

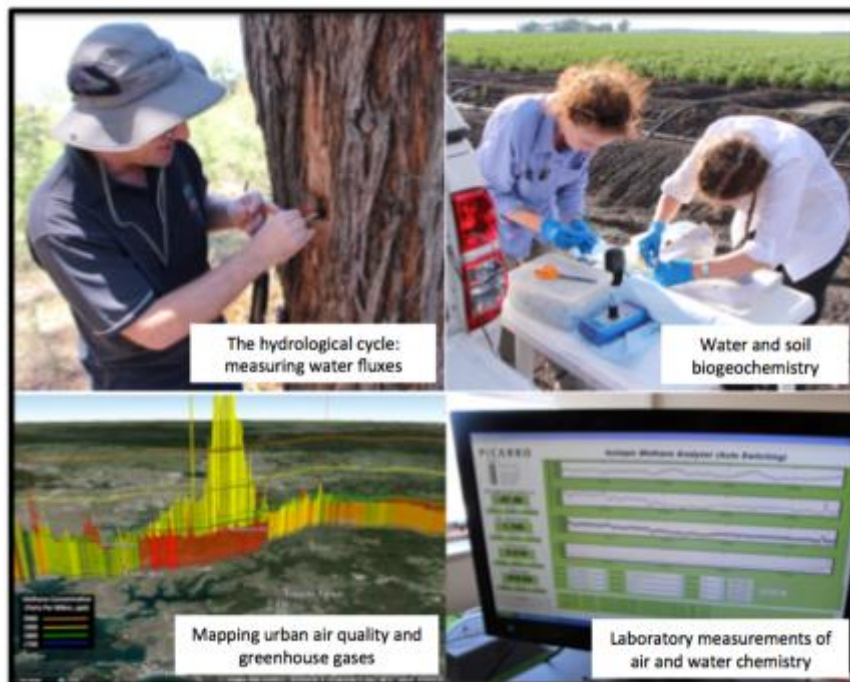


## FACULTY OF SCIENCE

### School of Biological Earth and Environmental Sciences

## GEOS2291

Earth's Interconnections: Hydrology, Biogeochemical Cycles and Ecosystems



## SESSION 2 2016

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## Faculty of Science - Course Outline

### 1. Information about the Course

NB: Some of this information is available on the [UNSW Virtual Handbook](http://www.handbook.unsw.edu.au/2016/index.html)<sup>1</sup>

<b>Year of Delivery</b>	2016			
<b><a href="#">Course Code</a></b>	GEOS2291			
<b>Course Name</b>	Earth's Interconnections: Hydrology, Biogeochemical Cycles and Ecosystems			
<b>Academic Unit</b>	Biological Earth and Environmental Science			
<b>Level of Course</b>	UG			
<b>Units of Credit</b>	6UOC			
<b>Session(s) Offered</b>	S2			
<b>Assumed Knowledge, Prerequisites or Co-requisites</b>	<i>No set prerequisites. BIOS1301, GEOS1211, GEOS1701 recommended but not required. No co-requisites</i>			
<b>Hours per Week</b>	Up to 5 hours per week			
<b>Number of Weeks</b>	12			
<b>Commencement Date</b>	Week 2			
<b>Summary of Course Structure (for details see 'Course Schedule')</b>				
<b>Component</b>	<b>HPW</b>	<b>Time</b>	<b>Day</b>	<b>Location</b>
Lectures				
Lectures	2	See Timetable	See Timetable	See Timetable
Computer Laboratory	3 - some weeks	See Timetable	See Timetable	See Timetable
Tutorials				
Field Trips	3 - some weeks			Centennial Parklands
<b>TOTAL</b>	5			
<b>Special Details</b>				

### 2. Staff Involved in the Course

Staff	Role	Name	Contact Details	Consultation
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<sup>1</sup> UNSW Virtual Handbook: <http://www.handbook.unsw.edu.au/2016/index.html>

