MODELLING ORGANS, TISSUES AND DEVICES

SESSION 1, 2013
# Contents

1. Introduction .......................................................................................................................... 2  
2. Course Information ............................................................................................................. 3  
3. Teaching Staff ................................................................................................................... 3  
4. Course Details .................................................................................................................... 4  
5. Rationale and Strategies Underpinning the Course ............................................................. 7  
6. Course Schedule ............................................................................................................... 8  
7. Assessment Tasks and Feedback ......................................................................................... 9  
8. Additional Resources and Support .................................................................................... 11  
9. Course Evaluation ............................................................................................................. 11  
10. Administration Matters .................................................................................................... 12  
11. Academic Honesty and Plagiarism .................................................................................. 13
1. Introduction

Welcome to BIOM9711: Modelling Organs, Tissues and Devices. This course provides a practical overview of computational modelling in bioengineering, focusing on a range of applications including electrical stimulation of neural and cardiac tissue, implantable drug delivery, cancer therapy, biomechanics, blood flow, and 3D surface techniques for realistic modelling of organs, tissues and devices. You will be introduced to the basic principles of modelling and simulation of dynamic physical systems using ordinary and partial differential equations.

Lecture notes will be handed out in class, and also available on-line from the Moodle module set up for this course. Weekly assignments and on-line quizzes provided during the tutorials are assessable. Along with the lectures, these will serve as the basis for the computer-based final exam at the end of session to ascertain your ability to implement and solve a given bioengineering model. Finally, students will also undertake two projects implementing current state-of-the-art biomedical models from a choice of topics.

This is an introductory subject. However, in order to cover the material necessary to give you adequate skills, you will be required to devote significant amounts of time to reading lecture and reference materials, and to performing the prescribed assignment tasks.

You will be taught in the GSBmE Green Room (Room 518) using the Windows XP operating system with Matlab and COMSOL Multiphysics mathematical software. The computer laboratories will be accessible using a swipe card system based on your student card (the same system that will give you access to the building and the lifts).

The assessment scheme for the course will be:

- Weekly Assignments (10) 25%
- Weekly On-line Quizzes (10) 15%
- Modelling Projects (2) 30%
- Computer-Based Exam 30%

We hope you find this course useful and enjoyable, serving as a stimulus for your own further explorations in the fascinating and boundless field of bioengineering modelling!

A/Prof Socrates Dokos
Room: 506  Ph: 9385 9406
Email: s.dokos@unsw.edu.au
2. Course Information

<table>
<thead>
<tr>
<th>Component</th>
<th>HPW</th>
<th>Time</th>
<th>Day</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures</td>
<td>1</td>
<td>12 noon – 1 pm</td>
<td>Thurs</td>
<td>Samuels 513</td>
</tr>
<tr>
<td>Tutorials*</td>
<td>2</td>
<td>1 pm – 3 pm</td>
<td>Thurs</td>
<td>Samuels 513 &amp; 518</td>
</tr>
<tr>
<td>TOTAL</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Special Details

* Teaching laboratories will be accessible using a swipe card system based on your student card. The same system will give you access to the building and the lifts.

3. Teaching Staff

<table>
<thead>
<tr>
<th>Staff</th>
<th>Name</th>
<th>Contact Details</th>
<th>Consultation Times</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course Coordinator</td>
<td>A/Prof Socrates Dokos</td>
<td>E-mail: <a href="mailto:s.dokos@unsw.edu.au">s.dokos@unsw.edu.au</a>, Ph: 9385 9406</td>
<td>Mon: 1 pm – 4 pm and other times by appointment</td>
</tr>
<tr>
<td>Lab Demonstrator</td>
<td>Dr Hong-Bo Xie</td>
<td>E-mail: <a href="mailto:hong-bo.xie@unsw.edu.au">hong-bo.xie@unsw.edu.au</a></td>
<td>-</td>
</tr>
<tr>
<td>Lab Demonstrator &amp; Guest Lecturer</td>
<td>Dr Siwei Bai</td>
<td>E-mail: <a href="mailto:s.bai@unsw.edu.au">s.bai@unsw.edu.au</a></td>
<td>-</td>
</tr>
</tbody>
</table>
### Course Description

This course provides an introduction to computational modelling of biomedical systems, with an emphasis on practical aspects of implementing and solving a broad range of models commonly used in bioengineering. Areas to be covered include systems of ordinary differential equations, partial differential equations and their solution using finite-difference and finite-element techniques, electrical stimulation of excitable tissues, diffusion models, solid and fluid biomechanics, multiphysics modelling, and surface representation of anatomical structures using Bezier patches.

