CVEN9407

Transport Modelling

Term 2, 2023

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Taha Hossein Rashidi	rashidi@unsw.edu.au			

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

Modelling transportation demand and safety; a broad range of econometric modelling techniques and its application to transportation systems will be considered; specific emphasis will be placed on estimation of these models and their use for forecasting and interpretation of results; transportation data, analysis and modelling including considerations of data sources, errors, time series analysis, stochastic models and extensions to simulation and optimisation in transportation systems.

Course Aims

Objective of the course is to impart advanced knowledge in transport modelling with a focus on application to traffic demand, safety and urban planning. The course will focus on econometric modelling techniques and statistical estimation used in traffic demand and safety planning and engineering. Assignments and class projects will require students to apply these methods to real datasets.

Course Learning Outcomes

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

Learning Outcome	EA Stage 1 Competencies
1. Explain basic statistics and econometrics in transport modelling	PE1.1, PE1.2, PE2.1
2. Identify the properties of random variables in large scale data	PE1.1, PE1.3, PE2.4, PE3.4
3. Perform a comprehensive statistical analysis on large data using statistical packages	PE1.1, PE1.2, PE1.5, PE2.3, PE3.3
4. Infer statistical conclusions from real world large data	PE1.1, PE1.2, PE1.3, PE2.1, PE2.2

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 3+1 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 get online help from the lecturers

To reinforce the learning experience, a total of nine assessments (quizzes, assignment and the 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.

Private Study

- Review lecture material and research literature
- Do set problems and assignments
- Reflect on class problems, assignments & literature review
- Do internet and library searches on topics related to the course
- Participate in class discussions
- Utilize material taught in class and learnt from literature review, to develop innovative solutions for the class project

Lectures

- Find out what you must learn
- Follow worked theory and examples
- Hear announcements on course changes

Workshops

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

Assessments (tests, examinations, assignments)

- Demonstrate your knowledge and skills

- Demonstrate higher understanding and problem solving

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

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Quiz 1	3%	08/06/2023 08:15 AM	1
2. Quiz 2	3%	22/06/2023 08:15 AM	1, 2
3. Quiz 3	3%	29/06/2023 08:15 AM	1, 2, 3
4. Quiz 4	3%	13/07/2023 08:15 AM	1, 3
5. Quiz 5	3%	03/08/2023 08:15 AM	1, 2
6. Assignment 1	15%	13/07/2023 08:00 AM	1, 2, 3
7. Assignment 2	15%	27/07/2023 08:00 AM	1, 2, 3, 4
8. Assignment 3	15%	04/08/2023 11:59 PM	1, 2, 3, 4
9. Final Exam	40%	Not Applicable	1, 2, 3, 4

Assessment 1: Quiz 1

Start date: 08/06/2023 08:00 AM
Due date: 08/06/2023 08:15 AM

Basics of statistic

Students will be assessed based on the accuracy and validity of their submitted solutions to the questions.

This Quiz is based on the discussion of the first lecture.

Comprehensive understanding of basic statistics and probabilities

Additional details

Comprehensive understanding of basic statistics and probabilities

Assessment 2: Quiz 2

Start date: 22/06/2023 08:00 AM
Due date: 22/06/2023 08:15 AM

Understanding basic assumptions behind linear regression models.

Students will be assessed based on the accuracy and validity of their submitted solutions to the questions.

Assessment 3: Quiz 3

Start date: 29/06/2023 08:00 AM
Due date: 29/06/2023 08:15 AM

Potential troubles resulting from violating the assumptions and common remedies for them.

Students will be assessed based on the accuracy and validity of their submitted solutions to the questions.

Assessment 4: Quiz 4

Start date: 13/07/2023 08:00 AM
Due date: 13/07/2023 08:15 AM

Time series regression and count data

Students will be assessed based on the accuracy and validity of their submitted solutions to the questions.

Assessment 5: Quiz 5

Start date: 03/08/2023 08:00 AM
Due date: 03/08/2023 08:15 AM

Discrete choice modelling

Students will be assessed based on the accuracy and validity of their submitted solutions to the questions.

