



Mechanical and Manufacturing Engineering

Course Outline

Term 1 2020

GSOE9712

ENGINEERING STATISTICS AND EXPERIMENT DESIGN

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1. Staff contact details

Contact details and consultation times for course convenor

Name: Dr Ron Chan
Office Location: Room ME507, Ainsworth Building
Tel: (02) 9385 1535
Email: r.chan@unsw.edu.au

Consultation concerning this course is available immediately after the classes. Direct consultation is preferred.

Please see the course [Moodle](#).

2. Important links

- [Moodle](#)
- [Lab Access](#)
- [Health and Safety](#)
- [Computing Facilities](#)
- [Student Resources](#)
- [Course Outlines](#)
- [Engineering Student Support Services Centre](#)
- [Makerspace](#)
- [UNSW Timetable](#)
- [UNSW Handbook](#)
- [UNSW Mechanical and Manufacturing Engineering](#)

3. Course details

Credit points

This is a 6 unit-of-credit (UoC) course and involves 3 hours per week (h/w) of face-to-face contact.

The normal workload expectations of a student are approximately 25 hours per term for each UOC, including class contact hours, other learning activities, preparation and time spent on all assessable work.

You should aim to spend about 9 h/w on this course. The additional time should be spent in making sure that you understand the lecture material, completing the set assignments, further reading, and revising for any examinations.

Contact hours

| | Day | Time | Location |
|----------|---------|---|-----------------------|
| Lectures | Tuesday | 1300 – 1600 | ElecEng G23 |
| | | | |
| Quiz | Tuesday | 1700 – 18:30 Week 3, 6 and 9 only | Ainsworth 203 and 204 |
| | | | |

Please refer to your class timetable for the learning activities you are enrolled in and attend only those classes.

Summary and Aims of the course

The course will introduce statistics, mathematics and associated techniques for analysing complex engineering processes for the purpose of improvement. Major disciplines covered include issue analysis, data collection, statistical data analysis, process modelling, decision-making and implementation. The course focuses on developing experimental techniques using statistical methods to test the performance of the processes in an engineering industry.

Student learning outcomes

This course is designed to address the learning outcomes below and the corresponding Engineers Australia Stage 1 Competency Standards for Professional Engineers as shown. The full list of Stage 1 Competency Standards may be found in Appendix A.

After successfully completing this course, you should be able to:

| Learning Outcome | | EA Stage 1 Competencies |
|------------------|--|-------------------------|
| 1. | Demonstrate critical thinking and derive improvement strategies from a managerial perspective | PE2.1, PE2.2, PE2.4 |
| 2. | Perform both parametric and non-parametric hypothesis tests for a range of engineering research problems | PE1.1, PE1.2, PE1.3 |
| 3. | Design and plan experiments to collect data to uncover critical information and knowledge in industry-based problems | PE1.2, PE2.1, PE2.3 |
| 4. | Demonstrate effective written communication skills for management | PE2.4, PE3.2, PE3.3 |

4. Teaching strategies

Lectures, statistics software package demonstrations, online quizzes, team assignments and the final exam in the course are designed to cover the core knowledge areas in engineering statistics. They do not simply reiterate the texts, but build on the lecture topics using

examples and cases taken directly from industry to show how the theory is applied in practice and the details of when, where and how it should be applied.

5. Course schedule

| Date | Lecture Content (Ainsworth G02) Monday 10:00-13:00 | Suggested Readings |
|----------------|---|--|
| Week 1 | Introduction to Data Mining | Montgomery, Design and analysis of experiments, 8th ed, Chapter 1 |
| Week 2 | Simple Comparative Experiments | Montgomery, Design and analysis of experiments, 8th ed, Chapter 2 |
| Week 3 | Analysis of Variance (ANOVA) | Montgomery, Design and analysis of experiments, 8th ed, Chapter 3 |
| Week 4 | Introduction to Experimental Design – Randomised Blocks | Montgomery, Design and analysis of experiments, 8th ed, Chapter 4 |
| Week 5 | Introduction to Factorial Design | Montgomery, Design and analysis of experiments, 8th ed, Chapter 5 |
| Week 6 | 2 ^k Factorial Design | Montgomery, Design and analysis of experiments, 8th ed, Chapter 6 |
| Week 7 | Blocking and Confounding in 2 ^k Factorial Design | Montgomery, Design and analysis of experiments, 8th ed, Chapter 7 |
| Week 8 | Two-Level Fractional Factorial Design | Montgomery, Design and analysis of experiments, 8th ed, Chapter 8 |
| Week 9 | Regression Models | Montgomery, Design and analysis of experiments, 8th ed, Chapter 10 |
| Week 10 | Response Surface Methods and Design | Montgomery, Design and analysis of experiments, 8th ed, Chapter 11 |

