UNSW Course Outline

CHEM3041 Advanced Analytical Methods - 2024

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General Course Information

Course Code : CHEM3041
Year : 2024
Term : Term 2
Teaching Period : T2
Is a multi-term course? : No
Faculty : Faculty of Science
Academic Unit : School of Chemistry
Delivery Mode : In Person
Delivery Format : Standard
Delivery Location : Kensington
Campus : Sydney
Study Level : Undergraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

Is this water safe to drink, or should a factory be charged for polluting it? And is this a question with only two possible answers? This course investigates analytical chemistry and how it can be applied to issues such as water quality, environmental contaminants, drugs, and doping in

sports.

This course builds on students' existing background in analytical chemistry to develop both theory and practice relating to the latest analytical techniques used in industry and research. This course covers advanced separation techniques, mass spectrometry, electroanalytical chemistry and the use of biologically derived analytical techniques. There are among the most widely used analytical instrumental techniques across a broad range of disciplines and industries, and may also be found in the domestic scene, and are necessary for solving a multitude of real world issues.

Examples of such real world issues are understanding the difference between water or soil not containing any lead vs merely not detecting the presence of lead due to a poor analytical technique; and the difference between a measurement of a drug being higher than a legal limit and being able to conclude with confidence that the drug is present at a level above a legal limit. Importantly, you will also learn to recognise when the appropriate answer is "we don't know".

This course has a theoretical component to teach the theory of these different techniques and the wide variety of applications; combined with a lab component which will provide hands on experience with the analytical techniques to reinforce the theoretical knowledge, followed by a workshop to build data analysis skills.

Course Aims

CHEM3041 aims to provide students with the skills necessary to carry out routine chemical analysis using a variety of instrumentation, along with subsequent analysis of the data; as well as a solid theoretical underpinning to allow development of new analytical methodology.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Justify conclusions and evaluate statements in the context of analytical chemistry through the application of knowledge of standard methods, quality assurance/quality control and statistical analysis.
CLO2 : Explain the principles of advanced separation and mass spectrometry techniques, including liquid and gas chromatography and ion separation techniques and apply them to analytical chemistry problems.
CLO3 : Explain the principles of dynamic electroanalytical chemistry and apply them to analytical chemistry problems.
CLO4 : Explain the principles of utilising biological compounds for analytical chemistry including immunoassays, enzyme assays and lateral flow devices and apply them to analytical chemistry problems.
CLO5 : Proficiently and safely operate modern analytical instrumentation to generate high quality data and subsequently analyse that data to generate and justify conclusions.
CLO6 : Propose an approach to solve an analytical chemistry problem by applying knowledge of analytical chemistry techniques.

Course Learning Outcomes	Assessment Item
CLO1 : Justify conclusions and evaluate statements in the context of analytical chemistry through the application of knowledge of standard methods, quality assurance/quality control and statistical analysis.	• Laboratory work • Analytical Proposal • Mid Term Test • Final Examination
CLO2 : Explain the principles of advanced separation and mass spectrometry techniques, including liquid and gas chromatography and ion separation techniques and apply them to analytical chemistry problems.	• Laboratory work • Analytical Proposal • Mid Term Test
CLO3 : Explain the principles of dynamic electroanalytical chemistry and apply them to analytical chemistry problems.	• Final Examination • Laboratory work • Analytical Proposal
CLO4 : Explain the principles of utilising biological compounds for analytical chemistry including immunoassays, enzyme assays and lateral flow devices and apply them to analytical chemistry problems.	• Final Examination • Laboratory work • Analytical Proposal
CLO5 : Proficiently and safely operate modern analytical instrumentation to generate high quality data and subsequently analyse that data to generate and justify conclusions.	• Laboratory work
CLO6 : Propose an approach to solve an analytical chemistry problem by applying knowledge of analytical chemistry techniques.	• Analytical Proposal

