COURSE DETAILS

Units of Credit
6

Contact hours
2 hours in weeks 1 – 10

Lecture
Online via Moodle
(allow approximately 2 hours per week)

Laboratory
By appointment (wks 2, 5/6 and 9) Neuroscience Research Australia

Tutorial
One of the following (all other weeks):
- Tuesday 9 – 11am
- Tuesday 12 – 2pm
- Friday 1 – 3pm

Course Coordinator
Dr Lauren Kark
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phone: (02) 9385 0560

Guest Lecturer
Dr Matthew Brodie
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Demonstrators
Matthew Hayes (m.hayes@student.unsw.edu.au)
Luke Wicent Sy (l.sy@unsw.edu.au)

INFORMATION ABOUT THE COURSE

Biomechanics is the study of the effect of 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.

Biomechanics is used in a diverse range of disciplines including biology, ergonomics, engineering, physiology, medicine, and mechanical physics. Many professionals – engineers, designers, physical therapists, 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 that 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. design of an implantable pacemaker or specialist surgical tools).

This course covers in depth the methods used in the analysis of the biomechanics of the human musculoskeletal system. Methods to analyse body segment and joint kinematics, joint kinetics, work and power, muscle forces and associated energy costs will be covered. Applications of biomechanics in clinical, occupational and recreational areas will be presented.

HANDBOOK DESCRIPTION
OBJECTIVES

The aims of this course are to:

• Integrate the knowledge of anatomy and mechanics to develop a deeper understanding of human movement; and
• Introduce the measurement, description, analysis and assessment of human movement.

On completion of this course, you should:

• Have a broad understanding of the scope of biomechanics and its applications
• Understand the fundamental general mechanical principles used
• Be able to discuss, develop and apply mechanical principles to a range of problems and medical applications.
• Be able to describe and discuss the measurement, analysis and assessment of human movement.
• Critically review the literature in the area and apply knowledge gained from the course to analyse biomechanical applications
• Clearly summarise and communicate findings from literature research using oral and written methods.

Graduate attributes developed in this course include:

• The skills involved in scholarly enquiry
• An in-depth engagement with the relevant disciplinary knowledge in its inter-disciplinary context
• The capacity for analytical and critical thinking and for creative problem solving
• Information literacy – the skills to appropriately locate, evaluate and use relevant information
• An appreciation of and respect for diversity
• A capacity to contribute to and work within the international community
• The skills required for collaborative and multidisciplinary work
• A respect for ethical practice and social responsibility
• The skills of effective communication

TEACHING STRATEGIES

<table>
<thead>
<tr>
<th>Private Study</th>
<th>Online Lectures</th>
<th>Tutorials</th>
<th>Assessments (multiple choice questions, quizzes, tests, examinations, assignments, site visit reports, hand-in tutorials, laboratory reports etc.)</th>
<th>Laboratory Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Review lecture material and textbook</td>
<td>• Find out what you must learn</td>
<td>• Independent study</td>
<td>• Demonstrate your knowledge and skills</td>
<td>• Hands-on work, to set studies in context</td>
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<tr>
<td>• Do set problems and assignments</td>
<td>• See methods that are not in the textbook</td>
<td>• Practice solving set problems</td>
<td>• Demonstrate higher understanding and problem solving</td>
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<tr>
<td>• Join Moodle discussions of problems</td>
<td>• Follow worked examples</td>
<td>• Ask questions</td>
<td></td>
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<tr>
<td>• Reflect on class problems</td>
<td>• Hear announcements on course changes</td>
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<tr>
<td>• Download materials from Moodle</td>
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<tr>
<td>• Keep up with notices and find out marks via Moodle</td>
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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 and tutorials are designed to explain the concepts introduced in the online lectures 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 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 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 tutorials, laboratories and group work is expected and will allow for alternative methods of absorbing the relevant information.

Expectations of students. Attendance at the tutorials and laboratories is compulsory. Non-attendance for reasons other than misadventure will preclude you from submitting the assignment related to the activity you missed. Your demonstrator will record attendance.

