CVEN2002

Civil and Environmental Engineering Computations

Term 2, 2023

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Elena Atroshchenko	e.atroshchenko@unsw.edu.au	appointment via e-mail	H20-607	
Gery Geenens	ggeenens@unsw.edu.au	appointment via e-mail		

School Contact Information

Engineering Student Support Services – The Nucleus - enrolment, progression checks, clash requests, course issues or program-related queries

Engineering Industrial Training – Industrial training questions

UNSW Study Abroad – study abroad student enquiries (for inbound students)

UNSW Exchange – student exchange enquiries (for inbound students)

UNSW Future Students – potential student enquiries e.g. admissions, fees, programs, credit transfer

Phone

(+61 2) 9385 8500 – Nucleus Student Hub

(+61 2) 9385 7661 – Engineering Industrial Training

(+61 2) 9385 3179 – UNSW Study Abroad and UNSW Exchange (for inbound students).

Course Details

Units of Credit 6

Summary of the Course

An introduction to the application of advanced analytical, statistical and numerical techniques to the solution of engineering problems relevant to civil and environmental engineers and surveyors. Review of analytical techniques. Addressing issues of variability and uncertainty in engineering. Descriptive statistics. Foundations of Probability. Random variables. Special distributions (discrete and continuous). Normal distribution, sampling distributions. Confidence Intervals. Hypothesis testing. Inferences for proportions, variances and means. Regression. ANOVA. Numerical solution of linear and non-linear equations; numerical differentiation and integration, finite differences; differential equations, boundary value problems, initial value problems and partial differential equations.

Course Aims

The aims of the course are to enable students to apply the fundamentals of Numerical Methods and Statistics to Engineering problems in the fields of Civil and Environmental Engineering and Surveying.

Course Learning Outcomes

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

Learning Outcome	EA Stage 1 Competencies
1. Students can effectively apply the fundamental calculation methods of Numerical Methods and Statistics to problems in the fields of Civil and Environmental Engineering and Surveying.	PE1.1, PE1.2, PE1.3
2. Numerical Methods strand: students will be able to calculate numerical (not analytical) solutions to problems in linear and non-linear equations; numerical differentiation and integration, finite differences; differential equations, boundary value problems, initial value problems and partial differential equations.	PE1.1, PE1.2, PE1.3
3. Statistics strand: students will understand the various ways in which random variation arises in engineering contexts and to develop facility at applying various graphical and data analysis methods for summarizing and understanding data; applying various statistical models and methods for drawing conclusions and making decisions under uncertainty in engineering contexts; and, applying MATLAB for graphical and statistical analysis.	PE1.1, PE1.2, PE1.3
4. Students should be familiar with the MATLAB environment and programming, or similar, and be able to calculate the solutions to numerical and statistical problems in their assignments in subsequent courses, using MATLAB or similar.	PE1.1, PE1.2

Teaching Strategies

We believe that effective learning is best supported by a climate of inquiry, in which students are actively engaged in the learning process. Hence this course is structured with a strong emphasis on problem-solving tasks in lectures, in tutorials and laboratories, and in assessment tasks. Students are expected to devote the majority of their class and study time to the solving of such tasks. New ideas and skills are first introduced and demonstrated in lectures, and then students develop these skills by applying them to specific tasks in tutorials and assessments. Computing skills are developed and practiced in regular computer laboratory sessions. This course has a major focus on research, inquiry and analytical thinking as well as information literacy. We will also explore capacity and motivation for intellectual development through the solution of both simple and complex mathematical models of problems arising in engineering, and the interpretation and communication of the results.

Assessment

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Numerics Online Quiz 1	5%	week 5	1, 2, 4
2. Numerics Online Quiz 2	10%	week 9	1, 2, 4
3. Numerics 5 online quizzes	5%	weeks 2, 4, 7, 9, 10	4
4. Statistics Mid-semester Test	10%	Weeks 6-7	1, 2, 3, 4
5. Statistics 10 online lectures and quizzes	10%	weeks 2-5, 7-10	3
6. Final Exam	60%	Not Applicable	1, 2, 3, 4

Assessment 1: Numerics Online Quiz 1

Start date: week 5
Assessment length: 40 min
Due date: week 5

40 mins. Numerics Strand Quiz 1: covering numerics part of this course for the first 4 lectures (5%)

Assessment 2: Numerics Online Quiz 2

Start date: week 9
Assessment length: 60 min
Due date: week 9

Students are expected to demonstrate their ability to apply the methods taught in the numerics part of this course. Covers material from previous week's lectures and since Quiz 1.

