



UNSW
THE UNIVERSITY OF NEW SOUTH WALES

FACULTY OF SCIENCE
SCHOOL OF CHEMISTRY

CHEM7115

TREATMENT OF ANALYTICAL DATA

SESSION 1, 2010

Faculty of Science - Course Outline

1. Information about the Course

NB: Some of this information is available on the UNSW Handbook¹

Year of Delivery	2010
Course Code	CHEM7115
Course Name	TREATMENT OF ANALYTICAL DATA
Academic Unit	SCHOOL OF CHEMISTRY
Level of Course	Postgraduate
Units of Credit	6 UOC
Session(s) Offered	S1
Prerequisite	None
Hours per Week	3 hours LECTURE / LABORATORY + 3 hours private study
Number of Weeks	12
Commencement Date	Wednesday 3 rd March, 2010

Summary of Course Structure (for details see 'Course Schedule')

Component	HPW	Time	Day	Location
<i>Lectures</i>	1.5			
<i>Lecture 1</i>		6 – 7.30 pm	Wednesday	Chem Sci M18
<i>Laboratory</i>	1.5	7.30 – 9 pm	Wednesday	Gibson lab (Dalton 162A)
<i>Private study</i>	3			
TOTAL	6			
Special Details	None			

2. Staff Involved in the Course

Staff	Role	Name	Contact Details	Consultation Times
Course Convener		Prof D B Hibbert	Room 134 Dalton b.hibbert@unsw.edu.au x 54713	drop in
Additional Teaching Staff	Lecturers & Facilitators	Prof D B Hibbert	Room 134 Dalton b.hibbert@unsw.edu.au x 54713	drop in
	Tutors & Demonstrators	Danmar Gloria	Room 121 Dalton dmgloria@unsw.edu.au	
	Technical & Laboratory Staff			
	Other Support Staff			

¹ UNSW Virtual Handbook: <http://www.handbook.unsw.edu.au/>

3. Course Details

Course Description² (Handbook Entry)	<i>Description of the course from UNSW Handbook</i>	
	<p>This course teaches the basic approaches to the assessment of chemical data. The statistics of the normal distribution and the Central Limit Theorem allow calculation of confidence intervals on repeated measurement results. Hypothesis testing is used to determine the significance of data under hypotheses. Analysis of variance (ANOVA) is explained and its use in determining significant effects in experiments. How to set up a calibration is described and errors associated with calibrations are evaluated. Experimental design to determine significant variables and then to optimise systems are covered.</p> <p>The practical part of the course consists of analysis of data sets in a spreadsheet environment.</p>	
Course Aims³	<p>The course will develop the theory and practice of data analysis as required in an analytical chemistry laboratory.</p> <p>Major areas, such as hypothesis testing, calibration and experimental design will be covered in detail. Experiments in Microsoft Excel compliment the lectures.</p>	
Student Learning Outcomes⁴	<p>You will be able to calculate a mean, standard deviation and confidence interval on repeated data and use this to identify outliers, or if a result conforms with an known value. When data is subjected to a number of effects, you will be able to apply Analysis of Variance (ANOVA) to determine the relative contributions and whether or not they are significant. You will be able to plan experiments to achieve a stated goal (optimise variables using experimental design).</p> <p>For analytical methods that require calibration you will be able to decide an optimum number of calibration points and the linear range, detection limit and uncertainties on values calculated from the calibration line.</p>	
Graduate Attributes Developed in this Course		
Science Graduate Attributes⁵	Select the level of FOCUS 0 = NO FOCUS 1 = MINIMAL 2 = MINOR 3 = MAJOR	Activities / Assessment
1. Research, inquiry and analytical thinking abilities	3	<i>Problems posed during face to face sessions. Practical examples and laboratory classes. /Practical component</i>
2. Capability and motivation for intellectual development	3	<i>Lectures and applied problems discussed in class. / Exam.</i>
3. Ethical, social and professional understanding	2	<i>Throughout course. /Exam</i>
4. Communication	2	<i>Group discussion and write up of practicals</i>
5. Teamwork, collaborative and management skills	3	<i>Laboratory course. / Assessment of practical reports.</i>
6. Information literacy	1	<i>Searching literature for readings</i>
Other attributes	None	
Professional accreditation attributes	RACI – membership of professional body See http://www.raci.org.au/	

² UNSW Virtual Handbook: <http://www.handbook.unsw.edu.au/postgraduate/courses/2010/CHEM7115.html>

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

⁴ Learning outcomes are explicit statements of what we want students to know, understand, or be able to do as a result of completing their chosen course.

