COURSE DETAILS

Units of Credit 6
Contact hours 3 hours per week
Lecture Tues, 14:00 – 17:00 Pioneer Theatre (AGSM)
Tutorial/Laboratory Tues, 14:00 – 17:00 Neuroscience Research Australia (NeuRA)

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phone: 9385 0560

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Guest Lecturer Matthew Brodie
email: matthew.brodie@neura.edu.au

Demonstrators Lucy Armitage

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

See link to virtual handbook -
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

| Private Study | • Review lecture material and course content
|              | • 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
| Lectures     | • Find out what you must learn
|              | • See methods that are not in textbooks
|              | • Follow worked examples
|              | • Hear announcements on course changes
| Tutorials    | • Be guided by demonstrators
|              | • Practice solving set problems
|              | • Ask questions
| Laboratory Work | • Hands-on work, to set studies in context
| Assessments  | • Demonstrate your knowledge and skills
|              | • Demonstrate higher understanding and problem solving

For each hour of contact it is expected that you will put in at least 1.5 hours of private study.

Lectures will be delivered through a mixture of face-to-face and online methods, and will include concept development, problem solving and discussion sessions. These will cover the theory supporting experimental methods and the practical research problems. Laboratories are designed to review content and explain 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 biomechanical applications. It is important to understand the fundamental concepts as soon as possible and to ask for help if you do not understand. Attend 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. Attendance will be recorded.

**COURSE PROGRAM**

**SEMESTER 2, 2016**

<table>
<thead>
<tr>
<th>Wk</th>
<th>Date</th>
<th>Lecture (Pioneer Theatre, or Online when Lab)</th>
<th>Laboratory (NeuRA)</th>
<th>Tutorials (own time)</th>
<th>Revision (own time, if required)</th>
<th>Assessments (see next page)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>26/07</td>
<td>Anthropometrics (Pioneer 2 – 5pm; LK)</td>
<td>-</td>
<td>OpenSim I</td>
<td>Static Equilibrium</td>
<td>-</td>
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<tr>
<td>2</td>
<td>02/08</td>
<td>Balance and Stability (Pioneer 2 – 4pm; LK)</td>
<td>MoCap Ia (4 – 5pm; LK)</td>
<td>OpenSim II</td>
<td></td>
<td></td>
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<tr>
<td>3</td>
<td>09/08</td>
<td>Rotation Matrices (Pioneer 2 – 4pm; LK)</td>
<td>MoCap Ib (4 – 5pm; LK)</td>
<td>OpenSim III</td>
<td></td>
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<tr>
<td>4</td>
<td>16/08</td>
<td>3D Kinematics (Pioneer 2 – 4pm; LK)</td>
<td>MoCap Ic (4 – 5pm; LK)</td>
<td>OpenSim IV</td>
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<tr>
<td>5</td>
<td>23/08</td>
<td>Wearable Devices (Pioneer 2 – 5pm; MB)</td>
<td>-</td>
<td>-</td>
<td>OpenSim V</td>
<td></td>
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<tr>
<td>6</td>
<td>30/08</td>
<td>-</td>
<td>MoCap II (2 – 5pm; MB)</td>
<td>-</td>
<td>OpenSim (10%) (Tues 2pm)</td>
<td></td>
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<tr>
<td>7</td>
<td>06/09</td>
<td>Remote Home Assessment (Pioneer 2 – 5pm; MB)</td>
<td>-</td>
<td>-</td>
<td>MoCap I (20%) (Mon 07/09)</td>
<td></td>
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<tr>
<td>8</td>
<td>13/09</td>
<td>MoCap II Tutorial (90mins) (Pioneer 2 – 3:30pm; MB)</td>
<td>-</td>
<td>-</td>
<td>Kinetics</td>
<td>Proposal (2.5%) (Tues 2pm)</td>
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<td></td>
<td></td>
<td>Inverse Dynamics (90mins) (Pioneer 3:30 – 5pm; LK)</td>
<td>-</td>
<td>-</td>
<td>Kinetics</td>
<td>Proposal (2.5%) (Tues 2pm)</td>
</tr>
<tr>
<td>9</td>
<td>20/09</td>
<td>3D Kinetics (Pioneer 2 – 5pm; LK)</td>
<td>Major Assignment Data Capture (LK)</td>
<td>-</td>
<td>Work, energy and power</td>
<td>MoCap II (10%) (Tues 2pm)</td>
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<td></td>
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<td></td>
<td>MID-SEMESTER BREAK</td>
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<tr>
<td>10</td>
<td>04/10</td>
<td>Optimisation (Online; LK)</td>
<td>Major Assignment Data Capture (LK)</td>
<td>-</td>
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<tr>
<td>11</td>
<td>11/10</td>
<td>Muscle Mechanics (Pioneer 2 – 5pm; LK)</td>
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<td>12</td>
<td>18/10</td>
<td>Presentations (Pioneer 2 – 5pm; you)</td>
<td>-</td>
<td>-</td>
<td>Oral Pres (7.5%) (Tues 2 – 5pm)</td>
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<tr>
<td>13</td>
<td>25/10</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Report (10%) (Tues 2pm)</td>
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**ASSESSMENT**