Assessment 3: Numerics 5 online quizzes

Start date: weeks 2, 4, 7, 9, 10
Due date: weeks 2, 4, 7, 9, 10

Matlab quizzes

Assessment 4: Statistics Mid-semester Test

Start date: Weeks 6-7
Due date: Weeks 6-7

40 mins. Students are expected to demonstrate their ability to apply the methods taught in the statistics part of this course, using Matlab, where appropriate. Cover materials up to and including Lecture 6 (Normal random variables)

Assessment 5: Statistics 10 online lectures and quizzes

Start date: weeks 2-5, 7-10
Due date: weeks 2-5, 7-10

1% each. Students are expected to demonstrate their ability to apply the methods taught in the statistics part of this course.

Assessment 6: Final Exam

2 hours. Exam in the formal exam period. Students are expected to demonstrate their ability to apply the methods taught in this course. Equal halves for numerics and statistics.

Attendance Requirements

For courses with Workshops and/or Labs, attendance for those classes is a necessary part of the course. You must attend at least 80% of the workshop/lab in which you are enrolled for the duration of the session.

Course Schedule

Lectures:

Monday 09:00 – 11:00 Numerics

Wednesday 14:00 –16:00 Statistics

Workshops:

1-hour Numerics

1-hour Statistics

View class timetable

Timetable

Date	Type	Content
O-Week: 22 May - 26 May		
Week 1: 29 May - 2 June	Lecture	Numerics: Introduction to Numerical Methods: Mathematical Modelling and Programming (Chapter 1 & 2) Approximations and Taylor Series (Chapter 3 & 4)
	Lecture	Statistics: Probability, Descriptive Statistics
	Workshop	Numerics: Revision of matrix, vector operations, and derivatives
	Laboratory	Statistics
Week 2: 5 June - 9 June	Lecture	Numerics: Bracketing Methods (Chapter 5)

		Open Methods (Chapter 6)
	Lecture	Statistics: Random variables
	Laboratory	Numerics: Computer Lab: Matlab basics
	Laboratory	Statistics
Week 3: 12 June - 16 June	Lecture	Numerics: Roots of Equations (Chapter 8)
	Lecture	Statistics: Special random variables
	Workshop	Numerics: Taylor series, solving roots of nonlinear equations using iterative methods
	Laboratory	Statistics
Week 4: 19 June - 23 June	Lecture	Numerics: Gauss Elimination (Chapter 9) Matrix Inversion (Chapter 10)
	Lecture	Statistics: Sampling distributions and the Central Limit Theorem
	Laboratory	Numerics: Root finding algorithms in Matlab
	Laboratory	Statistics
Week 5: 26 June - 30 June	Lecture	Numerics: Numerical Integration (Chapter 21 & 22) Numerical Differentiation (Chapter 23 & 24)
	Lecture	Statistics: Confidence intervals for means and proportions
	Workshop	Numerics: Matrix solutions of equations and iterative methods
	Laboratory	Statistics
Week 7: 10 July - 14 July	Lecture	Numerics: Introduction to ordinary differential equations (ODE) (Chapter 25) Numerical solutions of ODEs: Part I (Chapter 25)
	Lecture	Statistics: Hypothesis testing

	Laboratory	Numerics: Linear algebra in Matlab
	Laboratory	Statistics
Week 8: 17 July - 21 July	Lecture	Numerics: Numerical solutions of ODEs: Part II (Chapter 26-27)
	Lecture	Statistics: Inference concerning differences in means
	Workshop	Numerics: Numerical integration, Numerical differentiation
	Laboratory	Statistics
Week 9: 24 July - 28 July	Lecture	Numerics: Introduction to partial differential equations (PDE) (Chapter 29) Numerical solutions of PDEs: Part I (Chapter 29)
	Lecture	Statistics: Regression analysis
	Laboratory	Numerics: Numerical integration in Matlab
	Laboratory	Statistics
Week 10: 31 July - 4 August	Lecture	Numerics: Numerical solutions of PDEs: Part II (Chapter 30)
	Lecture	Statistics: Analysis of variance
	Workshop	Numerics: ODEs and PDEs
	Laboratory	Statistics

Resources

Prescribed Resources

Students are required to have an account on https://au.mathworks.com/

Recommended Resources

For the Numerical Methods strand of CVEN2002:

- Recommended: “Numerical Methods for Engineers”: Steven C. Chapra, Raymond P. Canale; McGraw Hill, 7th Ed (2015) ISBN 978 0 07 339792 4 or the equivalent ebook:
- www.mheducation.com.au/9781308573083-aus-ebook-numerical-methods-for-engineers-7e
- Any other Numerical Methods / for engineers book eg “Numerical Methods”, Author: Robert W. Hornbeck, Publisher: Prentice-Hall (1975), or “An Introduction to Numerical Methods and Analysis”, Author: James Epperson, Publisher: John Wiley & Sons, Second Edition (2013), or “Elementary Numerical Analysis”, Authors: Kendall Atkinson, Weimin Han, Publisher: John Wiley & Sons, Third Edition (2004)
- CVEN2002 class notes R. Lawther, W. Peirson, B. Cathers, X. Barthelemy, July 2015 (a pdf file on our Moodle site)