⁵ Faculty of Science – Science Graduate Attributes: <http://www2.science.unsw.edu.au/guide/slatig/sciga.html#ScienceGraduateAttributes>

Level of Material Delivered	<input type="checkbox"/> Introduction to material <input checked="" type="checkbox"/> Emphasised and taught in depth <input type="checkbox"/> Reinforced and additional expertise <input type="checkbox"/> Competencies applied
Major Topics (Syllabus Outline)	<p>Introduction Definitions and acronyms. Analysis in Industry. Chemometrics. Automation. Metrology. Legal and Regulatory Issues. Valid analytical measurement. Fitness for purpose.</p> <p>Errors and Uncertainty What are errors? Uncertainty, expressing uncertainty. Distributions — Normal, Poisson, rectangular. Definitions — Mean, variance, standard deviation etc Propagation of error. Uncertainty budgets (briefly, this is covered in detail in CHEM7111).</p> <p>Confidence Limits Confidence limits, Tails, Student t-test, Central Limit Theorem Use of confidence limits — number of experiments.</p> <p>Hypothesis Testing Null hypothesis. Confidence limits. Type I and Type II errors. Testing for outliers (Grubbs' test). Testing means (t-tests). Testing variances (F-test). Analysis of Variance (ANOVA).</p> <p>Calibration Relationships between variables. Linear least squares regression. Calibration in analytical chemistry. Uncertainty in estimated quantities. Detection limits, limits of determination. Standard addition.</p>
Relationship to Other Courses within the Program	<p>The course is part of the program "Chemical Analysis and Laboratory Management" It is particularly useful (although not a prerequisite) for CHEM7111 "Quality Assurance for the Analytical Chemistry Laboratory".</p>

4. Rationale and Strategies Underpinning the Course

Rationale for learning and teaching in this course⁶, i.e., How this course is taught?	<p><i>The integration of lectures and practical examples supports "Engaging"</i></p> <ol style="list-style-type: none"> 1. Effective learning is supported when students are actively engaged in the learning process. 2. Effective learning is supported by a climate of inquiry where students feel appropriately challenged and activities are linked to research and scholarship.
Teaching Strategies	<p><i>Examples from chemical practice allow "Contextualising"</i></p> <ol style="list-style-type: none"> 6. Students become more engaged in the learning process if they can see the relevance of their studies to professional, disciplinary and/or personal contexts. <p><i>We also have undertaken "Designing" to</i></p> <ol style="list-style-type: none"> 10. Clearly articulated expectations, goals, learning outcomes, and course requirements increase student motivation and improve learning. 12. Graduate attributes - the qualities and skills the university hopes its students will develop as a result of their university studies — are most effectively acquired in a disciplinary context. <p><i>"Teaching" in the use of laboratory groups supports</i></p> <ol style="list-style-type: none"> 14. Learning cooperatively with peers — rather than in an individualistic or competitive way — may help students to develop interpersonal, professional, and cognitive skills to a higher level.

⁶ LTU – Teaching Philosophy: http://learningandteaching.unsw.edu.au/content/LT/course_prog_support/graduate_attributes.cfm?ss=2

How the assessment supports and assists the learning

Timely feedback and marking of practical reports allows students to follow the thread of the course. The examination brings together the strands to complete the learning experience.

5. Course Schedule

Some of this information is available in the [UNSW Timetable](#)⁷.

Timetable

Week	Topic	Practical	Hand in # before (final deadline)
1	Basic statistics	#1	
2			
3	Confidence limits	#2	Prac #1 (19/3/2010)
4			
5	In session test		Prac #2 (2/4/2010)
Mid-Session Break			
6	Hypothesis testing	#3	
7			Prac #3 (22/4/2010)
8	ANOVA	#4	
9			Prac #4 (7/5/2010)
10	Calibration	#5	
11			Prac #5 (21/5/2010)
12	NO CLASS – Break (note this is only for this course 7115)		
13	Review and revision		

*NB: As stated in the UNSW Assessment Policy: 'one or more tasks should be set, submitted, marked and returned to students by the mid-point of a course, or no later than the end of Week 6 of a 12-week session'

⁷ UNSW Timetable: <http://www.timetable.unsw.edu.au/>

6. Assessment Tasks and Feedback

Task	% of total mark	Assessment Criteria	Date of		Feedback		
			Release	Submission	WHO	WHEN	HOW
5 Practical reports	50	Questions adequately answered with correct use of spreadsheet	Week 1	Every two weeks via Blackboard	Report assessor	Within 2 weeks of submission of report	Annotated report. Completed result sheet
Use of Blackboard discussion forum	10	Participation in on-line discussion using Blackboard	n/a	Throughout course	DBH	Throughout course	Contributions by DBH to bulletin board
In session test	10	Correctly answer short answer questions and complete spreadsheet questions	Week 5	Week 5	DBH	By end week 6	Individual results via Blackboard
Examination	30	Answers to questions given correctly. Discussion shows knowledge and understanding of the course.	n/a	In Exam period	DBH	With final result	

