School of Civil and Environmental Engineering

UNSW Engineering

CVEN4402

Transport Systems - Part 1: Network Analysis

Term 2, 2023

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Meead Saberi	meead.saberi@unsw.edu.au	By appointment	CE104	

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 subject covers strategic planning aspects related to transport systems, including transport network-based analysis, modelling and optimisation techniques. Network representation of transport systems and traffic route choice modelling including user equilibrium and system optimal are the two main broad topics that will be discussed in this subject. Knowledge about different types of transport network solutions and when and where to apply them are important for transport professionals. The subject material focuses on network theory in some depth, and a reasonable mathematical competency, as well as the ability to perform computational work, will be required to follow this subject. Computer literacy will be helpful but is not essential.

Course Aims

1. Understand operations research concepts applicable in the field of transport engineering
2. Learn and apply optimisation techniques adopted in transport engineering practice
3. Learn and apply transport modelling concepts and relevance to the design process
4. Learn and apply computation methods related to different transport systems
5. Learn and apply methods to compute route choice.
6. Learn and apply methods to compute route and network performance measures.
7. Learn and apply methods to compute optimal locations for urban network infrastructure.

Course Learning Outcomes

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

Learning Outcome	EA Stage 1 Competencies
1. Describe the fundamentals of transport network analysis	PE1.1, PE1.3, PE2.2
2. Apply route choice analysis techniques	PE1.1, PE1.2, PE1.3, PE1.5, PE2.1, PE2.2, PE2.3
3. Apply network user equilibrium solution methods	PE1.5, PE2.1, PE2.2, PE2.3
4. Justify the importance of transport system concept for analysis and design	PE1.1, PE1.2, PE1.3, PE1.5, PE2.1, PE2.2
5. Apply transport network planning techniques	PE1.1, PE1.2, PE1.3, PE1.5, PE2.1, PE2.2, PE2.3

Teaching Strategies

Learning rationale of the course are:

- Understand operations research concepts applicable in the field of transport engineering
- Learn optimization techniques adopted in transport engineering practice
- Learn transport modelling concepts and relevance to the design process

- Learn computation methods related to different transport modes
- Learn methods to compute accessibility
- Learn methods to compute route and network performance measures.
- Learn methods to compute optimum locations for urban infrastructure

The following teaching strategies will be used in the course.

Private Study

- Review lecture material and textbooks
- Do set problems and assignments
- Use Moodle for discussions
- Download class notes from Moodle if not collected during classes
- Reflect on class problems and assignments

Lectures

- Find out what you must learn
- See methods that are not in the textbooks
- Follow worked examples
- Hear announcements on course changes

Workshops and Labs

- Be guided by demonstrators
- Practice solving set problems
- Ask questions

Assessments

- Demonstrate your knowledge and skills
- Demonstrate higher understanding and problem-solving abilities

Assessment

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Weekly Moodle Quizzes	10%	Not Applicable	1, 2, 3, 4, 5
2. Assignment 1	20%	30/06/2023 05:00 PM	1, 2, 3, 4, 5
3. Assignment 2	20%	04/08/2023 05:00 PM	1, 2, 3, 4, 5
4. Final Exam	50%	Not Applicable	1, 2, 3, 4, 5

Assessment 1: Weekly Moodle Quizzes

Online weekly quizzes (administered via Moodle) will be used to gauge participation, and provide feedback on students understanding of the course material to date. The Moodle quizzes will be based on the material covered in lectures and workshops. They will be open book, and are intended to help prepare the students for the final exam.

Assessment 2: Assignment 1

Due date: 30/06/2023 05:00 PM

Assignment 1 will focus on Routing & optimization. The questions will be based on the material covered in lectures and workshop. The assignments are intended to build on the skills developed in workshop, and help prepare the students for the final exam. Assignments will be assessed on the technical merit and consistency of the methodology followed, with consideration given to the clarity of presentation.

Assessment 3: Assignment 2

Due date: 04/08/2023 05:00 PM

Assignment 2 will focus on Network Equilibrium Models. The questions will be based on the material covered in lectures and workshop. The assignments are intended to build on the skills developed in workshop, and help prepare the students for the final exam. Assignments will be assessed on the technical merit and consistency of the methodology followed, with consideration given to the clarity of presentation.

Assessment 4: Final Exam

An open-book final exam will be administered at the end of the semester. The exam will be Moodle-based but will run in-person in the CVEN computer labs. The exam is cumulative and is intended to assess the students' knowledge of the material covered throughout the entire course. The exam will be assessed on technical accuracy.

Hurdle requirement

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

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

Course Schedule

View class timetable

Timetable

Date	Type	Content
O-Week: 22 May - 26 May		
Week 1: 29 May - 2 June	Lecture	Course Introduction Introduction to Transport Systems, Planning and Networks
	Workshop	Introduction to Transport Systems, Planning and Networks
Week 2: 5 June - 9 June	Lecture	Routing Algorithms
	Workshop	Routing Algorithms
Week 3: 12 June - 16 June	Lecture	Convexity and Optimization
	Workshop	Convexity and Optimization
Week 4: 19 June - 23 June	Lecture	Introduction to User Equilibrium User Equilibrium Assignment Solution Methods
	Workshop	Introduction to User Equilibrium User Equilibrium Assignment Solution Methods
Week 5: 26 June - 30 June	Lecture	Path Based UE Solution Methods
	Workshop	Path Based UE Solution Methods
	Assessment	Assignment 1
Week 6: 3 July - 7 July		
Week 7: 10 July - 14 July	Lecture	User Equilibrium with Demand Elasticity
	Workshop	User Equilibrium with Demand Elasticity
Week 8: 17 July - 21 July	Lecture	Stochastic User Equilibrium
	Workshop	Stochastic User Equilibrium

Week 9: 24 July - 28 July	Lecture	System Optimal Assignment
	Workshop	System Optimal Assignment
Week 10: 31 July - 4 August	Lecture	Dynamic Traffic Assignment & Industry guest lecture
	Workshop	Course review
	Assessment	Assignment 2

Resources

Prescribed Resources

Lectures will be delivered online via Blackboard Collaborate and Moodle

Tutorials will be delivered hybrid including an in-person session as well as online via Blackboard Collaborate and Moodle

Recommended Resources

All required reading will be provided in the form of lecture notes.

Recommended reading (available in the library):

Urban Transportation Networks by Professor Yossi Sheffi (MIT)

https://sheffi.mit.edu/book/urban-transportation-networks

Free PDF download link: http://sheffi.mit.edu/sites/sheffi.mit.edu/files/sheffi_urban_trans_networks_0.pdf

Modelling Transport, Fourth Edition/Juan de Dios Ortúzar, Luis G. Willumsen

Published Online: http://onlinelibrary.wiley.com/book/10.1002/9781119993308

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

Photo by Deva Darshan on Unsplash

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	