### Course Aims

This course aims to provide a practical overview of computational modelling in bioengineering, focusing on a range of applications of importance for modelling organs, tissues and devices. You will be taught the basic principles of modelling and simulation of continuum dynamic physical systems using ordinary and partial differential equations.

### Student Learning Outcomes

By the end of this course, you will have learned how to implement current state-of-the-art computational models in bioengineering direct from recent publications. Along the way, you will have gained a solid understanding of:

- Systems of ordinary and partial differential equations and their application to modelling biomedical systems.
- Formulating relevant equations for bioengineering models.
- Computational techniques for solving models.
- Simulating models using Matlab and COMSOL Multiphysics finite-element software.
- Implementing a range of bioengineering models including, electrical stimulation of excitable tissues, models of drug delivery and heat flow, as well as modelling solid and fluid biomechanics.
- Validating model accuracy and performance.
- Complex shape reconstruction and modelling.

### Major Topics Covered

- Background to modelling in Bioengineering
- Solving systems of ordinary differential equations
- Partial differential equations
- Finite-difference and finite-element techniques
- Modelling electrical stimulation of excitable tissue
- Models of diffusion and heat transfer
- Biomechanics models
- Biofluid mechanics models
- Multiphysics modelling
- Modelling complex shapes and anatomical structures

### Relationship to Other Courses within GSBmE

This course is largely a standalone subject within GSBmE, serving as a practical introduction to modelling in bioengineering. Basic modelling theory and principles are also covered in other courses offered by GSBmE including BIOM9060 Biomedical Systems Analysis, BIOM9311 Mass Transfer in Medicine, BIOM9701 Dynamics of the Cardiovascular System, BIOM9541 Mechanics of the Human Body and BIOM9621 Biological Signal Analysis.
## UNSW Graduate Capabilities Developed in this Course

### Rigorous Scholarship

This course will assist in fostering scholarship by developing:
- An understanding of bioengineering modelling from within its interdisciplinary context of engineering, biology and medicine
- Independent enquiry through formulating and simulating appropriate models
- Analytical and critical skills through model selection and evaluation of model performance
- Problem solving by developing and executing appropriate models
- Effective communication through written reports of major projects
- Information literacy acquired through the teaching and learning of a range of multiphysics bioengineering models
- Digital literacy acquired through the learning of two powerful modelling software programs: Matlab and COMSOL.

### Professional Practice

The UNSW graduate capability of professionalism will be fostered through the development of
- Independent, self-directed practice, achieved mainly through the formulation of relevant models for the two major computational projects of the course
- Lifelong learning, by providing an introduction to the rich and multifaceted types of bioengineering models of potential use throughout a future biomedical engineering career

### Leadership

The graduate capability of leadership will be fostered through the assessment of innovative and creative solutions to computational modelling projects given in the course.