7. Additional Resources and Support

Text Books	Data Analysis for Chemistry : An Introductory Guide for Students and Laboratory Scientists , D. Brynn Hibbert and JJ Gooding, Oxford University Press, New York, (2006) P 540.72/20
Course Manual	<i>All material is on Blackboard</i>
Required Readings	<i>see Blackboard site</i>
Additional Readings	Quality Assurance in the Analytical Chemistry Laboratory , D B Hibbert, Oxford University Press, New York, (2007) P 543.028/2 <i>also see Blackboard for additional material</i>
Recommended Internet Sites	<i>See Blackboard site</i>
Societies	Royal Australian Chemical Institute http://www.raci.org.au/ Students of Chemistry Society (UNSW) http://www.chem.unsw.edu.au/schoolinfo/socs.html
Computer Laboratories or Study Spaces	<i>Laboratory – Chemical Sciences Building 162B Gibson Computer laboratory – Ground floor, Dalton Building</i>

8. Required Equipment, Training and Enabling Skills

Equipment Required	<i>None</i>
Enabling Skills - training which maybe required to complete this course	<i>OH&S briefing for computer laboratory Awareness of School plagiarism guidelines</i>



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	<i>None – planned review in 2010</i>	
CATEI ⁸	2008;	<p><i>The reviews were all positive. No respondent disagreed with the questions, and most strongly agreed.</i></p> <p><i>These are the written comments</i></p> <p>The best features of this course were</p> <ul style="list-style-type: none"> - that we were able to demonstrate in the computer lab all the theories taught in the lecture. In addition, it was good that Microsoft Excel was chosen as the module to demonstrate all the principles because it is the most readily available computing software. - It provides the basic statistics that required by the workers in very interesting and simple way. - the practical part <p>This course could be improved by</p> <ul style="list-style-type: none"> - The course was delivered in a very structured way. Each subjects was established very well. There is nothing much to improve. Perhaps, adding more sample computations for each type of testing will be helpful. <p>Due to constraint in time some areas of the course was drop. It would be good if there will be a quick discussion about different sampling strategies and sampling uncertainties</p> <ul style="list-style-type: none"> - by starting some activities where the discussion occurs. <p><i>I shall try and use the discussion boards and chat facilities better in 2010</i></p>
Student Focus Group	<i>none</i>	
Other	<i>none</i>	

⁸ Science CATEI procedure: https://www.catei.unsw.edu.au/catei/SYSTEM_LOGIN.login

10. Administration Matters

Expectations of Students	Workload <i>Contact hours are 3 per week. The major out-of-class workload is associated with the laboratory program and reading and reflecting on lecture material.</i>		
Assignment Submissions	<i>Through Blackboard</i>		
Occupational Health and Safety	Risks associated with using computers – see <i>Information on relevant Occupational Health and Safety policies and expectations at UNSW</i> http://www.hr.unsw.edu.au/ohswc/ohs/ohs_home.html/		
Examination Procedures	<i>Examination in usual period after Session counts for 30% of the total mark. Practical assignments must be completed and count for 70% of the total mark.</i>		
Equity and Diversity	<p><i>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 convener 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.equity.unsw.edu.au/disabil.html).</i></p> <p><i>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:</i> www.secretariat.unsw.edu.au/acboardcom/minutes/coe/disabilityguidelines.pdf</p>		
Grievance Policy⁹	School Contact	Faculty Contact	University Contact
	 <p>Dr Gavin Edwards Director of Teaching g.edwards@unsw.edu.au Tel: 9385 4652</p>	 <p>Associate Professor Julian Cox - Associate Dean (Education) BSc, PhD Qld, MAIFST, MIFT T: +61 2 9385 8574 F: +61 2 9385 8219 E: julian.cox@unsw.edu.au</p>	University Counselling Services Tel: 9385 5418

⁹ UNSW Grievance Policy: <https://my.unsw.edu.au/student/atoz/Complaints.html>

11. UNSW Academic Honesty and Plagiarism

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:

<http://www.lc.unsw.edu.au/plagiarism/index.html>

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.

The School has also produced a guide for students in chemistry courses, including examples of acceptable and unacceptable conduct, guidelines on avoiding misconduct in laboratory contexts and examples of acceptable referencing procedures for essays and literature reviews. This guide is available at <http://www.chem.unsw.edu.au/coursenotes/plagiarism/Plagpolicy.03.pdf> and is reproduced where appropriate in course manuals and on course websites.