General Information

Unit convenor and teaching staff
Danny Wong
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Building F7B Room 235
No formal consultation hours.

Christopher McRae
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No formal consultation hours.

Credit points
3

Prerequisites
CBMS208 and (CBMS204 or CBMS207)

Corequisites

Co-badged status

Unit description
This unit covers advanced aspects of chemical analysis, building on the foundations laid in CBMS208. Modern chemical principles and practice of identifying substances and of determining their composition are discussed. Topics include many analytical techniques commonly employed in both industrial and academic research laboratories. Examples of applications to environmental and biological samples include: analysis of heavy metals by atomic absorption spectroscopy; inductively coupled plasma atomic emission spectroscopy; advanced chromatographic separation and detection; electrochemical detection of biochemicals and environmental pollutants; analysis by mass spectrometry. The unit emphasises hands-on experience in analysing real life samples, using many of these techniques. Each student also devotes a proportion of the session to gain relevant work experience in off-campus laboratories in chemical industry and research organisations, such as CSIRO.

Important Academic Dates
Information about important academic dates including deadlines for withdrawing from units are available at https://www.mq.edu.au/study/calendar-of-dates
Learning Outcomes

On successful completion of this unit, you will be able to:

* To further appreciate the scope of analytical chemistry, following the foundations laid in CBMS208.
* To acquire hands-on experience in important analytical techniques commonly used in industrial and academic research.
* To improve further on students' scientific writing ability.
* To acquire new generic skills including oral presentation of scientific findings.
* To familiarise with chemical data processing and to draw scientifically sound conclusions from experimental results, leading to an understanding of the significance and validity of analytical results involving real-life samples.
* To provide an opportunity for students to gain work experience in several off-campus laboratories.
* To acquire experience in interacting with other members in teamwork.

Assessment Tasks

<table>
<thead>
<tr>
<th>Name</th>
<th>Weighting</th>
<th>Due</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignment 1</td>
<td>4%</td>
<td>8-04-2016</td>
</tr>
<tr>
<td>Assignment 2</td>
<td>3%</td>
<td>26-04-2016</td>
</tr>
<tr>
<td>Assignment 3</td>
<td>3%</td>
<td>30-05-2016</td>
</tr>
<tr>
<td>Laboratory work</td>
<td>40%</td>
<td>Every two weeks</td>
</tr>
<tr>
<td>Final examination</td>
<td>50%</td>
<td>June 2016</td>
</tr>
</tbody>
</table>

Assignment 1

Due: **8-04-2016**

Weighting: **4%**

Numerical calculations and short answers.

On successful completion you will be able to:

* To further appreciate the scope of analytical chemistry, following the foundations laid in CBMS208.
* To familiarise with chemical data processing and to draw scientifically sound
conclusions from experimental results, leading to an understanding of the significance and validity of analytical results involving real-life samples.

Assignment 2
Due: 26-04-2016
Weighting: 3%

Numerical calculations and short answers.

On successful completion you will be able to:
• * To further appreciate the scope of analytical chemistry, following the foundations laid in CBMS208.
• * To familiarise with chemical data processing and to draw scientifically sound conclusions from experimental results, leading to an understanding of the significance and validity of analytical results involving real-life samples.

Assignment 3
Due: 30-05-2016
Weighting: 3%

Numerical calculations and short answers.

On successful completion you will be able to:
• * To further appreciate the scope of analytical chemistry, following the foundations laid in CBMS208.
• * To familiarise with chemical data processing and to draw scientifically sound conclusions from experimental results, leading to an understanding of the significance and validity of analytical results involving real-life samples.

Laboratory work
Due: Every two weeks
Weighting: 40%

For each experiment, students are required to complete some Pre-laboratory work including Materials Safety Data Sheets and an oral assessment of the general understanding of aim and procedure of the experiment. Following the completion of a laboratory session, students will then decide on either completing a written report or performing an oral assessment on the laboratory work. Students must complete a total of 3 written reports and 2 oral assessments.

On successful completion you will be able to:
• * To further appreciate the scope of analytical chemistry, following the foundations laid in
CBMS208.

• To acquire hands-on experience in important analytical techniques commonly used in industrial and academic research.
• To improve further on students' scientific writing ability.
• To acquire new generic skills including oral presentation of scientific findings.
• To familiarise with chemical data processing and to draw scientifically sound conclusions from experimental results, leading to an understanding of the significance and validity of analytical results involving real-life samples.
• To provide an opportunity for students to gain work experience in several off-campus laboratories.
• To acquire experience in interacting with other members in teamwork.

