UNSW Course Outline

ENGG1400 Engineering Infrastructure Systems - 2024

Published on the 21 May 2024

General Course Information

Course Code : ENGG1400
Year : 2024
Term : Term 2
Teaching Period : T2
Is a multi-term course? : No
Faculty : Faculty of Engineering
Academic Unit : School of Civil and Environmental Engineering
Delivery Mode : In Person
Delivery Format : Standard
Delivery Location : Kensington
Campus : Sydney
Study Level : Undergraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

A course in optimization and modelling for engineering students who desire a higher capability in the application of the modelling of engineering systems, and seek to acquire a set of optimization tools that can be applied to various engineering applications. The course will

introduce fundamental engineering systems concepts and methods with real-world projects related to critical contemporary issues. The course includes lectures on the following topics: systems engineering, network modelling, optimization and operation research methods, transit network design and project management. After completing this course, students will learn about systems thinking approach and efficient methods to solve and design infrastructure systems. The course will use real-world examples as well as invite leading practitioners to present their expertise on selected topics.

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

Course Learning Outcomes
CLO1 : Solve engineering problems using an integrative holistic approach and systems-thinking methodologies.
CLO2 : Abstract a complex technical system into quantitative models that represent that system to evaluate and compare effective design decisions.
CLO3 : Implement optimisation methods to improve the performance of various infrastructure systems
CLO4 : Create justified solutions to real-world optimisation engineering problems using methods from discrete mathematics and economics.
CLO5 : Communicate the fundamental concepts and principles applied by engineers in advanced systems modelling.

Course Learning Outcomes	Assessment Item
CLO1 : Solve engineering problems using an integrative holistic approach and systems-thinking methodologies.	• Moodle Quizzes • Mid-Term exam • Final Examination
CLO2 : Abstract a complex technical system into quantitative models that represent that system to evaluate and compare effective design decisions.	• Moodle Quizzes • Mid-Term exam • Final Examination
CLO3 : Implement optimisation methods to improve the performance of various infrastructure systems	• Moodle Quizzes • Mid-Term exam • Final Examination
CLO4 : Create justified solutions to real-world optimisation engineering problems using methods from discrete mathematics and economics.	• Moodle Quizzes • Mid-Term exam • Final Examination
CLO5 : Communicate the fundamental concepts and principles applied by engineers in advanced systems modelling.	• Moodle Quizzes • Mid-Term exam • Final Examination

Learning and Teaching Technologies

Moodle - Learning Management System

Other Professional Outcomes

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

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Moodle Quizzes Assessment Format: Individual	20%	
Mid-Term exam Assessment Format: Individual	30%	Start Date: 24/06/2024 12:00 AM Due Date: 28/06/2024 12:00 AM
Final Examination Assessment Format: Individual	50%	Start Date: Not Applicable Due Date: Not Applicable

Assessment Details

Moodle Quizzes

Assessment Overview

These quizzes will consist of small, customized problems covering the material introduced during the current week. The quizzes will assess the expected learning outcomes and will be assessed based on technical accuracy and participation.

Course Learning Outcomes

- CLO1 : Solve engineering problems using an integrative holistic approach and systems-thinking methodologies.
- CLO2 : Abstract a complex technical system into quantitative models that represent that system to evaluate and compare effective design decisions.
- CLO3 : Implement optimisation methods to improve the performance of various infrastructure systems
- CLO4 : Create justified solutions to real-world optimisation engineering problems using methods from discrete mathematics and economics.
- CLO5 : Communicate the fundamental concepts and principles applied by engineers in advanced systems modelling.

Submission notes

Online Moodle Quiz

Assignment submission Turnitin type

This is not a Turnitin assignment

Mid-Term exam

Assessment Overview

The mid-term exam will be based on the material covered in Week 1 to Week 4 Lectures/ Workshops and is intended to assess students' knowledge of the expected learning outcomes, prepare students for the final exam, and discourage last minute cramming.

Course Learning Outcomes

- CLO1 : Solve engineering problems using an integrative holistic approach and systems-thinking methodologies.
- CLO2 : Abstract a complex technical system into quantitative models that represent that system to evaluate and compare effective design decisions.
- CLO3 : Implement optimisation methods to improve the performance of various infrastructure systems
- CLO4 : Create justified solutions to real-world optimisation engineering problems using methods from discrete mathematics and economics.
- CLO5 : Communicate the fundamental concepts and principles applied by engineers in advanced systems modelling.

Assessment Length

2 hours

Assessment information

See Moodle for more details.

Assignment submission Turnitin type

This is not a Turnitin assignment

Final Examination

Assessment Overview

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.

