CBMS860
Analytical Measurement Uncertainty and Method Validation
S1 Evening 2017
Dept of Chemistry & Biomolecular Sciences

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General Information

Unit convenor and teaching staff
Danny Wong
danny.wong@mq.edu.au

Credit points
4

Prerequisites
Admission to MLabQAMgt or MSc or MBiotech or MBioBus or MRadiopharmSc

Corequisites

Co-badged status

Unit description
Chemical measurements are required in forensic science, local and international trade, manufacture and production, government regulatory agencies, biotechnology, and nearly every field of science. However, there are always uncertainties associated with measurements owing to experimental errors. This unit systematically covers the estimation principles of measurement uncertainty of values deriving from analytical chemistry measurement procedures and a logical approach to the process of validating an analytical chemistry measurement method. These will then be applied to specific examples from common analytical chemistry.

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 understand the concept of making valid analytical measurements
To understand the meaning of, and to be able to evaluate, method performance characteristics
To define the requirements for valid measurements with respect to international standards
To understand the process of deconstructing a method so that factors that influence the final result can be identified
To familiarise with commonly applied statistical techniques for evaluation of chemical
Assessment Tasks

<table>
<thead>
<tr>
<th>Name</th>
<th>Weighting</th>
<th>Hurdle</th>
<th>Due</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignment 1</td>
<td>4%</td>
<td>No</td>
<td>22-03-2017</td>
</tr>
<tr>
<td>Assignment 2</td>
<td>6%</td>
<td>No</td>
<td>19-04-2017</td>
</tr>
<tr>
<td>Assignment 3</td>
<td>10%</td>
<td>No</td>
<td>17-05-2017</td>
</tr>
<tr>
<td>Assignment 4</td>
<td>10%</td>
<td>No</td>
<td>31-05-2017</td>
</tr>
<tr>
<td>Project</td>
<td>15%</td>
<td>No</td>
<td>Week 13</td>
</tr>
<tr>
<td>Final Examination</td>
<td>55%</td>
<td>No</td>
<td>June 2017</td>
</tr>
</tbody>
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Assignment 1
Due: 22-03-2017
Weighting: 4%
Numerical calculation and short answer type.

On successful completion you will be able to:
  • To understand the concept of making valid analytical measurements
  • To understand the meaning of, and to be able to evaluate, method performance characteristics
  • To define the requirements for valid measurements with respect to international standards
  • To understand the process of deconstructing a method so that factors that influence the final result can be identified
  • To familiarise with commonly applied statistical techniques for evaluation of chemical data

Assignment 2
Due: 19-04-2017
Weighting: 6%
Numerical calculations and short answer type.

On successful completion you will be able to:
• To understand the concept of making valid analytical measurements
• To understand the meaning of, and to be able to evaluate, method performance characteristics
• To define the requirements for valid measurements with respect to international standards
• To understand the process of deconstructing a method so that factors that influence the final result can be identified
• To familiarise with commonly applied statistical techniques for evaluation of chemical data

Assignment 3
Due: 17-05-2017
Weighting: 10%
Numerical calculations and short answer type.

On successful completion you will be able to:
• To understand the concept of making valid analytical measurements
• To understand the meaning of, and to be able to evaluate, method performance characteristics
• To define the requirements for valid measurements with respect to international standards
• To understand the process of deconstructing a method so that factors that influence the final result can be identified
• To familiarise with commonly applied statistical techniques for evaluation of chemical data

Assignment 4
Due: 31-05-2017
Weighting: 10%
Numerical calculations and short answer type.

On successful completion you will be able to:
• To understand the concept of making valid analytical measurements
• To understand the meaning of, and to be able to evaluate, method performance characteristics
• To define the requirements for valid measurements with respect to international standards
standards
• To understand the process of deconstructing a method so that factors that influence the final result can be identified
• To familiarise with commonly applied statistical techniques for evaluation of chemical data

Project
Due: Week 13
Weighting: 15%

A written report based on a research work that encompasses all theoretical concepts covered in the unit.

On successful completion you will be able to:
• To understand the concept of making valid analytical measurements
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• To define the requirements for valid measurements with respect to international standards
• To understand the process of deconstructing a method so that factors that influence the final result can be identified
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Final Examination
Due: June 2017
Weighting: 55%

A 3-hour written examination.

On successful completion you will be able to:
• To understand the concept of making valid analytical measurements
• To understand the meaning of, and to be able to evaluate, method performance characteristics
• To define the requirements for valid measurements with respect to international standards
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Delivered and Resources

Technology Used

It is important that you have a scientific calculator as hand-held calculators will be used 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.

The University does provide computers for general use, but it would be advantageous to have your own computer and internet access.

Prescribed text


Recommended references


ISO/IEC International Standard 17025 General Requirements for the competence of testing and calibration laboratories, ISO, 2005

In House Method Validation: A guide for Chemical Laboratories, LGC Ltd, 2003

Eurachem Guide: the Fitness for purpose of analytical methods, LGC Ltd, 1988


Useful websites

Eurachem -http://www.eurachem.org/
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:


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 Conduct: [https://students.mq.edu.au/support/student_conduct/](https://students.mq.edu.au/support/student_conduct/)

Results

Results shown in iLearn, or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in eStudent. For more information visit ask.mq.edu.au.

