ENGG255

Data Analysis and Visualisation

S1 Day 2018

Dept of Engineering

Contents

General Information

Unit convenor and teaching staff
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Credit points
3

Prerequisites
COMP115 and ENGG150 and (MATH132 or MATH135)

Corequisites

Co-badged status

Unit description
This unit provides knowledge and skills for further study in electrical and mechanical disciplines of engineering. Sound engineering relies on adequate modelling and visualisation of data. This unit develops the concept that engineering data consists of discrete and vectored quantities that is fit to a model of reality. Foundation knowledge and skill in computer programming, electrical and mechanical concepts, and mathematics is assumed. The concept of data as discrete numerical vectors is developed using computer controlled interfaces to acquire real electrical and mechanical measurements. Spreadsheets and numerical computing environments, are introduced and used to manipulate, process, view and present data. The adequacy of simple models of transient responses, temperature dependence, and other physical process is explored. Judgement is developed in the appropriate visualisation of data to best expose physical processes and check the design of experiment. The concepts developed in this unit are required in the advanced engineering units for treatment of modelling, simulation, optimisation, and computer aided design. The skills in this unit also will be used in subsequent engineering units dealing with presentation of data.

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:

Demonstrate a good understanding of different types of data and methods of data visualisation: To achieve the skill in different methods of data visualisation to present the information in the most understandable way.
To apply foundational scientific knowledge (mathematics, physics and engineering) in collecting and processing engineering data. This requires knowledge on data acquisition systems, design of experiments, noise and error analysis.
Develop students' knowledge in engineering through the relationship between theoretical, mathematical and computational modelling to solve real world and complex engineering problems

General Assessment Information

General Assessment Information

Notifications

Formal notification of assessment tasks, grading rubrics and due dates will be posted on iLearn. Although all reasonable measures to ensure the information is accurate, the University reserves the right to make changes without notice. Each student is responsible for checking iLearn for changes and updates.

Weekly Plan

A weekly plan of lectures, assignments, tests, laboratory and workshop sessions will be posted on iLearn. Students are expected to be aware of possible minor variations.

Assignment Tasks

Assignment questions will be posted on iLearn. Assignment solutions will be posted within one to three days after the submission date. Submissions will not be accepted once the solution is posted.

All assignments must be submitted electronically through iLearn (in pdf format). Submissions are expected to be typed in a logical layout and sequence. Markers WILL NOT grade poorly organized or illegible scans or drafts. The expected workload includes preparation of final copies and clear diagrams. Resubmissions will be permitted up to due date.

All assignments should be prepared individually. It is expected that students consult tutors, lecturers or other students while learning the concepts, but copying assignments from others is not accepted. Students are expected to have read and understood the academic honesty policy.

Absences

Late notices or absences from tests, workshops and laboratories will be considered under extenuating circumstances upon lodgement and approval of a formal notice of disruption of studies.

Grading

To obtain a passing grade (P/CR/D/HD) a total mark of 50 more is required AND a mark of 50 or more is required for the final examination. The final exam is a hurdle requirement because it is the only reliable assessment of individual performance for this unit. A passing grade of 50% or more in the final examination is a condition of passing this unit. Students who make a serious attempt but fail to meet the hurdle requirement will be given one further opportunity to pass. A serious attempt is defined as achievement of a mark of 40% or greater.

Laboratory

Due: Weekly

Weighting: 20%

Practical sessions start in Week 2. They are comprised of laboratory or problem-solving workshop sessions linked to each learning outcome; and they are compulsory for all students. Students are expected to arrive on time and use the laboratory time efficiently. Students should enroll to one practical class at the beginning of the semester. Laboratory or workshop worksheets, required data and other necessary items will be posted on iLearn prior to the weekly sessions and it is compulsory for students to complete the preparatory work before coming to the session.