## Relevance of Course Assessments to Learning Outcomes and UNSW Graduate Capabilities

<table>
<thead>
<tr>
<th>Weekly Assignments</th>
<th>Learning Outcome</th>
<th>Corresponding UNSW Graduate Capability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A solid understanding of systems of ordinary and partial differential equations and their application to modelling biomedical systems</td>
<td>An understanding of their discipline in its interdisciplinary context</td>
</tr>
<tr>
<td></td>
<td>Implementing a range of bioengineering models including, electrical stimulation of excitable tissues, models of drug delivery and heat flow, as well as modelling solid and fluid biomechanics</td>
<td>Capable of independent and collaborative enquiry</td>
</tr>
<tr>
<td></td>
<td>Computational techniques for solving models</td>
<td>Able to apply their knowledge and skills to solving problems</td>
</tr>
<tr>
<td></td>
<td>Formulating relevant equations for bioengineering models</td>
<td>Information literate</td>
</tr>
<tr>
<td></td>
<td>Simulating models using Matlab and COMSOL Multiphysics finite-element software</td>
<td>Digitally literate</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Weekly On-Line Quizzes</th>
<th>Learning Outcome</th>
<th>Corresponding UNSW Graduate Capability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A solid understanding of systems of ordinary and partial differential equations and their application to modelling biomedical systems</td>
<td>An understanding of their discipline in its interdisciplinary context</td>
</tr>
<tr>
<td></td>
<td>Computational techniques for solving models</td>
<td>Able to apply their knowledge and skills to solving problems</td>
</tr>
<tr>
<td></td>
<td>Formulating relevant equations for bioengineering models</td>
<td>Information literate</td>
</tr>
<tr>
<td></td>
<td>Simulating models using Matlab and COMSOL Multiphysics finite-element software</td>
<td>Digitally literate</td>
</tr>
<tr>
<td>Major Modelling Projects</td>
<td>Learning Outcome</td>
<td>Corresponding UNSW Graduate Capability</td>
</tr>
<tr>
<td>--------------------------</td>
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<td>---------------------------------------</td>
</tr>
<tr>
<td></td>
<td>• A solid understanding of systems of ordinary and partial differential equations and their application to modelling biomedical systems</td>
<td>• An understanding of their discipline in its interdisciplinary context.</td>
</tr>
<tr>
<td></td>
<td>• Implementing a range of bioengineering models including, electrical stimulation of excitable tissues, models of drug delivery and heat flow, as well as modelling solid and fluid biomechanics</td>
<td>• Capable of independent and collaborative enquiry.</td>
</tr>
<tr>
<td></td>
<td>• Computational techniques for solving models</td>
<td>• Able to apply their knowledge and skills to solving problems.</td>
</tr>
<tr>
<td></td>
<td>• Formulating relevant equations for bioengineering models</td>
<td>• Information literate. Enterprising, innovative and creative. Capable of independent, self-directed practice.</td>
</tr>
<tr>
<td></td>
<td>• Validating model accuracy and performance</td>
<td>• Capable of lifelong learning.</td>
</tr>
<tr>
<td></td>
<td>• Simulating models using Matlab and COMSOL Multiphysics finite-element software</td>
<td>• Rigorous in their analysis, critique and reflection. Capable of effective communication.</td>
</tr>
<tr>
<td></td>
<td>• Digital literacy</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Computer-Based Final Exam</th>
<th>Learning Outcome</th>
<th>Corresponding UNSW Graduate Capability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• A solid understanding of systems of ordinary and partial differential equations and their application to modelling biomedical systems</td>
<td>• An understanding of their discipline in its interdisciplinary context</td>
</tr>
<tr>
<td></td>
<td>• Computational techniques for solving models</td>
<td>• Able to apply their knowledge and skills to solving problems</td>
</tr>
<tr>
<td></td>
<td>• Formulating relevant equations for bioengineering models</td>
<td>• Information literate</td>
</tr>
<tr>
<td></td>
<td>• Validating model accuracy and performance</td>
<td>• Rigorous in their analysis, critique and reflection</td>
</tr>
<tr>
<td></td>
<td>• Simulating models using Matlab and COMSOL Multiphysics finite-element software</td>
<td>• Digitally literate</td>
</tr>
</tbody>
</table>
5. Rationale and Strategies Underpinning the Course

<table>
<thead>
<tr>
<th>Teaching Strategies</th>
<th>This course will be taught via weekly lectures, tutorials and computer labs. Students will be expected to apply theory covered in lectures to solving the assignment exercises. Assessments and feedback of these assignment submissions will be regularly provided to the students. Weekly on-line quizzes will help reinforce theory given in previous lectures and tutorials.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rationale for learning and teaching in this course</td>
<td>Students learn modelling principles effectively via exposure to a broad range of modelling examples reinforced through computer-based assignments. Hence, a large proportion of this course is dedicated to tutorial sessions. Feedback provided by tutors is important in teaching correct understanding of practical modelling principles. In addition, students will gain extensive modelling experience by implementing two full biomedical models as major projects.</td>
</tr>
</tbody>
</table>
### 6. Course Schedule

