CVEN9415

Transport Systems Part 2

Term 2, 2023

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Divya Nair	divya.nair@unsw.edu.au	Wednesday 10am to 5pm	Room 103, Level 1, H20	(+61 2) 9065 4861

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 offers students an advanced understanding of the field of traffic engineering and congestion management, with a focus on traffic stream characteristics, stochasticity in transport systems and queuing theory to address congestion and delay minimisation. The course covers topics related to the analysis, design and evaluation of traffic congestion management systems using queuing theory including data collection and analysis methods, simulation techniques and stochastic process techniques used for modelling queuing systems. The main topics include an introduction to queuing theory, discussion of common queuing models, application of queuing models in traffic flow, and tools required to manage and analyse big volume of real-world data. The focus is on the application of queuing theory to vehicle flow at traffic intersections in real-world settings. In addition, it focusses on applications to traffic flow using real-world data to constrain the models presented in the course material.

Course Aims

This course is designed to develop students' understanding, skills and knowledge in the field of traffic and transport engineering. It introduces stochasticity and queuing in transport systems and the methods used to account for this within the transport infrastructure assessment. The unit will complement the skills learnt in the other transport units to provide a well-rounded knowledge of transport planning and management.

While the focus of the course is congestion analysis and management applying queuing theory, specifically, describing queuing theory and operations research concepts in transport context, modelling and characterizing traffic congestion, the statistical distribution of fundamental traffic flow elements, comparing modelling techniques (deterministic and stochastic) adopted in transport engineering practice, applying queuing models and data analysis to real-world transport problems using real data and conducting big data analysis, simulation experiments using softwares and generalising on modelling results to produce policy recommendations, importance is also placed on the reporting and presentation of technical material that can be used by high level decision makers.

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 traffic congestion models. Students will have the opportunity to analyse real traffic data, develop traffic congestion management plans and design traffic management models using industry prevalent modelling software, developing necessary practical skills as a traffic engineer.

Course Learning Outcomes

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

Learning Outcome	EA Stage 1 Competencies
1. Explain the basic concepts and fundamental assumptions in modelling queues in transport systems.	PE1.1, PE1.2, PE1.3
2. Describe stochastic characteristics of traffic flow in road network.	PE1.1, PE1.2, PE1.3, PE2.1, PE2.2
3. Utilise queueing models to evaluate existing conditions and transport policy alternatives.	PE1.2, PE1.3, PE2.1, PE2.2
4. Design research question, methodology and data approach to solve real-world transport system problems.	PE2.1, PE1.1, PE1.4, PE1.6, PE2.3, PE2.4
5. Demonstrate the ability to critically analyse real-world data applying statistical methods.	PE1.1, PE1.2, PE2.2
6. Demonstrate solving complex existing and potential transport system problems in team environment	PE1.1, PE1.2, PE2.1, PE2.2, PE2.4, PE3.2, PE3.3, 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 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 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 three assessments (quizzes, assignment and project delivery) will be run throughout the term.

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 will undertake a variety of individual and group assessment components that are associated with course objectives and learning outcomes. Groups with four members will be self-selected using groups on Moodle by end of Week 2. For group assessment items only one submission is allowed to be submitted per group. All assessment submissions will be through Moodle and/or Turnitin.

There is no final exam for this course*. The final grade for this course will normally be based on the sum of the scores from each of the assessment tasks. Read the information under the individual assignment briefs to understand the breakdown between individual and group marks for each assessment task. The lecturers reserve the right to adjust the final scores by scaling if agreed by the Head of School.*

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Moodle Quiz	20%	16/06/2023 04:00 PM	1, 2
2. Preliminary Project Design Brief (Individual Assessment)	10%	30/06/2023 04:00 PM	3, 4
3. Data Analysis and Simulation Techniques (Individual Assessment)	20%	14/07/2023 04:00 PM	4, 5
4. Project - Presentation, Professional skills and Technical Report	50%	04/08/2023 04:00 PM	4, 5, 6

Assessment 1: Moodle Quiz

Start date: 14/06/2023 01:00 PM
Due date: 16/06/2023 04:00 PM

An online quiz will be administered via Moodle. The Moodle quiz will be based on the material covered in the first 3 weeks lectures and workshops. The Moodle quiz will assess students understanding on the basic tenets of queueing theory which will be applicable to the rest of the assessments in the course. The questions will be marked based on technical accuracy.

The Moodle quiz will be an open-book assessment. Students
must submit their responses while the quiz is still active. You will be given only one attempt to do the quiz. Failure to complete/submit a quiz within the accessible time period will result in a mark of zero.

Additional details

See Moodle for details

Assessment 2: Preliminary Project Design Brief (Individual Assessment)

Submission notes: The Preliminary Project Design Brief is formed using a “Moodle Questionnaire”,

where your task is to respond to a series of short answer and multiple choice questions. (Note a report is not necessary for this assignment). Late submissions will attract penalities
Due date: 30/06/2023 04:00 PM

In this assessment, you will prepare a Preliminary Project Design Brief related to a transport planning and management topic of your choice.

This assessment will require you to:

1. Identify your research question;
2. Describe your approach to answering this question;
3. Define your data needs for addressing this question;
4. Identify the skills required to solve this problem;
5. Expected outcome of the project.