			Times
<b>Course Convenor</b>		A/Prof. B .Kelly	<a href="mailto:bryce.kelly@unsw.edu.au">bryce.kelly@unsw.edu.au</a> Arrange via email
<b>Additional Teaching Staff</b>	Lecturers & Facilitators	Prof. R. Kingsford	<a href="mailto:richard.kingsfors@unsw.edu.au">richard.kingsfors@unsw.edu.au</a>
		Prof. A, Baker	<a href="mailto:a.baker@unsw.edu.au">a.baker@unsw.edu.au</a> Arrange via email

### 3. Course Details

<p><a href="#">Course Description</a><sup>2</sup> (Handbook Entry)</p>	<p>GEOS2291 focuses on developing your understanding of how air and water move through the landscape and influence biogeochemical processes and ecosystems – both locally and globally. The course covers global water and energy cycles, measuring air and water quality and fluxes, water geochemical processes, microbiological biochemical reactions and gas production, and monitoring ecosystems for signs of environmental stress.</p> <p>Measuring air and water quality, gauging fluxes, and assimilating information on biogeochemical processes is critical for improving our knowledge of Earth's processes, assessing ecosystem health and quantifying the impact of human activities. Many human activities are locally altering air, surface water, soil, and groundwater quality. Case studies will be presented on monitoring the impact of agricultural, manufacturing, mining, coal seam gas, oil, and gas developments. The theory and methods of analysis presented in lectures will be linked to your own field measurements and data interpretation at case study sites in Sydney.</p> <p>Water fluxes and biogeochemical processes control ecosystems. Examples will be presented that highlight how river and wetland function under normal climatic variability, and how such ecosystems are stressed by dam construction and alterations to flow regimes.</p> <p>This course will prepare you for research in hydrology, hydrogeology, geochemistry, biogeosciences, and ecosystem sciences, or careers in land and water management, agriculture, contaminated land remediation, greenhouse gas monitoring, and environmental impact assessments of urban, agricultural, mining, oil, and gas developments.</p>
<p><a href="#">Course Aims</a><sup>3</sup></p>	<p>GEOS2291 provides you with a broad background to the interconnections between the hydrological cycle, biogeochemical cycles and ecosystem response. You will gain an understanding of the influence of human activities on air and water quality and quantity. You will be taught how to analyse data that relate to air and water and how to interpret the patterns and trends hidden within the data. From case studies, tutorial problems and field trip observations, you will gain an appreciation of why management decisions that relate to air and water cannot be made in isolation and that decisions need to be based on scientific analysis of data.</p>

<sup>2</sup> UNSW Virtual Handbook: <http://www.handbook.unsw.edu.au/2016/index.html>

<sup>3</sup> Learning and Teaching Unit: <http://www.ltu.unsw.edu.au>

<b>Student Learning Outcomes<sup>4</sup></b>	<p>This course will give an appreciation of the close links between the hydrological cycle, biogeochemical cycles and ecosystem health.</p> <p>You will develop your skills in:</p> <ul style="list-style-type: none"> <li>- measuring water chemistry and fluxes</li> <li>- measuring air chemistry and mapping greenhouse gases sources and sinks</li> <li>- analysing spatial and temporal data</li> <li>- ecosystem characterisation</li> <li>- report writing</li> <li>- scientific poster preparation and presentation</li> <li>- quantifying human impacts on urban environments and natural ecosystems.</li> </ul>
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**Graduate Attributes Developed in this Course<sup>5</sup>**

<b>Science Graduate Attributes<sup>5</sup></b> (maybe replaced by UNSW, School or professional attributes)	<b>Select the level of FOCUS</b> <i>0 = NO FOCUS</i> <i>1 = MINIMAL</i> <i>2 = MINOR</i> <i>3 = MAJOR</i>	<b>Activities / Assessment</b>
<b>Research, inquiry and analytical thinking abilities</b>	<b>3</b>	<i>Centennial Park – Field trip report</i> <i>Computer Laboratory Assignments</i> <i>Final Examination</i>
<b>Capability and motivation for intellectual development</b>	<b>3</b>	
<b>Ethical, social and professional understanding</b>	<b>3</b>	
<b>Communication</b>	<b>2</b>	
<b>Teamwork, collaborative and management skills</b>	<b>2</b>	
<b>Information literacy</b>	<b>3</b>	