Practicals will be largely assessed in class but there will some "take-home assignment" for the laboratory sections. There will be one final exam from practical contents in week 13. More information will be available on iLearn.

In laboratory sessions, students learn how to utilize their data visualisation knowledge in processing real-world engineering problems. Students will work on different skills such as advance plotting in MATLAB and Excel, programming in MATLAB, data visualisation and programming in LabVIEW. Students do not need to bring their personal laptop to the laboratory session. Computers with required software (such as MATLAB, Excel, LabVIEW will be provided.

Each student must have a bound notebook to be used as a logbook (A4 size preferred, graph pages are not required). This logbook should be used for all practical work including preliminary and post (reflection) work. It should contain dates, calculations and results recorded during these sessions, in time order. On the completion of each session, logbook entries must be signed and dated by a tutor. Logbooks must be kept in good order for a final check at the end of the semester.

Food and drink are not permitted in the laboratory. Students will not be permitted to enter the laboratory without appropriate footwear. Thongs and sandals are not acceptable.

Assignments:

Assessment Tasks are relates to the following Learning Outcomes:

1. Demonstrate practical use of MATLAB and Excel in plotting different types of data, image and

video processing

2. Demonstrate creativity and initiative in developing data processing

3. Demonstrate practical use of mathematical techniques in solving engineering questions

Assignment 1

Due: Week 4 or check iLearn

Weighting: 10%

Questions to be solved at home on the concepts learning outcome 1 and to be submitted electronically to iLearn.

This assessment task is related to being able to visualise different types of data using MALAB and Excel. It also evaluate student's understanding on different types of data and visualisation methods.

Assignment 2

Due: Week 8 or check iLearn Weighting: 10%

Questions to be solved at home on the concepts learning outcome 2 and to be submitted electronically to iLearn

This assignment task relates to data acquisition and noise analysis in engineering systems.

Assignment 3

Due: Week 12 or check iLearn Weighting: 10%

Questions to be solved at home on the concepts learning outcome 3 and to be submitted electronically to iLearn.

This assignment task is related to developing a simulation method to model and an engineering problem.

Final exam

Due: Will appear in exam calendar

Weighting: 50%

A close-book 3-hour exam will be conducted in the formal examination period

This Assessment Task relates to the following Learning Outcomes:

- Demonstrate a good understanding of the different types of data confronting engineers and the methods of data visualisation.
- To apply mathematics, physics and engineering principles to the analysis of measured data.
- Demonstrate knowledge of data acquisition systems, noise and error analysis.

- Demonstrate knowledge in engineering through the relationship between theoretical, mathematical and computational modelling to solve real world and dynamical problems.

Assessment Tasks

Name	Weighting	Hurdle	Due
Laboratory	20%	No	Weekly (starts in week 2)
Assignment 1	10%	No	Week 4
Assignment 2	10%	No	Week 8
Assignment 3	10%	No	week 12
Final exam	50%	Yes	Based on the exam calender

Laboratory

Due: **Weekly (starts in week 2)**
Weighting: **20%**

Practical

On successful completion you will be able to:

- Demonstrate a good understanding of different types of data and methods of data visualisation: To achieve the skill in different methods of data visualisation to present the information in the most understandable way.
- To apply foundational scientific knowledge (mathematics, physics and engineering) in collecting and processing engineering data. This requires knowledge on data acquisition systems, design of experiments, noise and error analysis.
- Develop students' knowledge in engineering through the relationship between theoretical, mathematical and computational modelling to solve real world and complex engineering problems

Assignment 1

Due: **Week 4**
Weighting: **10%**

Demonstrate a good understanding of the different types of data confronting engineers and the methods of data visualisation.

On successful completion you will be able to:

- Demonstrate a good understanding of different types of data and methods of data visualisation: To achieve the skill in different methods of data visualisation to present the information in the most understandable way.

Assignment 2

Due: **Week 8**
Weighting: **10%**

To apply mathematics, physics and engineering principles to the analysis of measured data.

