CVEN3402

Transport Engineering and Environmental Sustainability

Term 2, 2023

Course Overview

Staff Contact Details

Convenors

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Divya Nair	divya.nair@unsw.edu.au	Monday 10am to 3pm	Room 103, Level 1, H20	+61 2 9065 4861

Lecturers

Name	Email	Availability	Location	Phone
Elnaz Irannezhad	e.irannezhad@unsw.edu.au	Monday 10am to 3pm	Room 105, Level 1, H20	+61432712 822

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 is the first introductory course in the discipline of transport engineering as part of the broad field of civil and environmental engineering. An outline of the field of transport engineering and its relationships with other engineering and non-engineering disciplines is provided within the course. The course comprises two strands. Strand one covers the analysis, design, and evaluation of traffic and transport systems, including the fundamentals of traffic flow theory and the "4-step transport modelling" approach to determine travel demands, a key component of infrastructure feasibility assessments and design to ensure satisfactory operations. The second strand emphasises the need of addressing sustainability issues in the transport system and covers technical skills and analysis methods required for the evaluation and management of environmental impacts from transport projects, including estimation of vehicle emission and dispersion, energy consumption, and travel demand management. The course covers the application of planning concepts in the development of environmentally and economically sustainable transport systems. Additionally, estimation of noise levels and engineering solutions to control noise is covered in the context of transport noise generators such as road traffic.

Course Aims

The course aims to develop skills related to the analysis of traffic and transport systems and quantifying sustainability impacts with regard to transport systems.

Strand one aims to introduce components of the field of transport engineering and basic elements of transport and traffic engineering practice, provide an opportunity to learn the engineering properties of traffic streams along with relevant measurement and network analysis techniques and explain urban transport planning concepts adopted by planning agencies and Roads and Traffic Authorities. The second strand will describe the importance of transport within the framework of Ecologically Sustainable Development and explain the nature of transport and traffic noise, the sources and impacts of transport emissions and dispersions and the sustainability of the transport system from a broad multi-criteria perspective.

In particular, the students will be able to apply the data analysis and modelling concepts of transport planning and traffic engineering to develop and manage transport systems. Further, the students will be able to develop creative and critical thinking skills through the lens of sustainable transport systems.

Course Learning Outcomes

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

Learning Outcome	EA Stage 1 Competencies
1. Explain relationships between fundamental traffic flow parameters;	PE1.1, PE1.2, PE1.3, PE1.4
2. Explain basic concepts of four-step travel demand modelling and demonstrate calculation methods related to each step	PE1.1, PE1.2, PE1.3, PE2.1, PE2.2
3. Perform computational evaluations of network traffic management methods	PE1.1, PE1.2, PE1.5, PE2.1, PE2.2
4. Describe the relationships between Land Use, Transport and the Environment	PE1.1, PE1.2, PE1.6
5. Estimate traffic noise levels, emissions, dispersions and energy consumption	PE1.2, PE1.3, PE1.6, PE2.1, PE2.2
6. Explain the economies of transport externalities and apply travel demand management policies	PE1.2, PE2.2, PE1.3, PE1.6, PE3.2, PE3.4, PE3.6

Teaching Strategies

The learning process of this course consists of a mixture of lectures, workshops, assignment activities and private study to apply the learned knowledge.

Each week, lecture and workshop material will be available on Moodle prior to the lecture session to give you an orientation to the topics covered that week.

Across the term, the weekly 2+2 hour lectures will give students an understanding of the theory and practice of strategic design and an appreciation of key conceptual drivers in the field of transport engineering. Lectures will be delivered in person and a part of the lecture will be devoted to answering student questions. Lecture recordings will be available on Moodle. Lectures recordings are not intended to be a substitute for class attendance but may be useful for students who cannot avoid missing a class and for those who attend the class but want to rehear part of it to aid their understanding. Based on studies by a higher education research expert John Biggs, most active students in the class do not just listen, see, collect notes and take notes, but most importantly, they will “express understanding; raise issues, speculate, solve problems, discuss, answer questions and reflect”

Weekly 2 hour workshops will be guided by demonstrators and will be delivered in person. The workshops will focus on the application of the theoretical concepts learned during the lecture and are meant to further develop and consolidate problem solving skills. A step-by-step solution to the practice problems will be discussed during the workshop and you will be encouraged, from time to time, to work in small groups to solve problems. In addition to that, a part of the workshop will be devoted to answering student questions. We encourage you to develop a close working relationship with your demonstrators and the rest of your class. Note: Workshop attendance is mandatory and workshop sessions are not recorded.