The assessment for this course is comprised of a series of individual and group assignments throughout the semester and a final examination in the examination period, as follows:

- OpenSim Tutorials (10%)
- MoCap I (20%)
- MoCap II (10%)
- Major Assignment, consisting of three individual and group tasks (20% total)
- Final examination (40%)

Details of each assessment component, the marks assigned to it, and the criteria by which marks will
be assigned will be provided in each of the assignment outlines. Dates of submission for each assignment are shown in the course program overleaf.

The final grade for this course will normally be based on the sum of the scores from each of the assessment tasks. The Final Examination is worth 40% of the final mark if class work is included and 100% if class work is not included. The class work is worth 60% of the final mark if included. A mark of at least 40% in the final examination is required before the class work is included in the final mark. The formal exam scripts will not be returned. Students who perform poorly in the assignments are recommended to discuss progress with the lecturer during the semester. Note: the course coordinator reserves the right to adjust the final scores by scaling if agreed by the Head of School.

### ASSIGNMENTS

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Task Description</th>
<th>Type</th>
<th>Due Date</th>
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<tbody>
<tr>
<td>1.</td>
<td>Assignment 1: OpenSim Tutorials</td>
<td>Individual</td>
<td>30/08</td>
</tr>
<tr>
<td>2.</td>
<td>Assignment 2: MoCap I</td>
<td>Individual</td>
<td>06/09</td>
</tr>
<tr>
<td>3.</td>
<td>Assignment 3: Proposal</td>
<td>Group</td>
<td>13/09</td>
</tr>
<tr>
<td>4.</td>
<td>Assignment 4: MoCap II</td>
<td>Individual</td>
<td>20/09</td>
</tr>
<tr>
<td>5.</td>
<td>Assignment 5: Oral Presentation</td>
<td>Group</td>
<td>18/10</td>
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<tr>
<td>6.</td>
<td>Assignment 6: Report</td>
<td>Group</td>
<td>25/10</td>
</tr>
</tbody>
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Late work will be penalised at the rate of 10% per day after the due time and date have expired.

### RELEVANT RESOURCES

The recommended text for this subject is:


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/](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 online evaluations as part of UNSW’s Course and Teaching Evaluation and Improvement (CATEI) process. Changes to the course this year in response to student feedback last year have included streamlining of the assessment process, and adjustment of the laboratory classes to improve student experience.

### DATES TO NOTE

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

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<thead>
<tr>
<th>ACADEMIC ADVICE</th>
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<tbody>
<tr>
<td>For information about:</td>
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<tr>
<td>• Notes on assessments and plagiarism,</td>
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<tr>
<td>• Special Considerations,</td>
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<td>• School Student Ethics Officer, and</td>
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<td>• BESS</td>
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<td>Refer to the School website available at:</td>
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<tr>
<td><a href="http://www.engineering.unsw.edu.au/biomedical-engineering/">http://www.engineering.unsw.edu.au/biomedical-engineering/</a></td>
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