COURSE PROGRAM

<table>
<thead>
<tr>
<th>Wk</th>
<th>Lectures</th>
<th>Practice Questions (PQ)</th>
<th>Software Tutorials (ST)</th>
<th>Project Analysis (PA)</th>
<th>Laboratories</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Online via Moodle (must be completed before class of following week)</td>
<td>Own time (question time during private consults)</td>
<td>In class (question time during tutorial classes)</td>
<td>In class (question time during tutorial classes)</td>
<td></td>
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<tr>
<td>1</td>
<td>Welcome* Gait Analysis</td>
<td>PQ1</td>
<td>ST1</td>
<td>Intro to MoCap</td>
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<tr>
<td>2</td>
<td>Anthropometry</td>
<td>PQ2</td>
<td></td>
<td></td>
<td>MoCap</td>
</tr>
<tr>
<td>3</td>
<td>3D Mathematics</td>
<td>PQ3</td>
<td>ST2 and ST3</td>
<td></td>
<td></td>
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<tr>
<td>4</td>
<td>3D Kinematics</td>
<td>PQ4</td>
<td>ST4</td>
<td></td>
<td></td>
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<tr>
<td>5</td>
<td>3D Kinetics</td>
<td>PQ5</td>
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<tr>
<td>6</td>
<td>Muscle Mechanics</td>
<td>PQ6</td>
<td>PA1</td>
<td></td>
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<tr>
<td>7</td>
<td>Musculoskeletal Modelling</td>
<td>PQ7</td>
<td>PA2</td>
<td></td>
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<tr>
<td>8</td>
<td>(no online content)</td>
<td>PQ8</td>
<td></td>
<td>PA3</td>
<td></td>
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<tr>
<td>9</td>
<td>Wearable Devices I</td>
<td>PQ9</td>
<td></td>
<td>Wearables</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Wearable Devices II</td>
<td>PQ10</td>
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* Due before class in Week 1
### ASSESSMENT

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<thead>
<tr>
<th>Task</th>
<th>Knowledge &amp; abilities assessed</th>
<th>Assessment Criteria</th>
<th>% of total mark</th>
<th>Date</th>
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<tbody>
<tr>
<td>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 two times, but the lesson can be attempted as many times as you like. Your mark at the beginning of the tutorial or laboratory class of the week in question will be recorded in the grade book.</td>
<td>Weekly lessons</td>
<td>Completion Note: you will receive 100% for this task if you complete at least 8 topics on time and score at least 80%. Submitting fewer than 8 will result in a score of 0.</td>
<td>7.5</td>
<td>Continuous</td>
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<tr>
<td><strong>Yay and Boo</strong> is a lighthearted assessment that will allow you to share your triumphs and failures with your colleagues. There will be three opportunities throughout the semester to participate in the <strong>Yay and Boo</strong> assessment.</td>
<td>OpenSim</td>
<td>Posting to the forum with a complete and concise explanation of your post, including one or two sentences that describe one positive aspect (<strong>Yay</strong>) and one negative aspect (<strong>Boo</strong>) from the experience. Note: you must post three times to receive the marks for this component of the assessment. Posting fewer than three times will result in a score of 0 regardless of the marks assigned to individual posts.</td>
<td>7.5</td>
<td>Continuous</td>
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<tr>
<td><strong>Software Tutorials</strong> provide you with an opportunity to learn and use your own data collected from the Intro to MoCap laboratory to analyse and simulate human movement. Assessment is based on short weekly demonstrations of your mode to your demonstrator. Each week your demonstrator will also ask you a series of questions to evaluate your understanding of the tutorial.</td>
<td>• Scaling • Inverse Kinematics • Inverse Dynamics</td>
<td>Ability to define, solve, analyse, and communicate problems of human movement.</td>
<td>10</td>
<td>Weeks 1, 3, 4</td>
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| **Project Analysis** will see you design, perform and analyse an experiment of your choosing, using a published research paper to guide you. There will be multiple assessment items:  
  - Project Proposal (5%; Week 4)  
  - PA1 Plotting (5%; Week 6)  
  - PA2 Calculations (10%; Week 7)  
  - PA3 Presentation (10%; Week 8)  
You will use the data collected during the Mocap session to calculate and analyse a number of human movement parameters such as joint centres, joint angles and segment coordinate systems, amongst others. | • Gait analysis • Anthro • 3D Maths • 3D KN | Ability to define, solve, analyse, and communicate problems of human movement. | 30 | Weeks 5 – 8 |
| **Wearables** is a short report based on the Wearables laboratory. You will use IMUs to collect data of human movement, which you will use to create and test a hypothesis of your own choosing. | • Wearables I and II | Ability to define, solve, analyse, and communicate problems of human movement. | 10 | 07/10/18 |
| **Final examination** | • All | Ability to define, solve, analyse, and communicate problems of human movement. | 35 | TBA |

Late submissions will be penalized at a rate of **10% per day** after the due time and date has expired.
RELEVANT RESOURCES
The recommended text for this course are:


Other useful reference books that are held in the UNSW Library are:


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

Additional readings and recommended websites will be listed on Moodle when required.

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 assessments which you hand in must have a Non Plagiarism Declaration Cover Sheet. This is for both individual and group work. Attach it to your assignment before submitting it to the Course Coordinator or at the School Office.

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/