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.

Assessment 6: Assignment 1

Start date: 01/06/2023 12:00 PM
Due date: 13/07/2023 08:00 AM

Linear regression

A hands on project with real world data

Assessment 7: Assignment 2

Start date: 13/07/2023 12:00 PM
Due date: 27/07/2023 08:00 AM

Time series regression and count data

A hands on project with real world data

Assessment 8: Assignment 3

Start date: 27/07/2023 12:00 PM
Due date: 04/08/2023 11:59 PM

Discrete choice modelling

Assessing students' knowledge about models for non-continuous dependent variables

A hands on project with synthesised data

Assessment 9: Final Exam

Covering all topic covered in the course.

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 (double hurdle).

Hurdle requirement

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

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

A table of lectures and workshops or practical class topics for each week, indicating the name of the lecturer involved (where multiple lecturers teaching in the course), online activities, such as discussion forums, and relevant readings from textbooks and other reference material identified for the course.

View class timetable

Timetable

Date	Type	Content
O-Week: 22 May - 26 May		
Week 1: 29 May - 2 June	Lecture	**Topic:** Introduction to transport modelling Statistical inference **Lecture Content:** Basics of econometrics Review of statistics and probabilities Statistical hypothesis testing **Demonstration Content:** Introduction to R
Week 2: 5 June - 9 June	Lecture	**Topic:** Statistical inference Regression analysis **Lecture Content:** Two-variable regression

		assumptions Dummy variables **Demonstration Content:** Running regression in R
	Assessment	Quiz 1
Week 3: 12 June - 16 June	Lecture	**Topic:** Regression analysis **Lecture Content:** Multiple regression analysis Multicollinearity Count data **Demonstration Content:** Running multiple regression in R
Week 4: 19 June - 23 June	Lecture	**Topic:** Regression model troubleshooting **Lecture Content:** Heteroscedasticity Autocorrelation **Demonstration Content:** Heteroscedasticity Autocorrelation
	Assessment	Quiz 2
Week 5: 26 June - 30 June	Lecture	**Topic:** Regression Model Time Series **Lecture Content:** Time series formulations and Count Data

		Demonstration Content: Running time series in R
	Assessment	Quiz 3
Week 6: 3 July - 7 July	Reading	***Flexibility week for all courses (non□teaching)***
Week 7: 10 July - 14 July	Lecture	**Topic:** Discrete choice **Lecture Content:** Basic definitions Choice set Logit models **Demonstration Content:** Running logit with biogeme
	Assessment	Quiz 4
	Assessment	Assignment 1
Week 8: 17 July - 21 July	Lecture	**Topic:** Discrete choice **Lecture Content:** Nested logit **Demonstration Content:** Running nested logit with biogeme
Week 9: 24 July - 28 July	Lecture	**Topic:** Discrete choice **Lecture Content:** Ordered logit **Demonstration Content:** Running Ordered logit with biogeme
	Assessment	Assignment 2

Week 10: 31 July - 4 August	Lecture	**Topic:** Survival analysis **Lecture Content:** Baseline hazard, definition and interpretations **Demonstration Content:** Estimating Cox Proportional Hazard in R
	Assessment	Quiz 5
	Assessment	Assignment 3

Resources

Prescribed Resources

Material essential for this course is provided in lecture notes available through Moodle.

Suggested references are listed below:

- Gujarati, D.N. (2004) Basic Econometrics, 4th Edition, McGraw Hill
- Casella, G., and R.L. Berger (2001) Statistical Inference, 2nd Edition, Duxbury Press
- Train, K. (2009) Discrete Choice Methods with Simulation, 2nd Edition, Cambridge University Press
- Washington, S. P., M. G. Karlaftis and F. L. Mannering (2011) Statistical and Econometric Methods for Transportation Data Analysis, CRC Press Taylor and Francis Group
- Alain Zuur, Elena N. Ieno, Erik Meesters (2009) A Beginner's Guide to R, Springer
- Randall Schumacker, Sara Tomek (2013) Understanding Statistics Using R, Springer

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	