A Moodle discussion forum is available for you to ask questions about lecture and workshop material in

general, and also about particular assignments. You may use this to discuss the lecture/workshop content with your peers as well as getting online help from the lecturers.

To reinforce the learning experience, a total of five assessments (quizzes, assignment and final exam) will be run throughout the term. Further, Moodle practice Online Quizzes with automated feedback come available in parallel to the lecture content to allow students to practice transport engineering problems as often as they like while receiving feedback on how they are going.

For each hour of contact it is expected that a student will put in about 1.5 hours of private study: for example, reading the course related materials provided through the course Moodle page, solving problems and reflecting on the conceptual framework discussed in the lectures and workshops. You are recommended to review the lecture and workshop material weekly and ask questions during the lecture/workshop or via the discussion forum.

Additional Course Information

The most important factors in learning are students' commitment and learning methods. You are encouraged to attend all the lectures and other teaching activities, ask questions and participate in class discussions. Weekly review of lecture and workshop material. Follow worked examples. Reflect on lecture/workshop problems and quizzes. In addition, relevant resources on the Moodle course page are of great help in understanding the basic concepts discussed in the lectures and the trends in the discipline of transport engineering.

Complete all the required tasks in the Moodle course page. Weekly reading and recording of your learning. Planning your time to achieve all assessment requirements (see assessment). We encourage you to work with your peers. A good way to learn the material is in small study groups. Such groups work best if members have attempted the problems individually before meeting as a group. A valued and honest collaboration occurs when, for example, you "get stuck" early on in attacking an exercise and go to your classmate with a relevant question. Your classmate then has the opportunity to learn from your question as well as help you. You then bring something to the collaboration.

Students who perform poorly in the assessments are strongly encouraged to discuss their progress with the lecturer during the term. Please do not suffer in silence – seek help at an early stage! We would like you to make the most of this learning process.

Assessment

Students who miss the assessments 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. Moodle Quizzes	30%	Quiz 1: 15/06/2023 4:00PM, Quiz 2: 22/06/2023 4:00PM, Quiz 3: 29/06/2023 4:00PM	1, 2, 3, 4
2. Assignment	20%	04/08/2023 04:00 PM	4, 5, 6
3. Final Exam	50%	Not Applicable	1, 2, 3, 4, 5, 6

Assessment 1: Moodle Quizzes

Due date: Quiz 1: 15/06/2023 4:00PM, Quiz 2: 22/06/2023 4:00PM, Quiz 3: 29/06/2023 4:00PM

Three online quizzes will be administered via Moodle in weeks 3, 4 and 5. The Moodle quizzes will be based on the material covered in lectures and workshops. The Moodle quizzes are intended to help prepare the students for the final exam. These weekly assessments also provide a means for continuous assessment and feedback for students throughout the course. The questions will be marked based on technical accuracy.

QUIZ 1: Topics covered - Transport Planning and Traffic Flow Theory

QUIZ 2: Topics covered - Trip Generation Models and Trip Distribution Models

QUIZ 3: Topics covered - Mode Choice Models and Traffic Assignment Models

Additional details

See Moodle for details

Assessment 2: Assignment

Start date: 12/07/2023 04:00 PM
Due date: 04/08/2023 04:00 PM

This assessment will be a group assignment in which the students estimate the aggregated Greenhouse Gas Emissions forecasts of Transport Sectors for the Australian states, and assess if Australia would meet the 2050 Net-zero carbon target based on the current fleet transitioning trend or not. Students will use the Australian Bureau of Statistics (ABS) data and deliver a group presentation to the class as well a group project report.