<table>
<thead>
<tr>
<th>Session Week No.</th>
<th>Date</th>
<th>Lectures (Thursday 12-1), Topics</th>
<th>Tutorials (Thursday 1-3), Topics</th>
<th>Assignment submission dates (see also ‘Assessment Tasks and Feedback’)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>7/3/13</td>
<td>Introduction to Modelling in Bioengineering</td>
<td>On-line Quiz 0. Assignment 1 – Model Scaling and Glucose-Insulin Kinetics.</td>
<td>Assignment 1 due 14/3/13</td>
</tr>
<tr>
<td>Week 7</td>
<td>25/4/13</td>
<td>ANZAC Day Public Holiday (No Lecture)</td>
<td>(No Lab)</td>
<td></td>
</tr>
<tr>
<td>Week 9</td>
<td>9/5/13</td>
<td>Solid Mechanics</td>
<td>On-line Quiz 7. Assignment 8 – Stress and Strain.</td>
<td>Assignment 8 due 16/5/13</td>
</tr>
<tr>
<td>Week 12</td>
<td>30/5/13</td>
<td>Case Example: Modelling Brain Activation During Electroconvulsive Therapy</td>
<td>On-line Quiz 10. Revision.</td>
<td></td>
</tr>
</tbody>
</table>
## Assessment Tasks and Feedback

<table>
<thead>
<tr>
<th>Task</th>
<th>% of total mark</th>
<th>Date of</th>
<th>Feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Release</td>
<td>Submission</td>
</tr>
<tr>
<td>Assignment 1</td>
<td>2.5</td>
<td>7/3/13</td>
<td>14/3/13</td>
</tr>
<tr>
<td>On-Line Quiz 1</td>
<td>1.5</td>
<td>14/3/13</td>
<td>14/3/13</td>
</tr>
<tr>
<td>Assignment 2</td>
<td>2.5</td>
<td>14/3/13</td>
<td>21/3/13</td>
</tr>
<tr>
<td>On-Line Quiz 2</td>
<td>1.5</td>
<td>21/3/13</td>
<td>21/3/13</td>
</tr>
<tr>
<td>Assignment 3</td>
<td>2.5</td>
<td>21/3/13</td>
<td>28/3/13</td>
</tr>
<tr>
<td>On-Line Quiz 3</td>
<td>1.5</td>
<td>28/3/13</td>
<td>28/3/13</td>
</tr>
<tr>
<td>Assignment 4</td>
<td>2.5</td>
<td>28/3/13</td>
<td>11/4/13</td>
</tr>
<tr>
<td>Assignment 5</td>
<td>2.5</td>
<td>11/4/13</td>
<td>18/4/13</td>
</tr>
<tr>
<td>On-Line Quiz 5</td>
<td>1.5</td>
<td>18/4/13</td>
<td>18/4/13</td>
</tr>
<tr>
<td>Assignment 6</td>
<td>2.5</td>
<td>18/4/13</td>
<td>2/5/13</td>
</tr>
<tr>
<td>Major Project 1</td>
<td>15</td>
<td>7/3/13</td>
<td>2/5/13</td>
</tr>
<tr>
<td>On-Line Quiz 6</td>
<td>1.5</td>
<td>2/5/13</td>
<td>2/5/13</td>
</tr>
<tr>
<td>Assignment 7</td>
<td>2.5</td>
<td>2/5/13</td>
<td>9/5/13</td>
</tr>
<tr>
<td>Assignment/Quiz</td>
<td>Marks</td>
<td>Due Date 1</td>
<td>Due Date 2</td>
</tr>
<tr>
<td>-----------------</td>
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</tr>
<tr>
<td>On-Line Quiz 7</td>
<td>1.5</td>
<td>9/5/13</td>
<td>9/5/13</td>
</tr>
<tr>
<td>Assignment 8</td>
<td>2.5</td>
<td>9/5/13</td>
<td>16/5/13</td>
</tr>
<tr>
<td>On-Line Quiz 8</td>
<td>1.5</td>
<td>16/5/13</td>
<td>16/5/13</td>
</tr>
<tr>
<td>Assignment 9</td>
<td>2.5</td>
<td>16/5/13</td>
<td>23/5/13</td>
</tr>
<tr>
<td>On-Line Quiz 9</td>
<td>1.5</td>
<td>23/5/13</td>
<td>23/5/13</td>
</tr>
<tr>
<td>Assignment 10</td>
<td>2.5</td>
<td>23/5/13</td>
<td>30/5/13</td>
</tr>
<tr>
<td>On-Line Quiz 10</td>
<td>1.5</td>
<td>30/5/13</td>
<td>30/5/13</td>
</tr>
<tr>
<td>Major Project 2</td>
<td>15</td>
<td>3/7/13</td>
<td>31/5/13</td>
</tr>
<tr>
<td>Computer-Based Final Exam</td>
<td>30</td>
<td>TBA</td>
<td>TBA</td>
</tr>
</tbody>
</table>