Learning and Teaching Technologies

Moodle - Learning Management System | Echo 360

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Laboratory work Assessment Format: Individual	30%	
Analytical Proposal Assessment Format: Individual	10%	
Mid Term Test Assessment Format: Individual	20%	
Final Examination Assessment Format: Individual	40%	

Assessment Details

Laboratory work

Assessment Overview

During the term there will 8 lab experiments. As part of preparation for these experiment, you will complete a pre-lab quiz including questions on the theoretical underpinnings of the lab, the steps conducted during the lab and key safety considerations for the lab. After the lab you will be required to submit a proforma report in which you record and analyse the results of the lab, and discuss the results.
Reports will be due one week after the lab, and feedback will be provided in the form of annotated reports.

For each lab, the quiz is worth 20% of the mark and the proforma is worth 80%. The final course mark for the lab will be the average mark of the best 6 of 8 labs.

Hurdle requirement: You must attend a minimum of 6 labs, and achieve a score of 50% for this assessment task to be eligible to pass the course.

Course Learning Outcomes

- CLO1 : Justify conclusions and evaluate statements in the context of analytical chemistry through the application of knowledge of standard methods, quality assurance/quality control and statistical analysis.
- CLO2 : Explain the principles of advanced separation and mass spectrometry techniques, including liquid and gas chromatography and ion separation techniques and apply them to analytical chemistry problems.
- CLO3 : Explain the principles of dynamic electroanalytical chemistry and apply them to analytical chemistry problems.
- CLO4 : Explain the principles of utilising biological compounds for analytical chemistry including immunoassays, enzyme assays and lateral flow devices and apply them to analytical chemistry problems.
- CLO5 : Proficiently and safely operate modern analytical instrumentation to generate high quality data and subsequently analyse that data to generate and justify conclusions.

Analytical Proposal

Assessment Overview

You will be provided with an analytical chemistry problem which can be solved using one or more of the techniques used in the lab. Using the knowledge you have gained during the lab program and lectures, you will formulate a plan to address a provided analytical chemistry problem.
This will require you to detail what experimental techniques you will use, what sample

preparation needs to be done, expected data and how this data will be analysed; as well as any dependencies on prior parts of the plan.

Groups and analytical problems will be assigned in the week 7 lab, and a lab class will provide an opportunity to discuss the plan with lab demonstrators and learn how to write a proposal.

This final plan will be due at the end of week 10, with feedback provided in the form of an annotated version of your submission.

Course Learning Outcomes

- CLO1 : Justify conclusions and evaluate statements in the context of analytical chemistry through the application of knowledge of standard methods, quality assurance/quality control and statistical analysis.
- CLO2 : Explain the principles of advanced separation and mass spectrometry techniques, including liquid and gas chromatography and ion separation techniques and apply them to analytical chemistry problems.
- CLO3 : Explain the principles of dynamic electroanalytical chemistry and apply them to analytical chemistry problems.
- CLO4 : Explain the principles of utilising biological compounds for analytical chemistry including immunoassays, enzyme assays and lateral flow devices and apply them to analytical chemistry problems.
- CLO6 : Propose an approach to solve an analytical chemistry problem by applying knowledge of analytical chemistry techniques.

Mid Term Test

Assessment Overview

The mid term test is intended to summarise the theoretical aspects of the course, assessing your understanding of the first 2 topics covered
It will be of 45 minutes duration and will be conducted in week 5.

Questions may consist of a combination of multiple choice, short answer, long response and graphing.

Feedback is available within two weeks of completing the task.

Hurdle requirement: You must achieve a mark of ≥ 35% across assessment tasks 3 and 4 to be eligible to pass the course.

Course Learning Outcomes

- CLO1 : Justify conclusions and evaluate statements in the context of analytical chemistry through the application of knowledge of standard methods, quality assurance/quality control

and statistical analysis.
- CLO2 : Explain the principles of advanced separation and mass spectrometry techniques, including liquid and gas chromatography and ion separation techniques and apply them to analytical chemistry problems.