<sup>4</sup> Learning and Teaching Unit – Learning Outcomes: [http://www.ltu.unsw.edu.au/content/course\\_prog\\_support/outcomes.cfm?ss=0](http://www.ltu.unsw.edu.au/content/course_prog_support/outcomes.cfm?ss=0)

<sup>5</sup> Access the contextualised Science Graduate Attributes and your mapped courses: <http://www2.science.unsw.edu.au/guide/slatig/sciga.html>  
(Mapped courses are available at this site)

**Major Topics Outline**

Week 2: 1st to 7th Aug	Tue 15:00 - 17:00	A/Prof. Bryce Kelly	Lecture: <b>Central Lecture Block 3</b> Introduction: Global Hydrological, Energy, and Biogeochemical Cycles
	Fri 09:00 - 12:00		<b>NO FIELD TRIP OR LECTURE</b>
Week 3: 8th to 14th Aug	Tue 15:00 - 17:00	Prof. Andy Baker	Lecture: <b>Central Lecture Block 3</b> Water Quality Introduction
	Fri 09:00 - 12:00	Prof. Andy Baker	Computer Lab: Water quality databases – NCRIS groundwater database, NSW DOW river database
Week 4: 15th to 21st Aug	Tue 15:00 - 17:00	Prof. Andy Baker	Lecture: <b>Central Lecture Block 3</b> Urban Water Quality
	Fri 09:00 - 12:00	Prof. Andy Baker	Field Trip: Centennial Park: Water-quality 1. Sampling methods. Measuring EC, pH, DO, turbidity
Week 5: 22nd to 28th Aug	Tue 15:00 - 17:00	Prof. Andy Baker	Lecture: <b>Central Lecture Block 3</b> Non-urban Water Quality
	Fri 09:00 - 12:00	Prof. Andy Baker	Field Trip: Centennial Park (Water quality 1)
Week 6: 29th Aug to 4th Sep	Tue 15:00 - 17:00	Prof. Richard Kingsford	Lecture: <b>Central Lecture Block 3</b> Rivers and Wetlands A
	Fri 09:00 - 12:00	A/Prof. Bryce Kelly	Field Trip Centennial Parklands—Hydrogeology and Parklands Water Balance
Week 7: 5th to 11th Sep	Tue 15:00 - 17:00	Prof. Richard Kingsford	Lecture: <b>Central Lecture Block 3</b> Rivers and Wetlands B
	Fri 09:00 - 12:00	A/Prof. Bryce Kelly	Computer Laboratory (G11) Analysis of rainfall, groundwater hydrograph and tree sap flow data (Time Series Analysis)
Week 8: 12th to 18th Sep	Tue 15:00 - 17:00	A/Prof. Bryce Kelly	Lecture: <b>Central Lecture Block 3</b> Biosphere–Atmosphere Fluxes (water and gases): Microbiological processes in soils and aquifers
	Fri 09:00 - 12:00	A/Prof. Bryce Kelly	Field Trip: Centennial Park (greenhouse gas emissions)
Week 9: 19th to 28th Sep	Tue 15:00 - 17:00	Prof. Andy Baker	Lecture: <b>Central Lecture Block 3</b> Continuous Water Quality Monitoring
	Fri 09:00 - 12:00	Prof. Andy Baker	Field Trip: Centennial Park (Water quality 2)
Mid-Session Break			
Mid-Session Break			
Week 10: 3rd to 10th Oct	Tue 15:00 - 17:00	A/Prof. Bryce Kelly	Lecture: <b>Central Lecture Block 3</b> Air chemistry; greenhouse gases sources and sinks; urban and mining air quality
	Fri 09:00 - 12:00	A/Prof. Bryce Kelly	Field Trip: Air sampling throughout Sydney
Week 11: 10th to 16th Oct	Tue 15:00 - 17:00	A/Prof. Bryce Kelly	Material Science Rm 351 Isotope Lab Measurement and analysis of air samples
	Fri 09:00 - 12:00	A/Prof. Bryce Kelly	Material Science rm 351 Isotope Lab Measurement and analysis of air samples
Week 12: 17th to 23rd Oct	Tue 15:00 - 17:00	A/Prof. Bryce Kelly	Lecture: <b>Central Lecture Block 3</b> Introduction to regional water balance models; contaminant plumes; regional air models
	Fri 09:00 - 12:00	A/Prof. Bryce Kelly	Computer Laboratory (G11) Computer Lab: Modelling groundwater or air flow
Week 13: 24th to 30th Oct	Tue 15:00 - 17:00		Lecture: <b>Central Lecture Block 3</b> No Lecture / Assignment 3 help if needed
	Fri 09:00 - 12:00	A/Prof. Bryce Kelly	Computer Laboratory (G11) Assignment 3: Scientific Poster Presentations