Additional details

See Moodle for details

Assessment 3: Final Exam

A 2-hour final exam will be administered at the end of the semester. The exam will be cumulative (covering both Strand 1 and Strand 2 material), and intended to assess the student's knowledge of the material covered throughout the entire course. The exam questions (and weighting) will be evenly split between the two strands of the courses. The exam will be assessed on technical accuracy.

Additional details

See Moodle for details

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 sessions.

Course Schedule

View class timetable

Timetable

Date	Type	Content
Week 1: 29 May - 2 June	Lecture	Outline of the course; Introduction to Transport Systems and Planning
	Lecture	Introduction to Traffic Flow Theory
	Workshop	Practice Problems: Transport Planning and Traffic Flow Elements
Week 2: 5 June - 9 June	Lecture	Fundamental Relationship Between Traffic Flow Elements
	Lecture	Trip Generation Models
	Workshop	Practice Problems:Traffic Flow Fundamental Relationship and Trip Genaration
Week 3: 12 June - 16 June	Lecture	Trip Distribution Models
	Workshop	Practice Problems: Trip Distribution
	Assessment	QUIZ 1: Transport Planning and Traffic Flow
Week 4: 19 June - 23 June	Lecture	Mode Choice Models
	Lecture	Traffic Assignment Models
	Workshop	Practice Problems: Mode Choice and Traffic Assignment
	Assessment	QUIZ 2: Trip Generation and Distribution
Week 5: 26 June - 30 June	Lecture	The 4-step Urban Transport Planning Model
	Lecture	The 4-step Urban Transport Planning Model
	Workshop	Practice Problems: Review of Strand 1
	Assessment	QUIZ 3: Mode Choice and Traffic Assignment
Week 6: 3 July - 7 July		

Week 7: 10 July - 14 July	Lecture	Transport Air Pollution
	Lecture	Transport Fleet Transition towards Zero Carbon Vehicles
	Workshop	Practice Problem of Forecasting Fleet Transition Trend
Week 8: 17 July - 21 July	Lecture	Sustainability framework, Environmental Policies & Economies of Transport Externalities
	Lecture	Fuel Cell Technology (Guest Lecture)
	Workshop	Practice Problem of Fuel Economy
Week 9: 24 July - 28 July	Lecture	Transport Emission Modelling
	Lecture	Emission Dispersion Modelling
	Workshop	Practice Problem – Calculating Emission
Week 10: 31 July - 4 August	Lecture	Transport Noise Emission Modelling
	Lecture	Course Recap and Group Presentations
	Workshop	Practice Problem – Calculating Transport Noise
	Assessment	Assignment

Resources

Prescribed Resources

All required/recommended reading will be provided on Moodle or available in the library

- Copies of class notes are available at the Moodle site for this course: http://teaching.unsw.edu.au/elearning
- Austroads Guide to Road Design: Part 1 Objectives of Road Design and Part 3: Geometric Design.
- Traffic and Highway Engineering, fourth edition, Garber N.J. and Hoel L.A
- Principles of Highway Engineering and Traffic Analysis, Revised Edition/ Fred L. Mannering, Scott S. Washburn, Walter P. Kilareski
- An Introduction to Traffic Flow Theory, Lily Elefteriadou
- Moving People: Sustainable Transportation Development/Peter Cox
- Planning Sustainable Transport/Barry Hutton
- Sustainable Transportation Planning: Tools for Creating Vibrant, Healthy, and Resilient Communities/ Jeffrey Tumlin
- Sustainable Transportation: Problems and Solutions/ William R. Black
- An Introduction to Sustainable Transportation: Policy, Planning and Implementation/Preston L. Schiller, Eric Bruun, Jeffrey R. Kenworthy
- Modelling Transport, Fourth Edition/Juan de Dios Ortúzar, Luis G. Willumsen
    - Comments: Modelling Transport, Fourth Edition is Published Online: http://onlinelibrary.wiley.com/book/10.1002/9781119993308

See Moodle for details

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	✓