UNSW SYDNEY | Australia's Global University

Mechanical and Manufacturing Engineering

Course Outline

Term 1 2019

GSOE9712

ENGINEERING STATISTICS AND EXPERIMENT DESIGN

Contents

1. Staff contact details

Contact details and consultation times for course convenor

Name: Dr Ron Chan
Office Location: Room ME507, Ainsworth Building
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Consultation concerning this course is available immediately after the classes. Direct consultation is preferred.

Contact details and consultation times for additional lecturers/demonstrators/lab staff

Name: Dr Erik van Voorthuysen
Office Location: ME507, Ainsworth Building
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Please see the course Moodle.

2. Important links

- Moodle
- Lab Access
- Computing Facilities
- Student Resources
- Course Outlines
- Engineering Student Support Services Centre

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.

Contact hours

	Day	Time	Location
Lectures	Monday	10:00 – 13:00	Ainsworth G02

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 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

Date	Lecture Content (Ainsworth G02) Monday 10:00-13:00	Suggested Readings
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?	If Group, # 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	N/A	Multiple choice and short answer questions	15% (5% each)	1, 2 and 3	Lecture and demonstration contents	Week 3, 6, 9	Immediately after the quiz is closed on Moodle	1 week after the quiz is closed
Group Viva Assignment 1	Yes	Min 2 Max 4	20 minutes per team + 2-page Executive Summary (excluding diagram)	25%	1, 2, 3 and 4	See Assignment Section	Week 5	1 week after the due date	2 weeks after submission
Group Viva Assignment 2	Yes	Min 2 Max 4	20 minutes per team + 2-page Executive Summary (excluding diagram)	25%	1, 2, 3 and 4	See Assignment Section	Week 10	1 week after the due date	Upon release of final results
Final Exam	No	N/A	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 date 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 team work 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 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.

Online Quiz

Three quizzes (Quiz 1, 2 and 3) will be conducted online via Moodle. The format of the quiz is like those that are done on paper, which consist of multiple-choice questions, calculations and short answer questions. The link to the quiz will be available on Monday of the quiz week from 12:00 to 13:00. Each student gets ONE attempt to complete the quiz within the time limit. The feedback of the quiz will be provided 1-week after the quiz is closed. Note that the quiz questions are randomly drawn from a question bank with similar theme and difficulty, numerical questions may appear with random input numbers, so students will not expect to get the exact same question. Students are expected to complete the quiz individually.

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 Supper 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 has interfered with your assessment performance, you are eligible to 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 limited number of the prescribed 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 more demonstrator support to the student major group project.

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 School guidelines and polices, available on the intranet. In particular, students should be familiar with the following:

- Attendance
- UNSW Email Address
- Computing Facilities
- Special Consideration
- Exams
- Approved Calculators
- Academic Honesty and Plagiarism
- Student Equity and Disabilities Unit
- Health and Safety
- Lab Access
- Makerspace
- UNSW Timetable
- UNSW Handbook
- UNSW Mechanical and Manufacturing Engineering

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