** TOTAL 100 **

* Late submission of assignments will incur a penalty deduction of 20% per day.
** Your best 8 out of 10 on-line quiz marks will form your assessment for this component of the course.
*** Late submission of major projects will incur a penalty deduction of 10% per day.
8. Additional Resources and Support

<table>
<thead>
<tr>
<th>Recommended Texts</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Multiphysics Modeling With Finite Element Methods,</td>
</tr>
<tr>
<td>- An Introduction to Modeling of Transport Processes:</td>
</tr>
<tr>
<td>Applications to Biomedical Systems, by A. Datta and V.</td>
</tr>
<tr>
<td>Rakesh (Cambridge University Press, 2010)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Additional Texts (available in UNSW Library)</th>
</tr>
</thead>
<tbody>
<tr>
<td>- The Nature of Mathematical Modeling, by N. Gershenfeld</td>
</tr>
<tr>
<td>(Cambridge University Press, 1999).</td>
</tr>
<tr>
<td>- Mathematical and Computer Modelling of Physiological</td>
</tr>
<tr>
<td>- An Introduction to Mathematical Physiology and Biology</td>
</tr>
<tr>
<td>- Mathematical Physiology, by J. Keener and J. Sneyd</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Recommended on-line Software Tutorials</th>
</tr>
</thead>
<tbody>
<tr>
<td>- On-line Matlab tutorials from Mathworks, Inc can be</td>
</tr>
<tr>
<td>student_center/tutorials/index.html</td>
</tr>
<tr>
<td>- A downloadable pdf chapter on solving systems of</td>
</tr>
<tr>
<td>ordinary differential equations (ODEs) using Matlab,</td>
</tr>
<tr>
<td>from the text Numerical Computing with Matlab, by Cleve</td>
</tr>
<tr>
<td>Moler, is at <a href="http://www.mathworks.com/moler/odes.pdf">www.mathworks.com/moler/odes.pdf</a></td>
</tr>
<tr>
<td>- On-line COMSOL Multiphysics tutorials can be accessed</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Computer Laboratory</th>
</tr>
</thead>
<tbody>
<tr>
<td>The computer laboratory is located in GSBmE's Green</td>
</tr>
<tr>
<td>Room (518) of the Samuels Building. This laboratory is</td>
</tr>
<tr>
<td>accessible throughout session using a swipe card system.</td>
</tr>
</tbody>
</table>

9. Course Evaluation

At the end of the course, you will be asked to complete two on-line evaluations – one for the course and one for the course coordinator, as part of UNSW's Course and Teaching Evaluation and Improvement (CATEI) Process. Your feedback is voluntary, but 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.
## 10. Administrative Matters

<table>
<thead>
<tr>
<th>Expectations of Students</th>
<th>It is expected that students attend all lectures and tutorial sessions. To encourage such attendance, no lecture and tutorial handouts will be given to students in advance of the Wednesday afternoon classes. Handouts will be available on-line from the Blackboard module for this course at <a href="http://lms-blackboard.telt.unsw.edu.au">http://lms-blackboard.telt.unsw.edu.au</a>. In order to use the teaching laboratories, students must agree to the GSBmE student regulations governing use of network computer resources. These regulations may be found at <a href="http://wiki.gsbme.unsw.edu.au/schoolwiki/index.php?title=GSBmE_Network_Student_Declaration">http://wiki.gsbme.unsw.edu.au/schoolwiki/index.php?title=GSBmE_Network_Student_Declaration</a></th>
</tr>
</thead>
</table>
| Assignment Submissions | In general, computer-based assignments will be due on the week following the tutorial. **All late submissions will incur a mark deduction of 20% per day late.** This means that an assignment submitted a week late will not be accepted.  

