on work, to set studies in context

Lectures will be delivered online and include concept development, problem solving and discussion sessions. These will cover the theory supporting experimental methods and the practical research problems. Laboratories (one per week) are designed to review tutorial problems (it is expected that you will have attempted the tutorial questions prior to the tutorial) and explain the concepts using practical approaches. These strategies are intended to support you in attaining the learning outcomes. Content, including notes and videos, will be available via Moodle. Assessments and feedback on tutorial work will be provided to you regularly.

Suggested approach to learning. This course requires you to understand the lecture material and then apply the knowledge to basic biomechanical applications. It is important to understand the fundamental concepts as soon as possible and to ask for help if you do not understand. Complete all the lectures and if something is unclear, please ask questions. Make sure you review lecture notes and read all material that is suggested or handed out. Class participation through attendance at exercises and group work is expected and will allow for alternative methods of absorbing the relevant information.

Expectations of students. Attendance at the practical activities is compulsory. Non-attendance for reasons other than misadventure will preclude you from submitting the activity related to the activity you missed. Your demonstrator will record attendance. Tutorials are designed to review problems distributed online, and it is expected that you will have attempted these questions prior to attending the tutorial.

COURSE PROGRAM

Wk	Block	Lectures	Tutorials	Practical	Assessment (see next page)
		Online via Moodle (due before lab class of following week)	**Own time** *(Question time during class of following week)*	**During the laboratory period** *(Lab report due before lab class in week indicated in Assessment column)*	
1	**Block 1: Statics**	Welcome Math Revision Forces	Math revision Forces	No practical-	
2		Moments	Moments	P1 (a) Forces (b) Friction	
3		Static Equilibrium	Static Equilibrium	P2: Moments	P1 report
4		Mechanics of Materials	Mechanics of Materials	P3: Static Equilibrium	**Block test 1** P2 report
5	**Block 2 : Kinematics**	Linear Kinematics Projectile Motion	Linear Kinematics Projectile Motion	P4: Mechanics of Materials	P3 report
6		Angular Kinematics	Angular Kinematics	P5: Linear Kinematics P6: Projectile Motion	P4 report
7	**Block 3: Kinetics**	Linear Kinetics Angular Kinetics	Linear Kinetics Angular Kinetics	P7: Angular Kinematics	**Block test 2** P5 report P6 report
8		Impulse-Momentum	Impulse-Momentum	P8: Linear Kinetics P9: Angular Kinetics	P7 report
9		Work, Energy and Power	Work, Energy and Power	P10: Impulse Momentum	P8 report P9 report
10		Fluid Mechanics	Fluid Mechanics	P11: Work Energy and Power (Wed classes only) Monday and Thursday classes will not run due to public holidays	P10 report P11 report (in class)
11		No Lecture	No Tutorial	P11: Work Energy and Power (Mon & Thurs Classes – please check timetable for details on class times)	**Block test 3** P11 report (in class)

ASSESSMENT

Task	Knowledge & abilities assessed	Assessment Criteria	% of total mark	Date
Weekly progress marks will ensure you are keeping up with content. The online content contains checkpoint questions to allow you to gauge your understanding. There are a variety of question types such as comprehension, true/false, multiple-choice and short answer. You can attempt the questions multiple times. Your highest mark will be recorded in the Gradebook.	Weekly lecture topic	Completion Note: you will receive 100% for this task if you complete at least 10 topics on time and score at least 85%. Submitting fewer than ten will result in a score of 0.	10	Continuous
Block test 1 is made up of 5 multiple-choice questions of equal weighting, and one to two calculation-based questions.	**Statics:** **Topics included in test:** Math Revision, Forces, Moments, Static Equilibrium **Tuts**: Wks 1 –3 **Pracs**: P1 & P2	Ability to solve problems of static equilibrium.	8	11 March
Block test 2 is made up of 5 multiple-choice questions of equal weighting, and one to two calculation-based questions.	**Kinematics:** **Topics included in test:** Linear Kinematics, Projectile Motion, Angular Kinematics **Tuts:** Wks 5 & 6 **Pracs:** P4,5 & 6	Ability to solve problems pertaining to linear and angular kinematics.	8	1 April
Block test 3 is made up of 5 multiple-choice questions of equal weighting, and one to two calculation-based questions.	**Kinetics:** **Topics included in test:** Linear kinetics, angular kinetics, impulse-momentum, work, energy & power, fluid mechanics **Tuts:** Wks 7-10 **Pracs:** P7-P10	Ability to solve problems pertaining to linear kinetics, angular kinetics, and impulse-momentum.	8	29 April
Practical activity reports are due before your next class, one week after the practical activity is conducted, except for P11 which will be due at the end of the class. Submission is online. Each practical activity should provide you with real world and relevant illustrations of the content you have learned.	All topics, one at a time, as well as data collection, manipulation and interpretation.	Similarly to the progress marks, you must submit all reports on time to be awarded marks for this component of the course. There is no minimum mark requirement however. Each report is marked out of 100. The final mark for this component will be a weighted sum of all the individual reports.	16	Continuous
Final Examination	All lectures, tutorials and practical activities.	Application and discussion of concepts learned throughout the semester.	50	TBA