Final examination
Due: June 2016
Weighting: 50%
A three-hour examination.

On successful completion you will be able to:
• To further appreciate the scope of analytical chemistry, following the foundations laid in CBMS208.
• To familiarise with chemical data processing and to draw scientifically sound conclusions from experimental results, leading to an understanding of the significance and validity of analytical results involving real-life samples.

Delivery and Resources
Technology used
It is important that you have a scientific calculator as hand-held calculators will be used during laboratory sessions, for assignments, and in the final examination. Note that text retrieval calculators are not allowed in the final examination.

Use will be made of Excel and other data processing and display software. Computers carrying this software are available in the teaching laboratories. Items of interest, links to other on-line material will be placed on the unit website.

Prescribed text

Recommended references
Unit Schedule

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>February 29</td>
<td>9:00 – 10:30</td>
<td>Outline of Unit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Calibration Methods</td>
</tr>
<tr>
<td></td>
<td>11:00 – 1:00</td>
<td>Voltammetry</td>
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<tr>
<td></td>
<td>2:00 – 4:00</td>
<td>Information Retrieval</td>
</tr>
<tr>
<td></td>
<td>4:00 – 6:00</td>
<td>Scientific Report Writing</td>
</tr>
<tr>
<td>March 7</td>
<td>9:00 – 1:00</td>
<td>Laboratory Session</td>
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<tr>
<td></td>
<td>2:00 – 3:30</td>
<td>Voltammetry</td>
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<tr>
<td></td>
<td>4:00 – 5:30</td>
<td>Voltammetry</td>
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<tr>
<td></td>
<td></td>
<td>Tutorial Set 1 on Voltammetry</td>
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<tr>
<td></td>
<td></td>
<td>Assignment 1 due at 6 pm, April 8, 2016</td>
</tr>
<tr>
<td>March 14</td>
<td>9:00 – 1:00</td>
<td>Laboratory Session</td>
</tr>
<tr>
<td></td>
<td>2:00 – 3:30</td>
<td>Voltammetry</td>
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<tr>
<td></td>
<td>4:00 – 5:30</td>
<td>Voltammetry</td>
</tr>
<tr>
<td>March 21</td>
<td>9:00 – 1:00</td>
<td>Laboratory Session</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Activity</th>
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<tbody>
<tr>
<td>April 4</td>
<td>9:00 – 1:00</td>
<td>Laboratory Session</td>
</tr>
<tr>
<td></td>
<td>2:00 – 3:30</td>
<td>Electrophoresis</td>
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<td></td>
<td>4:00 – 5:30</td>
<td>Electrophoresis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tutorial Set 3 on Electrophoresis</td>
</tr>
<tr>
<td>May 2</td>
<td>9:00 – 1:00</td>
<td>Laboratory Session</td>
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<tr>
<td></td>
<td>2:00 – 3:30</td>
<td>Mass Spectroscopy</td>
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<tr>
<td></td>
<td>4:00 – 5:30</td>
<td>Mass Spectroscopy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Assignment 2 due at 6 pm, April 26, 2016</td>
</tr>
<tr>
<td>May 9</td>
<td>9:00 – 1:00</td>
<td>Laboratory Session</td>
</tr>
<tr>
<td></td>
<td>2:00 – 3:30</td>
<td>Mass Spectroscopy</td>
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<tr>
<td></td>
<td>4:00 – 5:30</td>
<td>Chromatography</td>
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<tr>
<td></td>
<td></td>
<td>Tutorial Set 4 on Mass Spectroscopy</td>
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<tr>
<td>May 16</td>
<td>9:00 – 1:00</td>
<td>Laboratory Session</td>
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<tr>
<td></td>
<td>2:00 – 3:30</td>
<td>Chromatography</td>
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<tr>
<td></td>
<td>4:00 – 5:30</td>
<td>Chromatography</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tutorial Set 4 on Chromatography</td>
</tr>
</tbody>
</table>
Assignment 3 due at 6 pm, May 30, 2016

June 6
9:00 – 10:30 Immunoassays
11:00 – 12:30 Immunoassays

Tutorial Set 5 on Immunoassays

1:30 – 5:30 Presentation of project work (CBMS825)

April 25, May 16, May 23 and May 30 - Off-campus Laboratory Visits

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central. Students should be aware of the following policies in particular with regard to Learning and Teaching:

Academic Honesty Policy http://mq.edu.au/policy/docs/academic_honesty/policy.html


Disruption to Studies Policy http://www.mq.edu.au/policy/docs/disruption_studies/policy.html The Disruption to Studies Policy is effective from March 3 2014 and replaces the Special Consideration Policy.