#### 4. Rationale and Strategies Underpinning the Course

<b>Teaching Strategies</b>	<p>Interactive lectures – engaging discussion forums that place the learning goals and presented information in the context of scientific analysis, societal goals and environmental management.</p> <p>Field trips – observations and measurements, report writing.</p> <p>Computer laboratories – problem based learning (a toolbox of methods for data analysis)</p> <p>Poster Presentation – learning via analysis, visual communication, and discussion of scientific measurements.</p> <p>Final examination – informative reading and reflection on the topics discussed throughout the course. An opportunity to convey your knowledge on the links between the hydrological cycle, biogeochemical cycles and ecosystem health.</p>
<b>Rationale for learning and teaching in this course.</b>	<p>The structure and content of this course are guided by over 50 years of collective research and consulting experience accumulated by the lecturers. The background knowledge and skills developed in this course are those needed to undertake research or be employed as a consultant in disciplines associated with monitoring ecosystem health, writing environmental impact assessments, and advancing our understanding of Earth's biogeochemical cycles.</p>

#### 5. Course Schedule

Some of this information is available on the [Virtual Handbook](#) and the [UNSW Timetable](#).

UNSW Virtual Handbook: <http://www.handbook.unsw.edu.au/2014/index.html>

UNSW Timetable: <http://www.timetable.unsw.edu.au/>

Refer to the timetable spreadsheet

#### 6. Assessment Tasks and Feedback

Assignment 1 (worth 10% Due Friday week 6)

Analysis of Centennial Park hydrogeological data

Written feedback will be provided within two weeks (provided all students have submitted in a timely manner).

Assignment 2 (worth 20% - due Friday week 7)

Time Series Analysis of Climate Data

Written feedback will be provided within two weeks (provided all students have submitted in a timely manner).

Assignment 3 (worth 30% - poster presentations week 13)

Scientific Poster and Presentation. Graphical and statistical analysis of air and water quality data.

Students will be provided with a grading sheet that assesses

- The visual layout and effectiveness of communication
- Quality of data analysis (appropriate method, handling of units and errors)
- Adherence to the scientific method: background, method, results, discussion and conclusion.

Final Examination (40%)

##### **"Late report submission**

*For reports submitted up to seven (7) days late a 10% per day penalty applies.*

*Reports submitted more than seven (7) days late will not be marked.*

*If medical grounds preclude submission of report by due date, contact should be made with subject authority as soon as possible. A medical certificate will be required for late submission on medical grounds and must be appropriate for extension period."*