Late submissions will be penalized at a rate of **10% per day** after the due time and date has expired.

RELEVANT RESOURCES

Useful reference books that are held in the UNSW Library are:

- McGinnis, P.M., *Biomechanics of sport and exercise science.* Second edition, Human Kinetics, 2005.
- Watkins, J., *An introduction biomechanics of sport and exercise.* Churchill Livingstone Elsevier, 2007.
- Hall, S.J., *Basic biomechanics*, Sixth edition, McGraw Hill, 2012.

Students seeking additional resources can also obtain assistance from the UNSW Library at **http://library.unsw.edu.au/**. Relevant professional societies include:

- Exercise and Sports Science Australia (**www.essa.org.au**)
- Australian and New Zealand Society of Biomechanics (**www.anzsb.asn.au**)
- International Society of Biomechanics (**www.isbweb.org**)

COURSE EVALUATION AND DEVELOPMENT

Student feedback has helped to shape and develop this course, including feedback obtained from on-line evaluations as part of UNSW's myExperience process. Your feedback is much appreciated and taken very seriously. Continual improvements are made to the course based in part on such feedback and this helps us to improve the course for future students. Informal student feedback is also sought frequently throughout the semester and used to assist in the progression of the course.

DATES TO NOTE

Refer to MyUNSW for Important Dates, available at:
https://my.unsw.edu.au/student/resources/KeyDates.html

PLAGIARISM

Beware! An assignment that includes plagiarised material will receive a 0% Fail, and students who plagiarise may fail the course. Students who plagiarise will have their names entered on a plagiarism register and will be liable to disciplinary action, including exclusion from enrolment.

It is expected that all students must at all times submit their own work for assessment. Submitting the work or ideas of someone else without clearly acknowledging the source of borrowed material or ideas is plagiarism.

All assignments are submitted through Moodle. In the process of submitting you must confirm that you have not plagiarised.

Plagiarism is the use of another person's work or ideas as if they were your own. When it is necessary or desirable to use other people's material you should adequately acknowledge whose words or ideas they are and where you found them (giving the complete reference details, including page number(s)). The Learning Centre provides further information on what constitutes Plagiarism at:

https://student.unsw.edu.au/plagiarism

ADMINISTRATION MATTERS

Assignment submissions. Assignments must be submitted in soft-copy via Moodle.

Occupational Health and Safety. Each practical activity performed as part of this course has been assessed for risk. Your demonstrators will communicate the risks with you prior to the commencement of your practical activity.

Special consideration. Applications for special consideration must be lodged through myUNSW. In addition, it is recommended that you discuss your circumstances with your lecturer.

Disability Support Services. Those students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course Convenor prior to, or at the commencement of, their course, or with the Disability Advisor at Disability Support Services (9385 4734 or **https://student.unsw.edu.au/disability**). Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made.

ACADEMIC ADVICE

For information about:

- Notes on assessments and plagiarism,
- Special Considerations,
- School Student Ethics Officer, and
- BESS

refer to the School website available at
http://www.engineering.unsw.edu.au/biomedical-engineering/