In addition, a number of other policies can be found in the Learning and Teaching Category of Policy Central.

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of
Graduate Capabilities

Creative and Innovative

Our graduates will also be capable of creative thinking and of creating knowledge. They will be imaginative and open to experience and capable of innovation at work and in the community. We want them to be engaged in applying their critical, creative thinking.

This graduate capability is supported by:
Learning outcome

• * To improve further on students' scientific writing ability.

Capable of Professional and Personal Judgement and Initiative

We want our graduates to have emotional intelligence and sound interpersonal skills and to demonstrate discernment and common sense in their professional and personal judgement. They will exercise initiative as needed. They will be capable of risk assessment, and be able to handle ambiguity and complexity, enabling them to be adaptable in diverse and changing environments.

This graduate capability is supported by:

Learning outcomes

• * To further appreciate the scope of analytical chemistry, following the foundations laid in CBMS208.
• * To acquire hands-on experience in important analytical techniques commonly used in industrial and academic research.
• * To improve further on students' scientific writing ability.
• * To acquire new generic skills including oral presentation of scientific findings.
• * To familiarise with chemical data processing and to draw scientifically sound conclusions from experimental results, leading to an understanding of the significance and validity of analytical results involving real-life samples.
• * To provide an opportunity for students to gain work experience in several off-campus laboratories.
• * To acquire experience in interacting with other members in teamwork.

Assessment tasks

• Assignment 1
• Assignment 2
• Assignment 3
• Laboratory work
• Final examination

Commitment to Continuous Learning

Our graduates will have enquiring minds and a literate curiosity which will lead them to pursue knowledge for its own sake. They will continue to pursue learning in their careers and as they participate in the world. They will be capable of reflecting on their experiences and relationships with others and the environment, learning from them, and growing - personally, professionally and socially.
This graduate capability is supported by:

**Learning outcomes**

- * To further appreciate the scope of analytical chemistry, following the foundations laid in CBMS208.
- * To acquire hands-on experience in important analytical techniques commonly used in industrial and academic research.
- * To improve further on students' scientific writing ability.
- * To acquire new generic skills including oral presentation of scientific findings.
- * To familiarise with chemical data processing and to draw scientifically sound conclusions from experimental results, leading to an understanding of the significance and validity of analytical results involving real-life samples.
- * To provide an opportunity for students to gain work experience in several off-campus laboratories.
- * To acquire experience in interacting with other members in teamwork.

**Assessment tasks**

- Assignment 1
- Assignment 2
- Assignment 3
- Laboratory work
- Final examination

**Discipline Specific Knowledge and Skills**

Our graduates will take with them the intellectual development, depth and breadth of knowledge, scholarly understanding, and specific subject content in their chosen fields to make them competent and confident in their subject or profession. They will be able to demonstrate, where relevant, professional technical competence and meet professional standards. They will be able to articulate the structure of knowledge of their discipline, be able to adapt discipline-specific knowledge to novel situations, and be able to contribute from their discipline to inter-disciplinary solutions to problems.

This graduate capability is supported by:

**Learning outcomes**

- * To further appreciate the scope of analytical chemistry, following the foundations laid in CBMS208.
- * To acquire hands-on experience in important analytical techniques commonly used in industrial and academic research.
- * To improve further on students' scientific writing ability.
• * To acquire new generic skills including oral presentation of scientific findings.
• * To familiarise with chemical data processing and to draw scientifically sound conclusions from experimental results, leading to an understanding of the significance and validity of analytical results involving real-life samples.
• * To provide an opportunity for students to gain work experience in several off-campus laboratories.

Assessment tasks

• Assignment 1
• Assignment 2
• Assignment 3
• Laboratory work
• Final examination

Critical, Analytical and Integrative Thinking

We want our graduates to be capable of reasoning, questioning and analysing, and to integrate and synthesise learning and knowledge from a range of sources and environments; to be able to critique constraints, assumptions and limitations; to be able to think independently and systemically in relation to scholarly activity, in the workplace, and in the world. We want them to have a level of scientific and information technology literacy.