Additional details

See Moodle for details

Assessment 3: Data Analysis and Simulation Techniques (Individual Assessment)

Submission notes: Late submissions will attract penalties.
Due date: 14/07/2023 04:00 PM
Deadline for absolute fail: Penalties: A late penalty of 5% per day will apply for failure to submit the assignment by the stated due date. Any reports submitted 5 or more days after the deadline will receive a mark of zero.
Marks returned: 28th July 2023

This assignment will be based on the topics covered in the Week 4 and 5 lectures and workshops. The assignment tests a student's ability to understand and interpret the available real-world traffic data, and simulation techniques used in queueing theory. The knowledge tested through this assignment will later be used in the group project assessment later in the course. The questions will be marked based on technical and methodological accuracy.

The assessment will be made available at the beginning of Week 5. The individual assessment must be submitted via the Turnitin link available on the Moodle course page.

Additional details

See Moodle for details

Assessment 4: Project - Presentation, Professional skills and Technical Report

Submission notes: Technical Report: Only one submission per group should be made via the Turnitin link available on the course page in Moodle. The assignment must have a cover sheet according to UNSW template and must list the name of all team members. Late submissions will attract penalties.
Due date: 04/08/2023 04:00 PM

The group project involves developing queueing models to analyse vehicle flow at a traffic intersection using the available real-world dataset. Students have to form teams comprising a maximum of 4, on Moodle, prior to commencing project work. The aim of the project is to give students an experience of

the practice followed by transport consultants in proposing solutions to real-world problems in transport. Students will also get experience working in a team environment and collaborating with team members during this project activity.

The assessment has three components:
(1) Presentation and Peer Assessment (10%) - An oral presentation to the lecturer and peers. The presentations will occur during Week 10.
(2) Technical Report (25%) - This is a group assessment - the final technical report. The report submission link will be made available at the beginning of Week 9 and the last date for submitting the technical report is Friday, 4th August 2023 4:00 PM (Week 10).
(3) Professional Skills (15%) - This is an individual assessment where the students are required to submit a project management statement, a self reflection statement, and a statement on policy implications of Queuing Models in Transport Engineering (based on the Guest Lecture). The deadline for the submission is Friday, 4th August 2023 4:00 PM (Week 10).

This assignment is submitted through Turnitin and students do not see Turnitin similarity reports.

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 session.

Course Schedule

View class timetable

Timetable

Date	Type	Content
Week 1: 29 May - 2 June	Lecture	Introduction to Queuing Theory
	Workshop	Practice problems on Basics of Queueing Theory
Week 2: 5 June - 9 June	Lecture	Deterministic Queuing Models
	Workshop	Practice problems on Deterministic Queueing Models
Week 3: 12 June - 16 June	Lecture	Stochastic Queuing Models
	Workshop	Problems on Stochastic Queuing Models
	Assessment	Moodle Quiz
Week 4: 19 June - 23 June	Lecture	Data Analysis and Preliminary Project Design
	Workshop	Data Analysis - Using SQLite + practice problems on SQL and Assessment 2 Consultation
Week 5: 26 June - 30 June	Lecture	Simulation Methods in Queuing Models
	Workshop	Practice problems on Monte Carlo Simulation and Assessment 2 and 3 Consultation
	Assessment	Preliminary Project Design Brief (Individual Assessment): The Preliminary Project Design Brief is formed using a “Moodle Questionnaire”, where your task is to respond to a series of short answer and multiple choice questions. (Note a report is not necessary for this assignment). Late submissions will attract penalities
Week 6: 3 July - 7 July		
Week 7: 10 July - 14 July	Lecture	Simulation Methods in Queuing Models Part II
	Workshop	Practtice Problems and Assessment 3 Discussion
	Assessment	Data Analysis and Simulation Techniques

		(Individual Assessment): Late submissions will attract penalties.
Week 8: 17 July - 21 July	Lecture	Queuing Models and Project Discussion
	Workshop	Practice Problems and Project Discussion
Week 9: 24 July - 28 July	Lecture	Policy Implications of Queueing Models
	Workshop	Group Project Consultation
Week 10: 31 July - 4 August	Lecture	Group Presentation and Peer Assessment
	Workshop	Group Presentation and Peer Assessment
	Assessment	Project - Presentation, Professional skills and Technical Report: Technical Report: Only one submission per group should be made via the Turnitin link available on the course page in Moodle. The assignment must have a cover sheet according to UNSW template and must list the name of all team members. Late submissions will attract penalties.

Resources

Prescribed Resources

- Roess, Roger P., Elene S. Prassas, William R. McShane. Traffic Engineering. Third Edition, Upper Saddle River: Pearson Prentice Hall, 2004 (ISBN 0-13-142471-8)
- Daganzo, C. Fundamentals of Transportation and Traffic Operations, Pergamon-Elsevier,Oxford, U.K. (1997)
- de Neufville, Richard. “Applied Systems Analysis - Engineering Planning and Technology Management”, McGraw Hill, 1990.
- Hall, W. Randolph. “Queueing Methods - For Services and Manufacturing”, Prentice Hall, 1991.
- Ravindran, A., Phillips, Don T. and Solberg, James J. "Operations Research - Principles and Practice", John Wiley and Sons, 1987.
- Additional resources will be made available through Moodle

Recommended Resources

Please see Moodle under "Resources" tab for all recommended and additional reading resources

Laboratory Workshop Information

Workshops: Workshops will be guided by the lecturer and demonstrators (postgraduate research students/research fellow) and will be focussed on solving practice problems and asking questions related to the lecture and assessments. Workshops are online/face-to-face sessions and are scheduled on Weeks 1 to 10.

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	✓