ENGG1400

Engineering Infrastructure Systems

Term 2, 2023

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Elnaz Irannezhad	e.irannezhad@unsw.edu.au	Weeks 1 - 5 & 7 – 10: Electrical Engineering G22 (K-G17-G22)	H20, Room 105	+61432712822

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

This course provides a holistics and solid foundation of the concept and application of Engineering Infrastructure Systems across a variety of industries. This course is relevant to any engineering student who wants to learn about how complex engineering problems can be formulated and optimised. This course is strong in Model-Based Systems Engineering and covers optimisation concepts in engineering, logistics engineering, project management and operation research. Students learn how to use coding softwares to optimise the real-world infrastructure engineering problems. The course instills significant understanding together with engineering problem-solving methods from which skill can be developed for the workplace.

Course Aims

The aims of the course are:

- To reinforce a students' capability in infrastructure modelling and engineering problem-solving.
- To introduce students to the fundamental optimisation coding tools and concepts applied by engineers in advanced systems modelling.
- To abstract a complex technical system into quantitative models and/or qualitative frameworks that represent that system.
- To analyse and optimise various engineering systems with the abstracted models.
- Provide a foundation in modelling and operation research knowledge required for Engineering students.

Course Learning Outcomes

1. Develop an integrative holistic approach to problem-solving through systems-thinking methodologies used by engineers.
2. Abstract a complex technical system into quantitative models that represent that system to evaluate and compare effective design decisions.
3. Implement optimization methods to improve the performance of various infrastructure systems
4. Create justified solutions to real-world optimisation engineering problems using methods from discrete mathematics and economics.
5. Communicate the fundamental concepts and principles applied by engineers in advanced systems modelling.

	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

Teaching Strategies

The teaching/learning activities are summarized as below:

Lectures

- Cover material to be learned for assessment tasks
- Follow worked examples

Workshops/Computer Sessions:

- Practice solving set problems
- Hand on exercises using coding software
- Guided by Lecturer and demonstrators
- Ask questions

Private Study

- Review lecture material and textbook
- Preparation for the workshops and do set problems
- Reflect on class problems
- Study relevant references

Assessments (hand-in, assignments, examinations)

- Demonstrate your understanding, knowledge and problem solving skills

Assessment

All assessments must be submitted on Moodle

Failure to attend the quizzes will result in a mark of zero. Students who miss the assessment as a result of illness or unforeseen circumstances must apply for special considerations through **https://student.unsw.edu.au/special-consideration** and contact the course coordinator.

Students who perform poorly in the assignment and workshops are recommended to discuss progress with the lecturer during the term. The lecturer reserves the right to adjust the final scores by scaling if agreed to by the Head of School.

The pass mark in this course is 50% overall, however, students must score at least 40% in the final examination in order to qualify for a Pass in this course. If below a 40% is scored on the Final Exam, the final exam mark will replace your course mark.

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Final Examination	50%	Not Applicable	1, 2, 3, 4, 5
2. Mid-Term exam	30%	30/06/2023 12:00 PM	1, 2, 3, 4, 5
3. Weekly Moodle Quizzes	20%	Week 2, Week 4, Week 8, Week 10	1, 2, 3, 4, 5

Assessment 1: Final Examination

Assessment length: 2 hours

The final written examination will be in the conventional open book format covering all topics introduced throughout the course. The final examination will consists of a series of problems and focus on theoretical and methodological concepts presented within the lectures as well as within previous assessments. The final examination will assess the expected learning outcomes and will be assessed based on technical accuracy, clarity in reporting and presentation.

Hurdle requirement

A mark of at least 40% in the final examination is required before the class work is included in the final mark.

Assessment 2: Mid-Term exam

Start date: 30/06/2023 10:00 AM
Assessment length: 2 hours
Due date: 30/06/2023 12:00 PM

A mid-session exam will be administered on Moodle in the second lecture of Week 5 in the Computer Lab. The mid-term exam will be based on the material covered in Week 1 to Week 4 Lectures/Workshops and is intended to assess student's knowledge of the expected learning outcomes, prepare students for the final exam, and discourage last minute cramming. The exam will be assessed

on the technical merit and consistency of the methodology followed, with consideration given to the clarity of presentation.

Assessment 3: Weekly Moodle Quizzes

Submission notes: Online Moodle Quiz
Due date: Week 2, Week 4, Week 8, Week 10

Weekly Moodle Quizzes will be provided totalling in 20% of the course mark. These quizzes will consist of small, customized problems covering the material introduced during the current week. The weekly quizzes will assess the expected learning outcomes and will be assessed based on technical accuracy and participation.

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

View class timetable

Timetable

Date	Type	Content
O-Week: 22 May - 26 May		
Week 1: 29 May - 2 June	Lecture	Introduction to Course and Optimization Problems and Applications in Infrastructure Systems
	Workshop	Formulating Engineering Optimisation Problems: Practice with Excel Solver
Week 2: 5 June - 9 June	Lecture	Resource Allocation and Assignment Problem
	Workshop	Introduction to Coding Software and Practice Problems in Resource Allocation
	Assessment	Weekly Moodle Quizzes: Online Moodle Quiz
Week 3: 12 June - 16 June	Lecture	Network Optimisation
	Workshop	Network Flow Optimisation: Practice with AMPL
Week 4: 19 June - 23 June	Lecture	Portfolio and Capacity Optimisation
	Workshop	Capacity Optimisation: Practice
	Assessment	Weekly Moodle Quizzes: Online Moodle Quiz
Week 5: 26 June - 30 June	Lecture	Facility Location Optimisation
	Workshop	Facility Location Optimisation: Practice with AMPL
	Assessment	Mid-Term exam
Week 7: 10 July - 14 July	Lecture	Routing Optimisation
	Workshop	Routing Optimisation: Practice with AMPL
Week 8: 17 July - 21 July	Lecture	Real-World Industry Demonstration Projects
	Workshop	Multi-objective Optimisation Problems: Practice

	Assessment	Weekly Moodle Quizzes: Online Moodle Quiz
Week 9: 24 July - 28 July	Lecture	Non-Linear Optimisations and Project Scheduling Optimisation
	Workshop	Practice Problems in Non-Linear Optimisation
Week 10: 31 July - 4 August	Lecture	Modelling Infrastructure User Preferences & Course Review
	Workshop	Modelling User Preferences in Infrastructure Engineering Problems: Practice
	Assessment	Weekly Moodle Quizzes: Online Moodle Quiz

Resources

Prescribed Resources

Lecture Notes

Recommended Resources

- Fourer, Robert, Gay, David M. and Brian W. Kernighan. *AMPL: A Modeling Language for Mathematical Programming,* Second edition, ISBN 0-534-38809-4. AMPL Chapters freely available: https://ampl.com/resources/the-ampl-book/chapter-downloads/
- Penn, Michael R. and Philip J. Parker. *Introduction to Infrastructure – An Introduction to Civil and Environmental Engineering*. John Wiley & Sons, Inc. 2011. ISBN : 978-0-470-41191-9
- Ravindra K. Ahuja Thomas L. Magnanti James B. Orlin. *Network flows : theory, algorithms, and applications.* Pearson new international edition., Harlow, Essex Pearson, 2014.

Course Evaluation and Development

Based on the MyExperience feedback in the previous years, the contents of this course was slightly modified.

Additionally, a Google Form survey will be provided at the end of each lecture to collect the students' feedback and the collected feedback will be presented in the next session.

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.

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.