CBMS760

Analytical Measurement Uncertainty and Method Validation

S1 Evening 2019

Dept of Molecular Sciences

Contents

General Information

Unit convenor and teaching staff
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Credit points
4

Prerequisites
Admission to MRes

Corequisites

Co-badged status
CBMS860

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 interpret the concept of making valid analytical measurements

To identify and then to evaluate analytical method performance characteristics

To identify the requirements for valid measurements with respect to international standards

To deconstruct an analytical method in order to identify factors that influence the final result

To evaluate the validity of chemical data using commonly applied statistical techniques

General Assessment Information

In addition to hardcopies, all assessment items must be electronically submitted through turnitin. A permanent record of all assessment items must be kept on ILearn.

Assessment Tasks

Name	Weighting	Hurdle	Due
Assignment 1	4%	No	22-03-2019
Assignment 2	6%	No	18-04-2019
Assignment 3	10%	No	17-05-2019
Assignment 4	10%	No	31-05-2019
Project	15%	No	Week 13
Final Examination	55%	No	June 2019

Assignment 1

Due: **22-03-2019**
Weighting: **4%**

Numerical calculation and short answer type.

On successful completion you will be able to:

- To interpret the concept of making valid analytical measurements
- To identify and then to evaluate analytical method performance characteristics
- To identify the requirements for valid measurements with respect to international standards
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- To evaluate the validity of chemical data using commonly applied statistical techniques

Assignment 2

Due: **18-04-2019**
Weighting: **6%**

Numerical calculations and short answer type.

On successful completion you will be able to:

- To interpret the concept of making valid analytical measurements
- To identify and then to evaluate analytical method performance characteristics
- To identify the requirements for valid measurements with respect to international standards
- To deconstruct an analytical method in order to identify factors that influence the final result
- To evaluate the validity of chemical data using commonly applied statistical techniques

Assignment 3

Due: **17-05-2019**
Weighting: **10%**

Numerical calculations and short answer type.

On successful completion you will be able to:

- To interpret the concept of making valid analytical measurements
- To identify and then to evaluate analytical method performance characteristics
- To identify the requirements for valid measurements with respect to international standards
- To deconstruct an analytical method in order to identify factors that influence the final result
- To evaluate the validity of chemical data using commonly applied statistical techniques

Assignment 4

Due: **31-05-2019**
Weighting: **10%**

Numerical calculations and short answer type.

On successful completion you will be able to:

- To interpret the concept of making valid analytical measurements
- To identify and then to evaluate analytical method performance characteristics
- To identify the requirements for valid measurements with respect to international standards
- To deconstruct an analytical method in order to identify factors that influence the final result
- To evaluate the validity of chemical data using commonly applied statistical techniques

Project

Due: **Week 13**
Weighting: **15%**

An oral presentation based on a relevant statistical tool not covered in the unit.

On successful completion you will be able to:

- To interpret the concept of making valid analytical measurements
- To identify and then to evaluate analytical method performance characteristics
- To identify the requirements for valid measurements with respect to international standards
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Final Examination

Due: **June 2019**
Weighting: **55%**

A 3-hour written examination.

On successful completion you will be able to:

- To interpret the concept of making valid analytical measurements
- To identify and then to evaluate analytical method performance characteristics
- To identify the requirements for valid measurements with respect to international standards
- To deconstruct an analytical method in order to identify factors that influence the final result
- To evaluate the validity of chemical data using commonly applied statistical techniques

Delivery 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

J.N.Miller, J,C.Miller, *Statistics and Chemometrics for Analytical Chemistry*, 6th Edition, Pearson Prentice Hall, 2010 (ISBN: 978-0-273-73042-2)

Recommended references

D.C.Montgomery, *Design and Analysis of Experiments*, 6th Edition, John Wiley & Sons, 2005 (ISBN: 0 471 48735 X)

R.G.Brereton, *Applied Chemometrics for Scientists*, John Wiley & Sons, 2007 (ISBN: 978 0 470 01686 2)

J.Lawson, J.Erjavec, *Modern Statistics for Engineering and Quality Improvement*, Duxbury Thomson Learning, 2001 (ISBN: 0 534 19050 2)

Eurachem/CITAC Guide: Traceability in Chemical Measurement, Eurachem and CITAC, 2003

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

Eurachem/CITAC Guide CG4: Quantifying Uncertainty in Analytical Measurement 2nd Edition, Eurachem & CITAC, 2000

L.Kirkup, *Data Analysis with Excel: An introduction for physical scientists*, Cambridge University Press, 2002

D.B.Hibbert, *Quality Assurance for the Analytical Chemistry Laboratory*, Oxford University Press, 2007

Useful websites

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

NIST/SEMATECH Engineering Statistics Handbook http://www.itl.nist.gov/div898/handbook/index.htm

Valid Analytical Measurements http://www.vam.org.uk/home.asp

CITAC - http://www.citac.cc/

AOAC - http://www.aoac.org/

NATA - http://www.nata.com.au/publication-updates and download “Technical Note 17”.

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-centr

al). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- Academic Appeals Policy
- Academic Integrity Policy
- Academic Progression Policy
- Assessment Policy
- Fitness to Practice Procedure
- Grade Appeal Policy
- Complaint Management Procedure for Students and Members of the Public
- Special Consideration Policy *(**Note:** The Special Consideration Policy is effective from 4 December 2017 and replaces the Disruption to Studies Policy.)*

Undergraduate students seeking more policy resources can visit the Student Policy Gateway (https://students.mq.edu.au/support/study/student-policy-gateway). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

If you would like to see all the policies relevant to Learning and Teaching visit Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/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/study/getting-started/student-conduct

Results

Results published on platform other than eStudent, (eg. iLearn, Coursera etc.) 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 or if you are a Global MBA student contact globalmba.support@mq.edu.au

Student Support

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

Learning Skills

Learning Skills (mq.edu.au/learningskills) provides academic writing resources and study strategies to improve your marks and take control of your study.

- Workshops
- StudyWise
- Academic Integrity Module for Students
- Ask a Learning Adviser

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

If you are a Global MBA student contact globalmba.support@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 interpret the concept of making valid analytical measurements
- To identify and then to evaluate analytical method performance characteristics
- To identify the requirements for valid measurements with respect to international standards
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- To evaluate the validity of chemical data using commonly applied statistical techniques

Assessment tasks

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

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 interpret the concept of making valid analytical measurements
- To identify and then to evaluate analytical method performance characteristics
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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 interpret the concept of making valid analytical measurements
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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 interpret the concept of making valid analytical measurements
- To identify and then to evaluate analytical method performance characteristics
- To identify the requirements for valid measurements with respect to international standards
- To deconstruct an analytical method in order to identify factors that influence the final result
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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 interpret the concept of making valid analytical measurements
- To identify and then to evaluate analytical method performance characteristics
- To identify the requirements for valid measurements with respect to international standards
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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 interpret the concept of making valid analytical measurements
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