Final Examination

Assessment Overview

The final exam is intended to summarise the theoretical aspects of the course, assessing your understanding of the topics covered
It will be of 2 hours duration (plus 10 minutes reading time) and will be conducted the formal end of term examination period.

Questions may consist of a combination of multiple choice, short answer, long response and graphing.

Feedback is available via consultation with the course coordinator.

Hurdle requirement: You must achieve a mark of ≥ 35% across assessment tasks 3 and 4 to be eligible to pass the course.

Course Learning Outcomes

- CLO1 : Justify conclusions and evaluate statements in the context of analytical chemistry through the application of knowledge of standard methods, quality assurance/quality control and statistical analysis.
- CLO3 : Explain the principles of dynamic electroanalytical chemistry and apply them to analytical chemistry problems.
- CLO4 : Explain the principles of utilising biological compounds for analytical chemistry including immunoassays, enzyme assays and lateral flow devices and apply them to analytical chemistry problems.

General Assessment Information

Grading Basis

Standard

Requirements to pass course

- You must achieve a weighted average mark of 50% or higher across all assessment tasks.
- You must achieve a weighted average mark of ≥35% out of 100% across both tests to be eligible to pass the course.
- You must attend at least six lab experiments and achieve a score of at least 50% across all lab experiments to be eligible to pass the course.

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 27 May - 2 June	Lecture	Watch the online, pre-recorded lectures for Week 1. See Moodle for details.
	Presentation	Attend the course introductory presentation followed by a Q&A with the Course Convenor. See Moodle for details.
	Laboratory	Attend the teaching laboratory in June Griffith 113 for: (i) a presentation introducing the practical component of the course, (ii) a safety induction and (iii) to perform the Week 1 laboratory experiment. See Moodle for details.
Week 2 : 3 June - 9 June	Lecture	Watch the online, pre-recorded lectures for Week 1. See Moodle for details.
	Laboratory	Attend the laboratory to perform you experiment for this week. See Moodle for details.
Week 3 : 10 June - 16 June	Lecture	Watch the online, pre-recorded lectures for Week 1. See Moodle for details.
	Laboratory	Attend the laboratory to perform you experiment for this week. See Moodle for details.
Week 4 : 17 June - 23 June	Lecture	Watch the online, pre-recorded lectures for Week 1. See Moodle for details.
	Laboratory	Attend the laboratory to perform you experiment for this week. See Moodle for details.
Week 5 : 24 June - 30 June	Lecture	Watch the online, pre-recorded lectures for Week 1. See Moodle for details.
	Laboratory	Attend the laboratory to perform you experiment for this week. See Moodle for details.
	Assessment	Mid-term exam on the first two lecture and tutorial topics (Weeks 1-4 content). See Moodle for details.
Week 7 : 8 July - 14 July	Lecture	Watch the online, pre-recorded lectures for Week 1. See Moodle for details.
	Workshop	Attend the laboratory for the introduction and workshop on your Lab Assignment (Proposal to appraoch an analytical chemistry problem). See Moodle for details.
Week 8 : 15 July - 21 July	Lecture	Watch the online, pre-recorded lectures for Week 1. See Moodle for details.
	Laboratory	Attend the laboratory to perform you experiment for this week. See Moodle for details.
Week 9 : 22 July - 28 July	Lecture	Watch the online, pre-recorded lectures for Week 1. See Moodle for details.
	Laboratory	Attend the laboratory to perform you experiment for this week. See Moodle for details.
Week 10 : 29 July - 4 August	Lecture	Watch the online, pre-recorded lectures for Week 1. See Moodle for details.
	Laboratory	Attend the laboratory to perform you experiment for this week. See Moodle for details.
	Assessment	Your lab assignment (Proposal to approach an analytical chemsitry problem) is due in Week 10.