## 7. Additional Resources and Support

<b>Text Books</b>	<p><b>Recommended</b></p> <p>Berner K. E. and Berner R.A. (2012) Global Environment: Water, Air, and Geochemical Cycles. 2nd Edition.</p> <p>Fitts C.R. (2013) Groundwater Science. Academic Press</p> <p>Kirkham M.B. (2004) Principles of Soil and Plant Water Relations. Academic Press</p> <p>Kingsford, R.T. Ed. (2006) Ecology of desert rivers. Cambridge: Cambridge University Press.</p> <p>Boulton, A. J. and Brock, M.A. (1999) Australian freshwater ecology: processes and management. Glen Osmond, S. Aust.: Gleneagles Publishing</p>
<b>Course Manual</b>	All lectures will be uploaded onto the online Moodle
<b>Required Readings</b>	Web links to required reading will be provided at the end of each set of lecture slides.
<b>Additional Readings</b>	Web links to additional reading will be given on the lectures slides.
<b>Recommended Internet Sites</b>	Links to internet sites will be provided in the lecture slides.
<b>Societies</b>	<ul style="list-style-type: none"> <li>- International Association of Hydrogeology ( IAH; <a href="http://www.iah.org.au">http://www.iah.org.au</a>)</li> <li>- American Geophysical Union (AGU; <a href="http://sites.agu.org">http://sites.agu.org</a>)</li> <li>- European Geosciences Union (EGU; <a href="https://www.egu.eu">https://www.egu.eu</a>)</li> </ul>
<b>Computer Laboratories or Study Spaces</b>	<p>Computer Laboratory Biological Science Building, Room G11</p> <p>All software used in the course is freely available. WEB links to the software will be provided in the course material.</p>

## 8. Required Equipment, Training and Enabling Skills

<b>Equipment Required</b>	You must wear enclosed footwear and be prepared for wet weather for all field trips.
<b>Enabling Skills Training Required to Complete this Course</b>	Any first year Science courses. A background in chemistry, physics, biology or the environmental sciences is helpful.



## 9. Course Evaluation and Development

Student feedback is gathered periodically by various means. Such feedback is considered carefully with a view to acting on it constructively wherever possible. This course outline conveys how feedback has helped to shape and develop this course.

Mechanisms of Review	Last Review Date	Comments or Changes Resulting from Reviews
Major Course Review		This course has not been reviewed in its current format.
<a href="#">CATEI</a> <sup>6</sup>		None
Other		None

## 10. Administration Matters

*Information about each of the following matters is best presented in a generic School handout or webpage. Reference should be made in every course handout to where the information can be found, and the importance of being familiar with the information.*

<b>Expectations of Students</b>	Attendance at 80% of lectures and laboratories is expected. You are expected to go on all field trips.
<b>Assignment Submissions</b>	Assignments are to be deposited in School of BEES Assignment Box (outside BEES Student Office, Room G27 Biosciences building). Assignment cover sheets are available from: <a href="http://www.bees.unsw.edu.au/current/indexcurrent.html">www.bees.unsw.edu.au/current/indexcurrent.html</a>
<b><a href="#">Occupational Health and Safety</a></b> <sup>7</sup>	<p>The School of BEES recognises its obligations to provide a safe working environment for all persons involved in School-related activities. To achieve this goal with regards to teaching and learning, the School adopts the UNSW Occupational Health and Safety Policy (2001) and the UNSW OH&amp;S Responsibility and Accountability Document (2001). These documents stipulate that everyone attending a UNSW workplace must ensure their actions do not adversely affect the health and safety of others. This outcome is achieved through the establishment of a documented chain of responsibility and accountability for all persons in the workplace, extending from the Head of School through to the students undertaking courses offered by the School of BEES.</p> <p>As part of this chain of responsibility and accountability, the Course Authority is responsible for ensuring all activities associated with this course are safe. The Course Authority has undertaken detailed risk assessments of all course activities and identified all associated potential hazards. These hazards have been minimised and appropriate steps taken to ensure your health and safety. For each activity, clear written instructions are given and appropriate hazard warnings or risk minimisation procedures included for your protection.</p> <p>It is the student's responsibility to prepare for all practical work. Students should be familiar with the written procedures scheduled for the practical class and identify all personal protection requirements needed to complete the exercise in a safe manner. Students must comply with all safety instructions given by the Course Authority and/or Laboratory / Field Demonstrator, and observe the Safety Information located outside or within teaching rooms. If you are unsure of any safe operating procedures or written instruction regarding safety, you should seek further information from the Course Authority and/or Laboratory / Field Demonstrator before attempting the task.</p> <p><b>NOTE: Students should discuss OHS matters in Labs and Field work as</b></p>