For the Statistics strand of CVEN2002:

Recommended textbook:

- “Applied Statistics for Engineers and Scientists”, Authors: J. Devore and N. Farnum, Publisher: Duxburry Press, 2nd Edition
- “Applied Statistics for Engineers and Scientists”, Authors: J. Devore, N. Farnum and J. Doi, Publisher: Cengage Learning, 3rd Edition

Additional references:

- “Probability and Statistics for Engineers and the Sciences”, Author: J. Devore, Publisher: Duxburry, 7th Edition
- “Applied Statistics and Probability for Engineers”, Authors: D. Montgomery and G. Runger, Publisher: Wiley, 5th Edition
- CVEN2002 class notes R. Lawther, W. Peirson, B. Cathers, X. Barthelemy, July 2015 (a pdf file on our Moodle site)

Course Evaluation and Development

Informal feedback will be gathered throughout the term and used to improve the course. Formal feedback will be gathered in the end of the term and used to improve the course in the upcoming years.

Laboratory Workshop Information

The course has one 1-hr workshop for Numerics and one 1-hr workshop for Statistics weekly.

Submission of Assessment Tasks

Please refer to the Moodle page of the course for further guidance on assessment submission.

UNSW has a standard late submission penalty of:

- 5% per day, for all assessments where a penalty applies, capped at five days (120 hours), after which a student cannot submit an assessment, and no permitted variation.

Academic Honesty and Plagiarism

Beware! An assignment that includes plagiarised material will receive a 0 fail, and students who plagiarise may fail the course. Students who plagiarise are also liable to disciplinary action, including exclusion from enrolment.

Plagiarism is the use of another person's work or ideas as if they were your own. When it is necessary or desirable to use other people's material you should adequately acknowledge whose words or ideas they are and where you found them (giving the complete reference details, including page number(s)). The Learning Centre provides further information on what constitutes Plagiarism at:

https://student.unsw.edu.au/plagiarism

Academic Information

Final Examinations:

Final Exams in T2 2023 will be held on campus between Friday 11th and Thursday 24th August (inclusive), and Supplementary Exams between Monday 4th and Friday 8th September (inclusive). You are required to be available on these dates. Please do not to make any personal or travel arrangements during this period.

For students enrolled in the distance offering of a postgraduate course, and who reside further than 100km from UNSW Kensington campus, will be contacted regarding sitting an external exam. The school's External Exam Policy can be found on the Intranet.

ACADEMIC ADVICE

- Key Staff to Contact for Academic Advice (log in with your zID and password): https://intranet.civeng.unsw.edu.au/key-staff-to-contact-during-your-studies-at-unsw
- Key UNSW Dates - eg. Census Date, exam dates, last day to drop a course without academic/financial liability etc.
- CVEN Student Intranet (log in with your zID and password): https://intranet.civeng.unsw.edu.au/student-intranet
- Student Life at CVEN, including Student Societies: https://www.unsw.edu.au/engineering/civil-and-environmental-engineering/student-life
- Special Consideration: https://student.unsw.edu.au/special-consideration
- General and Program-Specific Questions: The Nucleus: Student Hub
- Book an Academic Advising session: https://unswengacademicadvising.as.me/schedule.php

Disclaimer

This course outline sets out description of classes at the date the Course Outline is published. The nature of classes may change during the Term after the Course Outline is published. Moodle should be consulted for the up to date class descriptions. If there is any inconsistency in the description of activities between the University timetable and the Course Outline (as updated in Moodle), the description in the Course Outline/Moodle applies.

Image Credit

Mike Gal.

CRICOS

CRICOS Provider Code: 00098G

Acknowledgement of Country

We acknowledge the Bedegal people who are the traditional custodians of the lands on which UNSW Kensington campus is located.

Appendix: Engineers Australia (EA) Professional Engineer Competency Standard

Program Intended Learning Outcomes	
Knowledge and skill base	
PE1.1 Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline	✓
PE1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline	✓
PE1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline	✓
PE1.4 Discernment of knowledge development and research directions within the engineering discipline	
PE1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline	
PE1.6 Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline	
Engineering application ability	
PE2.1 Application of established engineering methods to complex engineering 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	
Professional and personal attributes	
PE3.1 Ethical conduct and professional accountability	
PE3.2 Effective oral and written communication in 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	