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

General Schedule Information

Lecture program:

- Weeks 1-10, Pre-recorded online lectures to be watched each week
- Weeks 1-10, Face-to-face tutorials for one hour each week

Additional information:

- Pre-recorded lectures will be released for each week in Weeks 1-10, accessed through

Moodle. Nominally ~3 h of lecture content will be released each week.
- The pre-recorded lecture content release at the start or before the week will be covered in a face-to-face tutorial later in the week.
- The live tutorials will involve a mix of solving example problems and answering student questions. The tutorial sessions will be recorded and available on Moodle.

Laboratory program:

- Labs will be conducted face-to-face in June Griffith Building (F10), Room 113.

Course Resources

Prescribed Resources

See Moodle.

Recommended Resources

See Moodle.

Course Evaluation and Development

See Moodle.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	William Alexander Donald				By appointment	Yes	Yes

Other Useful Information

Academic Information

Upon your enrolment at UNSW, you share responsibility with us for maintaining a safe, harmonious and tolerant University environment.

You are required to:

- Comply with the University's conditions of enrolment.
- Act responsibly, ethically, safely and with integrity.
- Observe standards of equity and respect in dealing with every member of the UNSW community.

- Engage in lawful behaviour.
- Use and care for University resources in a responsible and appropriate manner.
- Maintain the University's reputation and good standing.

For more information, visit the UNSW Student Code of Conduct Website.

Academic Honesty and Plagarism

Referencing is a way of acknowledging the sources of information that you use to research your assignments. You need to provide a reference whenever you draw on someone else's words, ideas or research. Not referencing other people's work can constitute plagiarism.
Further information about referencing styles can be located at https://student.unsw.edu.au/referencing

Academic integrity is fundamental to success at university. Academic integrity can be defined as a commitment to six fundamental values in academic pursuits: honesty, trust, fairness, respect, responsibility and courage. At UNSW, this means that your work must be your own, and others' ideas should be appropriately acknowledged. If you don't follow these rules, plagiarism may be detected in your work.
Further information about academic integrity, plagiarism and the use of AI in assessments can be located at:

- The Current Students site,
- The ELISE training site, and
- The Use of AI for assessments site.

The Student Conduct and Integrity Unit provides further resources to assist you to understand your conduct obligations as a student: https://student.unsw.edu.au/conduct

Submission of Assessment Tasks

Penalty for Late Submissions

UNSW has a standard late submission penalty of:

- 5% per day,
- for all assessments where a penalty applies,
- capped at five days (120 hours) from the assessment deadline, after which a student cannot submit an assessment, and
- no permitted variation.

Any variations to the above will be explicitly stated in the Course Outline for a given course or

assessment task.

Students are expected to manage their time to meet deadlines and to request extensions as early as possible before the deadline.

Special Consideration

If circumstances prevent you from attending/completing an assessment task, you must officially apply for special consideration, usually within 3 days of the sitting date/due date. You can apply by logging onto myUNSW and following the link in the My Student Profile Tab. Medical documentation or other documentation explaining your absence must be submitted with your application. Once your application has been assessed, you will be contacted via your student email address to be advised of the official outcome and any actions that need to be taken from there. For more information about special consideration, please visit: https://student.unsw.edu.au/special-consideration

Important note: UNSW has a "fit to sit/submit" rule, which means that if you sit an exam or submit a piece of assessment, you are declaring yourself fit to do so and cannot later apply for Special Consideration. This is to ensure that if you feel unwell or are faced with significant circumstances beyond your control that affect your ability to study, you do not sit an examination or submit an assessment that does not reflect your best performance. Instead, you should apply for Special Consideration as soon as you realise you are not well enough or are otherwise unable to sit or submit an assessment.

Faculty-specific Information

Additional support for students

- The Current Students Gateway
- Student Support
- Academic Skills and Support
- Student Wellbeing, Health and Safety
- Equitable Learning Services
- UNSW IT Service Centre
- Science EDI Student Initiatives, Offerings and Guidelines