<sup>6</sup> Science CATEI procedure: <http://www2.science.unsw.edu.au/guide/slatig/catei.html>

<sup>7</sup> UNSW Occupational Health and Safety: [www.riskman.unsw.edu.au/ohs/ohs.shtml](http://www.riskman.unsw.edu.au/ohs/ohs.shtml)

	<p><b>part of their research with their supervisor. These activities do not fall under the OH&amp;S requirements of BEES 4511/4521/9011</b></p> <p>Failure to comply with safety instructions may, in the first instance, be considered as a form of academic misconduct. If the outcome of a student's failure to comply with safety instructions results in personal injury, or endangers the health and safety of others, then the matter may be dealt with by WorkCover as a breach of the NSW OH&amp;S Act (2000).</p> <p>For more information on OHS and Safety at UNSW visit the following site: <a href="http://www.ohs.unsw.edu.au/">www.ohs.unsw.edu.au/</a> or the relevant pages on the BEES website at: <a href="http://www.bees.unsw.edu.au/ohs">www.bees.unsw.edu.au/ohs</a></p>		
<b>Assessment Procedures</b>	<p><i>Please Read the UNSW Assessment Policy</i></p> <p><a href="https://my.unsw.edu.au/student/academiclife/assessment/AssessmentPolicyNew.html">https://my.unsw.edu.au/student/academiclife/assessment/AssessmentPolicyNew.html</a></p>		
<b>Equity and Diversity</b>	<p>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 Equity Officer (Disability) in the Equity and Diversity Unit (phone: 9385 4734). <a href="http://www.equity.unsw.edu.au/disabil.html">www.equity.unsw.edu.au/disabil.html</a></p> <p>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. Information on designing courses and course outlines that take into account the needs of students with disabilities can be found at: <a href="http://www.secretariat.unsw.edu.au/acboardcom/minutes/coe/disabilityguidelines.pdf">www.secretariat.unsw.edu.au/acboardcom/minutes/coe/disabilityguidelines.pdf</a></p>		
<b><a href="#">Grievance Policy</a><sup>8</sup></b>	<b>School Contact</b>	<b>Faculty Contact</b>	<b>University Contact</b>
	<p>Dr. Jes Sammut (BEES School Grievance Officer) J.Sammut@unsw.edu.au 9385 8281</p> <p>Dr Wendy Shaw (BEES School Equity Officer) w.shaw@unsw.edu.au 9385 3715</p>	<p>A/Prof Julian Cox Associate Dean (Education) <a href="mailto:julian.cox@unsw.edu.au">julian.cox@unsw.edu.au</a> Tel: 9385 8574</p> <p>or</p> <p>Dr Gavin Edwards Associate Dean (Undergraduate Programs) <a href="mailto:g.edwards@unsw.edu.au">g.edwards@unsw.edu.au</a> Tel: 9385 4652</p>	<p>Student Conduct and Appeals Officer (SCAO) within the Office of the Pro-Vice-Chancellor (Students) and Registrar.</p> <p>Telephone 02 9385 8515, email <a href="mailto:studentcomplaints@unsw.edu.au">studentcomplaints@unsw.edu.au</a></p> <p>University Counselling and Psychological Services<sup>9</sup> Tel: 9385 5418</p>

<sup>8</sup> UNSW Grievance Policy: [http://www.infonet.unsw.edu.au/poldoc/student\\_grievance\\_resolution.pdf](http://www.infonet.unsw.edu.au/poldoc/student_grievance_resolution.pdf)

<sup>9</sup> [University Counselling and Psychological Services](#)

## 11. UNSW Academic Honesty and Plagiarism

*The following information should appear in all course outlines or be available on the web in unaltered form. It is recommended, however, that additional discipline-specific advice and/or material be added to assist students wherever possible. Faculty of Science has information on the website<sup>10</sup>:*

### What is Plagiarism?

Plagiarism is the presentation of the thoughts or work of another as one's own.

\*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

<sup>10</sup> Faculty of Science – Academic Misconduct: <http://www2.science.unsw.edu.au/guide/slatig/acadmisc.html>