Student Support

Macquarie University provides a range of support services for students. For details, visit [http://students.mq.edu.au/support/](http://students.mq.edu.au/support/)

Learning Skills

Learning Skills ([mq.edu.au/learningskills](http://mq.edu.au/learningskills)) provides academic writing resources and study strategies to improve your marks and take control of your study.
Student Services and Support

Students with a disability are encouraged to contact the Disability Service who can provide appropriate help with any issues that arise during their studies.

Student Enquiries

For all student enquiries, visit Student Connect at ask.mq.edu.au

IT Help

For help with University computer systems and technology, visit http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/.

When using the University’s IT, you must adhere to the Acceptable Use of IT Resources Policy. The policy applies to all who connect to the MQ network including students.

Graduate Capabilities

PG - Capable of Professional and Personal Judgment and Initiative

Our postgraduates will demonstrate a high standard of discernment and common sense in their professional and personal judgment. They will have the ability to make informed choices and decisions that reflect both the nature of their professional work and their personal perspectives.

This graduate capability is supported by:

Learning outcomes

• To understand the concept of making valid analytical measurements
• To understand the meaning of, and to be able to evaluate, method performance characteristics
• To define the requirements for valid measurements with respect to international standards
• To understand the process of deconstructing a method so that factors that influence the final result can be identified
• To familiarise with commonly applied statistical techniques for evaluation of chemical data

Assessment tasks

• Assignment 1
PG - Discipline Knowledge and Skills

Our postgraduates will be able to demonstrate a significantly enhanced depth and breadth of knowledge, scholarly understanding, and specific subject content knowledge in their chosen fields.

This graduate capability is supported by:

**Learning outcomes**

- To understand the concept of making valid analytical measurements
- To understand the meaning of, and to be able to evaluate, method performance characteristics
- To define the requirements for valid measurements with respect to international standards
- To understand the process of deconstructing a method so that factors that influence the final result can be identified
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**Assessment tasks**

- Assignment 1
- Assignment 2
- Assignment 3
- Assignment 4
- Project
- Final Examination

PG - Critical, Analytical and Integrative Thinking

Our postgraduates will be capable of utilising and reflecting on prior knowledge and experience, of applying higher level critical thinking skills, and of integrating and synthesising learning and knowledge from a range of sources and environments. A characteristic of this form of thinking is the generation of new, professionally oriented knowledge through personal or group-based critique of practice and theory.

This graduate capability is supported by:
Learning outcomes

• To understand the concept of making valid analytical measurements
• To understand the meaning of, and to be able to evaluate, method performance characteristics
• To define the requirements for valid measurements with respect to international standards
• To understand the process of deconstructing a method so that factors that influence the final result can be identified
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Assessment tasks

• Assignment 1
• Assignment 2
• Assignment 3
• Assignment 4
• Project
• Final Examination

PG - Research and Problem Solving Capability

Our postgraduates will be capable of systematic enquiry; able to use research skills to create new knowledge that can be applied to real world issues, or contribute to a field of study or practice to enhance society. They will be capable of creative questioning, problem finding and problem solving.

This graduate capability is supported by:

Learning outcomes

• To understand the concept of making valid analytical measurements
• To understand the meaning of, and to be able to evaluate, method performance characteristics
• To define the requirements for valid measurements with respect to international standards
• To understand the process of deconstructing a method so that factors that influence the final result can be identified
• To familiarise with commonly applied statistical techniques for evaluation of chemical data
Assessment tasks

- Assignment 1
- Assignment 2
- Assignment 3
- Assignment 4
- Project
- Final Examination

PG - Effective Communication

Our postgraduates will be able to communicate effectively and convey their views to different social, cultural, and professional audiences. They will be able to use a variety of technologically supported media to communicate with empathy using a range of written, spoken or visual formats.

This graduate capability is supported by:

Learning outcomes

- To understand the concept of making valid analytical measurements
- To understand the meaning of, and to be able to evaluate, method performance characteristics
- To define the requirements for valid measurements with respect to international standards
- To understand the process of deconstructing a method so that factors that influence the final result can be identified
- To familiarise with commonly applied statistical techniques for evaluation of chemical data

Assessment tasks

- Assignment 1
- Assignment 2
- Assignment 3
- Assignment 4
- Project
- Final Examination

PG - Engaged and Responsible, Active and Ethical Citizens

Our postgraduates will be ethically aware and capable of confident transformative action in relation to their professional responsibilities and the wider community. They will have a sense of connectedness with others and country and have a sense of mutual obligation. They will be able
to appreciate the impact of their professional roles for social justice and inclusion related to national and global issues.

This graduate capability is supported by:

**Learning outcomes**

- To understand the concept of making valid analytical measurements
- To understand the meaning of, and to be able to evaluate, method performance characteristics
- To define the requirements for valid measurements with respect to international standards
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**Assessment tasks**

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- Project
- Final Examination