**NB.** A non-plagiarism declaration form must also be attached to every assignment. To download this form, follow the link at [http://www.gsbme.unsw.edu.au/info-about/our-school/academic-matters](http://www.gsbme.unsw.edu.au/info-about/our-school/academic-matters) |
| Assessment Procedures | All assignments will be assessed through hardcopy submission of reports containing Matlab source code or HTML-generated COMSOL reports in addition to assumptions, diagrams, working or calculations. If for any reason you are experiencing difficulties in submitting your assignment, please see the course coordinator. |
| Equity and Diversity | 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 coordinator prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equity and Diversity Unit (9385 4734 or [www.studentequity.unsw.edu.au](http://www.studentequity.unsw.edu.au)).  

**Issues to be discussed may include access to materials or additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made.** |
| Student Support | UNSW has a wide range of student support services. The resources listed below should be used by students needing assistance related to aspects of their overall University experience. Specific help regarding this course can be sought from the course coordinator.  

[http://www.counselling.unsw.edu.au/](http://www.counselling.unsw.edu.au/) |
11. Academic Honesty and Plagiarism

The University has a very firm policy on Academic Honesty and Plagiarism which will be enforced during this course. Details of the UNSW plagiarism policy are available at [https://my.unsw.edu.au/student/atoz/Plagiarism.html](https://my.unsw.edu.au/student/atoz/Plagiarism.html). The plagiarism policy of the Graduate School of Biomedical Engineering is derived from the University’s policy and details can be found at [http://www.gsbme.unsw.edu.au/info-about/our-school/academic-matters](http://www.gsbme.unsw.edu.au/info-about/our-school/academic-matters). Whilst we encourage discussion of assignment solutions between students, all material handed in for assessment MUST be your own work. Any plagiarized submission will result in a mark of zero.

As part of the School’s policy on plagiarism, a non-plagiarism declaration form must be attached to all assignments as well as the major projects. No assignment will be accepted without such a declaration. The form can be downloaded from [http://www.gsbme.unsw.edu.au/info-about/our-school/academic-matters](http://www.gsbme.unsw.edu.au/info-about/our-school/academic-matters).

Copying sections of computer code from another student is very easy to detect, and constitutes plagiarism. **Detection is easy, even when variables names may have been altered in the copy.** If such copying has been deemed to have occurred between two or more students, all relevant submissions will have their marks reduced to zero, irrespective of who did the actual copying.

Below is a summary of UNSW guidelines on plagiarism:

<table>
<thead>
<tr>
<th>What is Plagiarism?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plagiarism is the presentation of the thoughts or work of another as one’s own.</td>
</tr>
</tbody>
</table>

Examples* include:

- direct duplication of the thoughts or work of another, including by copying material, ideas or concepts from a book, article, report or other written document (whether published or unpublished), composition, artwork, design, drawing, circuitry, computer program or software, web site, Internet, other electronic resource, or another person’s assignment without appropriate acknowledgement;
- paraphrasing another person’s work with very minor changes keeping the meaning, form and/or progression of ideas of the original;
- piecing together sections of the work of others into a new whole;
- presenting an assessment item as independent work when it has been produced in whole or part in collusion with other people, for example, another student or a tutor; and
- claiming credit for a proportion a work contributed to a group assessment item that is greater than that actually contributed.†

For the purposes of this policy, submitting an assessment item that has already been submitted for academic credit elsewhere may be considered plagiarism.

Knowingly permitting your work to be copied by another student may also be considered to be plagiarism.

Note that an assessment item produced in oral, not written, form, or involving live presentation, may similarly contain plagiarised material.

The inclusion of the thoughts or work of another with attribution appropriate to the academic discipline does not amount to plagiarism.

The Learning Centre website is main repository for resources for staff and students on plagiarism and academic honesty. These resources can be located via:

[www.lc.unsw.edu.au/plagiarism](http://www.lc.unsw.edu.au/plagiarism)

The Learning Centre also provides substantial educational written materials, workshops, and tutorials to aid students, for example, in:

- correct referencing practices;
- paraphrasing, summarising, essay writing, and time management;
- appropriate use of, and attribution for, a range of materials including text, images, formulae and concepts.

Individual assistance is available on request from The Learning Centre.

Students are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting, and the proper referencing of sources in preparing all assessment items.

* Based on that proposed to the University of Newcastle by the St James Ethics Centre. Used with kind permission from the University of Newcastle
† Adapted with kind permission from the University of Melbourne.