6. Assessment

Assessment overview

| Assessment | Group Project? (# Students per group) | Length | Weight | Learning outcomes assessed | Assessment criteria | Due date and submission requirements | Deadline for absolute fail | Marks returned |
|-----------------|---------------------------------------|--|----------------|----------------------------|--|--------------------------------------|----------------------------|---------------------------------|
| Online Quiz x 3 | No | Multiple choice and short answer questions | 15% (5% each) | 1, 2 and 3 | Lecture and demonstration contents | Week 3, 6 and 9 | N/A | 1 week after the quiz is closed |
| Assignment x 2 | Yes (3) | 3000 words + 20 minutes VIVA | 50% (25% each) | 1, 2, 3 and 4 | See Assignment Section | Week 6 and 10 | 1 week after the due date | 2 weeks after submission |
| Final Exam | No | 2-hour, short answer questions | 35% | 1, 2 and 3 | All lecture and demonstration contents | Exam period, date TBC | N/A | Upon release of final results |

Assignments

The assignment instructions will be posted on Moodle or handed out in class, and a reminder announcement will be made about due dates for the assignments. The assignments support the learning outcomes by incorporating an appropriate mix of activities such as issue analysis and fact-based data analysis that support the design of appropriate solutions and strategies. The assignments also support collaborative teamwork and integration of different ideas and components into an overall coherent quality management strategy.

The following criteria will be used to grade assignments:

Viva

The assignment will be assessed in person and feedback given as part of an oral examination or 'viva'. Each team member must be present during this formal examination in weeks 5 and 10. A system will be implemented on Moodle for booking a time with your lecturers. The team will still need to prepare appropriate documentation and material as preparation for this assessment.

Executive Summary

In addition to the Viva examination, each team is to provide a 1-page executive summary (excluding diagrams), outlining the key findings of the assignment.

Presentation

All submissions are expected to be neat and clearly set out. Your results are the pinnacle of all your hard work and should be treated with due respect. Presenting results clearly gives the marker the best chance of understanding your method; even if the numerical results are incorrect.

Submission

Work submitted late without an approved extension by the course coordinator or delegated authority is subject to a late penalty of 20 percent (20%) of the maximum mark possible for that assessment item, per calendar day.

The late penalty is applied per calendar day (including weekends and public holidays) that the assessment is overdue. There is no pro-rata of the late penalty for submissions made part way through a day.

Work submitted after the 'deadline for absolute fail' is not accepted and a mark of zero will be awarded for that assessment item.

For some assessment items, a late penalty may not be appropriate. These are clearly indicated in the course outline, and such assessments receive a mark of zero if not completed by the specified date. Examples include:

- a. Weekly online tests or laboratory work worth a small proportion of the subject mark, or
- b. Online quizzes where answers are released to students on completion, or
- c. Professional assessment tasks, where the intention is to create an authentic assessment that has an absolute submission date, or
- d. Pass/Fail assessment tasks.

Marking

Marking guidelines for assignment submissions will be provided at the same time as assignment details to assist with meeting assessable requirements. Submissions will be marked according to the marking guidelines provided.

Examinations

You must be available for all quizzes, tests and examinations.

Final examinations for each course are held during the University examination periods: February for Summer Term, May for T1, August for T2, and November/December for T3.

Please visit myUNSW for Provisional Examination timetable publish dates.

For further information on exams, please see the [Exams](#) webpage.

Calculators

You will need to provide your own calculator of a make and model approved by UNSW for the examinations. The list of approved calculators is available at student.unsw.edu.au/exam-approved-calculators-and-computers

It is your responsibility to ensure that your calculator is of an approved make and model, and to obtain an “Approved” sticker for it from the [Engineering Student Support Services Centre](#) prior to the examination. Calculators not bearing an “Approved” sticker will not be allowed into the examination room.