Course Learning Outcomes

- CLO1 : Solve engineering problems using an integrative holistic approach and systems-thinking methodologies.
- CLO2 : Abstract a complex technical system into quantitative models that represent that system to evaluate and compare effective design decisions.
- CLO3 : Implement optimisation methods to improve the performance of various infrastructure systems
- CLO4 : Create justified solutions to real-world optimisation engineering problems using methods from discrete mathematics and economics.
- CLO5 : Communicate the fundamental concepts and principles applied by engineers in advanced systems modelling.

Assessment Length

2 hours

Assessment information

See Moodle for more details.

Assignment submission Turnitin type

This is not a Turnitin assignment

Hurdle rules

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

General Assessment Information

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.

Grading Basis

Standard

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 27 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 : 3 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 : 10 June - 16 June	Lecture	Network Flow Optimisation
	Workshop	Practice Problem: Network Flow Optimisation
Week 4 : 17 June - 23 June	Lecture	Portfolio and Capacity Optimisation
	Workshop	Practice Problem: Capacity Optimisation
	Assessment	Weekly Moodle Quizzes: Online Moodle Quiz
Week 5 : 24 June - 30 June	Lecture	Facility Location Optimisation
	Workshop	Practice Problem: Facility Location
	Assessment	Mid-term Exam
Week 7 : 8 July - 14 July	Lecture	Infrastrcuture Project Optimisation and Scheduling
	Workshop	Practice Problem: Project Scheduling Optimisation
Week 8 : 15 July - 21 July	Lecture	Routing Optimisation
	Workshop	Practice Problem: Routing Optimisation
	Assessment	Weekly Moodle Quizzes: Online Moodle Quiz
Week 9 : 22 July - 28 July	Lecture	Multi-objective Optimisation Problems and Non-linear Optimisation
	Workshop	Practice Problem: Multi-objective Optimisation Problems
Week 10 : 29 July - 4 August	Lecture	Systems Modelling and Real-World Industry Demonstration Projects
	Workshop	Practice Problems and Course Overview
	Assessment	Weekly Moodle Quizzes: Online Moodle Quiz

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 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.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Elnaz Iran nezhad		H20, Room 105	61432712822	Weeks 1 - 5 & 7 ? 10: Electrical Engineering G22 (K-G17-G22)	No	Yes

Other Useful Information

Academic Information

I. 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, or within 3 working days of, submitting an assessment or sitting an exam.

Please note that UNSW has a Fit to Sit rule, which means that if you sit an exam, 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.

II. Administrative matters and links

All students are expected to read and be familiar with UNSW guidelines and polices. 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

III. Equity and diversity

Those students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course convener prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equitable Learning Services. Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made.

IV. Professional Outcomes and Program Design

Students are able to review the relevant professional outcomes and program designs for their streams by going to the following link: https://www.unsw.edu.au/engineering/student-life/student-resources/program-design.

Note: This course outline sets out the 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 or your primary learning management system (LMS) 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/Moodle/LMS, the description in the Course Outline/Moodle/LMS applies.

Academic Honesty and Plagarism

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.

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 or contract cheating) even suspension from the university. The Student Misconduct Procedures are available here:

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

Submission of Assessment Tasks

Work submitted late without an approved extension by the course coordinator or delegated authority is subject to a late penalty of five percent (5%) 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. This is for all assessments where a penalty applies.

Work submitted after five days (120 hours) will not be 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 will be clearly indicated in the course outline, and such assessments will receive a mark of zero if not completed by the specified date. Examples include:

- Weekly online tests or laboratory work worth a small proportion of the subject mark;
- Exams, peer feedback and team evaluation surveys;
- Online quizzes where answers are released to students on completion;
- Professional assessment tasks, where the intention is to create an authentic assessment that has an absolute submission date; and,
- Pass/Fail assessment tasks.

Faculty-specific 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)

School-specific Information

Final Examinations

Final Exams in T2 2024 will be held on campus between the 9th - 22nd August, and Supplementary Exams between the 2nd - 6th September 2024. You are required to be available

on these dates. Please do not to make any personal or travel arrangements during this period.

School Contact Information

For assistance with enrolment, class registration, progression checks and other administrative matters, please see the Nucleus: Student Hub. They are located inside the Library – first right as you enter the main library entrance. You can also contact them via http://unsw.to/webforms or reserve a place in the face-to-face queue using the UniVerse app.

For course administration matters, please contact the Course Coordinator.

Questions about the this course should normally be asked during the scheduled class so that everyone can benefit from the answer and discussion.