This graduate capability is supported by:

Learning outcomes

• * To further appreciate the scope of analytical chemistry, following the foundations laid in CBMS208.
• * To acquire hands-on experience in important analytical techniques commonly used in industrial and academic research.
• * To improve further on students' scientific writing ability.
• * To acquire new generic skills including oral presentation of scientific findings.
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• * To provide an opportunity for students to gain work experience in several off-campus laboratories.

Assessment tasks

• Assignment 1
• Assignment 2
Problem Solving and Research Capability

Our graduates should be capable of researching; of analysing, and interpreting and assessing data and information in various forms; of drawing connections across fields of knowledge; and they should be able to relate their knowledge to complex situations at work or in the world, in order to diagnose and solve problems. We want them to have the confidence to take the initiative in doing so, within an awareness of their own limitations.

This graduate capability is supported by:

Learning outcomes

- * To further appreciate the scope of analytical chemistry, following the foundations laid in CBMS208.
- * To acquire hands-on experience in important analytical techniques commonly used in industrial and academic research.
- * To improve further on students' scientific writing ability.
- * To acquire new generic skills including oral presentation of scientific findings.
- * To provide an opportunity for students to gain work experience in several off-campus laboratories.

Assessment tasks

- Assignment 1
- Assignment 2
- Assignment 3
- Laboratory work
- Final examination

Effective Communication

We want to develop in our students the ability to communicate and convey their views in forms effective with different audiences. We want our graduates to take with them the capability to read, listen, question, gather and evaluate information resources in a variety of formats, assess, write clearly, speak effectively, and to use visual communication and communication technologies as appropriate.

This graduate capability is supported by:

Learning outcomes

- * To further appreciate the scope of analytical chemistry, following the foundations laid in
CBMS208.

• To acquire hands-on experience in important analytical techniques commonly used in industrial and academic research.

• To improve further on students' scientific writing ability.

• To familiarise with chemical data processing and to draw scientifically sound conclusions from experimental results, leading to an understanding of the significance and validity of analytical results involving real-life samples.

• To provide an opportunity for students to gain work experience in several off-campus laboratories.

• To acquire experience in interacting with other members in teamwork.

Assessment tasks

• Assignment 1
• Assignment 2
• Assignment 3
• Laboratory work
• Final examination

Engaged and Ethical Local and Global citizens

As local citizens our graduates will be aware of indigenous perspectives and of the nation's historical context. They will be engaged with the challenges of contemporary society and with knowledge and ideas. We want our graduates to have respect for diversity, to be open-minded, sensitive to others and inclusive, and to be open to other cultures and perspectives: they should have a level of cultural literacy. Our graduates should be aware of disadvantage and social justice, and be willing to participate to help create a wiser and better society.

This graduate capability is supported by:

Learning outcomes

• To further appreciate the scope of analytical chemistry, following the foundations laid in CBMS208.

• To acquire hands-on experience in important analytical techniques commonly used in industrial and academic research.

• To improve further on students' scientific writing ability.

• To acquire new generic skills including oral presentation of scientific findings.

• To familiarise with chemical data processing and to draw scientifically sound conclusions from experimental results, leading to an understanding of the significance and validity of analytical results involving real-life samples.

• To provide an opportunity for students to gain work experience in several off-campus laboratories.
laboratories.
  • * To acquire experience in interacting with other members in teamwork.

Assessment tasks
  • Assignment 1
  • Assignment 2
  • Assignment 3
  • Laboratory work
  • Final examination

Socially and Environmentally Active and Responsible
We want our graduates to be aware of and have respect for self and others; to be able to work with others as a leader and a team player; to have a sense of connectedness with others and country; and to have a sense of mutual obligation. Our graduates should be informed and active participants in moving society towards sustainability.

This graduate capability is supported by:

Learning outcomes
  • * To further appreciate the scope of analytical chemistry, following the foundations laid in CBMS208.
  • * To acquire hands-on experience in important analytical techniques commonly used in industrial and academic research.
  • * To improve further on students' scientific writing ability.
  • * To acquire new generic skills including oral presentation of scientific findings.
  • * To familiarise with chemical data processing and to draw scientifically sound conclusions from experimental results, leading to an understanding of the significance and validity of analytical results involving real-life samples.
  • * To provide an opportunity for students to gain work experience in several off-campus laboratories.
  • * To acquire experience in interacting with other members in teamwork.

Assessment tasks
  • Assignment 1
  • Assignment 2
  • Assignment 3
  • Laboratory work
  • Final examination