On successful completion you will be able to:

- To apply foundational scientific knowledge (mathematics, physics and engineering) in collecting and processing engineering data. This requires knowledge on data acquisition systems, design of experiments, noise and error analysis.

Assignment 3

Due: **week 12**
Weighting: **10%**

Demonstrate knowledge in engineering through the relationship between theoretical, mathematical and computational modelling to solve real world and dynamical problems

On successful completion you will be able to:

- To apply foundational scientific knowledge (mathematics, physics and engineering) in collecting and processing engineering data. This requires knowledge on data acquisition systems, design of experiments, noise and error analysis.
- Develop students' knowledge in engineering through the relationship between theoretical, mathematical and computational modelling to solve real world and complex engineering problems

Final exam

Due: **Based on the exam calender**
Weighting: **50%**
This is a hurdle assessment task (see assessment policy for more information on hurdle assessment tasks)

A closed-book 3-hour exam will be conducted in the formal examination period.

On successful completion you will be able to:

- Demonstrate a good understanding of different types of data and methods of data

visualisation: To achieve the skill in different methods of data visualisation to present the information in the most understandable way.

- To apply foundational scientific knowledge (mathematics, physics and engineering) in collecting and processing engineering data. This requires knowledge on data acquisition systems, design of experiments, noise and error analysis.
- Develop students' knowledge in engineering through the relationship between theoretical, mathematical and computational modelling to solve real world and complex engineering problems

Delivery and Resources

Text books:

ENG255 book, from McGrawHill. Link is available on iLearn.

Technology used and required

• Library and internet search engines

• Word processing package

• MATLAB

• Excel

• LabVIEW

Learning and Teaching Activities

Practicals

In the laboratory sessions, students practice how to collect, visualise and present different types of data. They will get the opportunity to work with LabVIEW, Excel and MATLAB software. Students will be assess at the end of each laboratory session

Assignments

Four assignment tasks will be assigned for this course. The assignments provide an opportunity to process and visualise data from different sources, use LabVIEW modeling in data acquisition, develop codes in MATLAB, and attempt to model a real engineering problem.

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-central). 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 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/

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

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

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 outcomes

- Demonstrate a good understanding of different types of data and methods of data visualisation: To achieve the skill in different methods of data visualisation to present the information in the most understandable way.
- To apply foundational scientific knowledge (mathematics, physics and engineering) in collecting and processing engineering data. This requires knowledge on data acquisition systems, design of experiments, noise and error analysis.
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Assessment tasks

- Laboratory
- Assignment 1

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

- Demonstrate a good understanding of different types of data and methods of data visualisation: To achieve the skill in different methods of data visualisation to present the information in the most understandable way.
- To apply foundational scientific knowledge (mathematics, physics and engineering) in collecting and processing engineering data. This requires knowledge on data acquisition systems, design of experiments, noise and error analysis.
- Develop students' knowledge in engineering through the relationship between theoretical, mathematical and computational modelling to solve real world and complex engineering problems

Assessment tasks

- Assignment 2
- Assignment 3
- Final exam

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 apply foundational scientific knowledge (mathematics, physics and engineering) in collecting and processing engineering data. This requires knowledge on data acquisition systems, design of experiments, noise and error analysis.
- Develop students' knowledge in engineering through the relationship between theoretical, mathematical and computational modelling to solve real world and complex engineering problems

Assessment tasks

- Assignment 1
- Assignment 2

- Assignment 3

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

- Demonstrate a good understanding of different types of data and methods of data visualisation: To achieve the skill in different methods of data visualisation to present the information in the most understandable way.
- To apply foundational scientific knowledge (mathematics, physics and engineering) in collecting and processing engineering data. This requires knowledge on data acquisition systems, design of experiments, noise and error analysis.
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Assessment tasks

- Laboratory
- Assignment 1
- Assignment 2
- Assignment 3