Special consideration and supplementary assessment

If you have experienced an illness or misadventure beyond your control that will interfere with your assessment performance, you are eligible to apply for Special Consideration prior to submitting an assessment or sitting an exam.

Please note that UNSW now 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 enough to do so and cannot later apply for Special Consideration.

For details of applying for Special Consideration and conditions for the award of supplementary assessment, please see the information on UNSW's [Special Consideration page](#).

7. Expected resources for students

The prescribed textbook for this course is:

- Douglas C. Montgomery, Design and analysis of experiments, 8th ed, Hoboken, N.J.: John Wiley & Sons, Inc., 1118146921

You can find a free e-copy of the textbook from the UNSW library.

UNSW Library website: <https://www.library.unsw.edu.au/>

Moodle: <https://moodle.telt.unsw.edu.au/login/index.php>

8. Course evaluation and development

Feedback on the course is gathered periodically using various means, including the UNSW myExperience process, informal discussion in the final class for the course, and the School's Student/Staff meetings. Your feedback is taken seriously, and continual improvements are made to the course based, in part, on such feedback.

In this course, recent improvements resulting from student feedback include the continuous use of VIVA assessment as it received positive feedback when the course was revised in 2019

9. Academic honesty and plagiarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. *Plagiarism at UNSW is defined as using the words or ideas of others and passing them off as your own.*

Plagiarism is a type of intellectual theft. It can take many forms, from deliberate cheating to accidentally copying from a source without acknowledgement. UNSW has produced a website with a wealth of resources to support students to understand and avoid plagiarism, visit: student.unsw.edu.au/plagiarism. The Learning Centre assists students with understanding academic integrity and how not to plagiarise. They also hold workshops and can help students one-on-one.

You are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting and the proper referencing of sources in preparing all assessment tasks.

If plagiarism is found in your work when you are in first year, your lecturer will offer you assistance to improve your academic skills. They may ask you to look at some online resources, attend the Learning Centre, or sometimes resubmit your work with the problem

fixed. However more serious instances in first year, such as stealing another student's work or paying someone to do your work, may be investigated under the Student Misconduct Procedures.

Repeated plagiarism (even in first year), plagiarism after first year, or serious instances, may also be investigated under the Student Misconduct Procedures. The penalties under the procedures can include a reduction in marks, failing a course or for the most serious matters (like plagiarism in an honours thesis) even suspension from the university. The Student Misconduct Procedures are available here:

www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf

10. Administrative matters and links

All students are expected to read and be familiar with UNSW guidelines and policies. In particular, students should be familiar with the following:

- [Attendance](#)
- [UNSW Email Address](#)
- [Special Consideration](#)
- [Exams](#)
- [Approved Calculators](#)
- [Academic Honesty and Plagiarism](#)
- [Equitable Learning Services](#)

Appendix A: Engineers Australia (EA) Competencies

Stage 1 Competencies for Professional Engineers

| | Program Intended Learning Outcomes |
|--|---|
| PE1: Knowledge and Skill Base | PE1.1 Comprehensive, theory-based understanding of underpinning fundamentals |
| | PE1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing |
| | PE1.3 In-depth understanding of specialist bodies of knowledge |
| | PE1.4 Discernment of knowledge development and research directions |
| | PE1.5 Knowledge of engineering design practice |
| | PE1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice |
| PE2: Engineering Application Ability | PE2.1 Application of established engineering methods to complex problem solving |
| | PE2.2 Fluent application of engineering techniques, tools and resources |
| | PE2.3 Application of systematic engineering synthesis and design processes |
| | PE2.4 Application of systematic approaches to the conduct and management of engineering projects |
| PE3: Professional and Personal Attributes | PE3.1 Ethical conduct and professional accountability |
| | PE3.2 Effective oral and written communication (professional and lay domains) |
| | PE3.3 Creative, innovative and pro-active demeanour |
| | PE3.4 Professional use and management of information |
| | PE3.5 Orderly management of self, and professional conduct |
| | PE3.6 Effective team membership and team leadership |