School of Civil and Environmental Engineering

Term 2, 2020

CVEN9415: TRANSPORT SYSTEMS PART 2

COURSE DETAILS

Units of Credit	6	
Contact hours	4 hours per week	
Class	Wednesday, 12:00 – 14:00	Weeks 1 – 5 and 7 – 10: Online-blackboard Ultra
Workshop	Wednesday, 14:00 – 16:00, Thursdays, 14:00 – 16:00, Thursdays, 16:00 – 18:00 http://timetable.unsw.edu.au/2020/CVEN9415.html	Weeks 1 – 5 and 7 – 10: Online-blackboard Ultra
Course Coordinator and Lecturer	Dr. Ali Ardeshiri Email: A.Ardeshiri@unsew.edu.au Office: Room 111, Civil Engineering Building	

INFORMATION ABOUT THE COURSE

This course covers the role of stochasticity in transport systems using queuing theory to address congestion and delay minimisation. It focusses on applications to traffic flow using real-world data to constrain the models presented in the course material.

Students have the opportunity to work with real data in project-oriented design-based learning environment. In addition to the material presented on queuing theory and its applications, the course also develops skills for working with data and managing collaborative projects.

HANDBOOK DESCRIPTION

The handbook description for CVEN9415 can be accessed using the link below:
https://www.handbook.unsw.edu.au/undergraduate/courses/2020/CVEN9415/

OBJECTIVES

CVEN9415 introduces stochasticity and queuing in transport systems and the methods used to account for this within transport infrastructure assessment such as serviceability assessment of signalised intersections. The unit will complement skills learnt in the other transport units to provide a well-rounded knowledge of transport planning and management. 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.

The learning goals that this course aims to achieve and details how the achievement of these goals will be assessed are described as follows:

- Understand operations research concepts applicable in the field of transport engineering.
- Describe queuing theory concepts in transport context
- Compare modelling techniques (deterministic and stochastic) adopted in transport engineering practice.
- Apply queueing models and data analysis to real-world transport problems using real data.
- Generalise on modelling results to produce policy recommendations

TEACHING STRATEGIES

Private Study	• Review lecture material and textbook • Do set problems and assignments • Join Moodle discussions of problems • Reflect on class problems and assignments • Download materials from Moodle • Keep up with notices and find out marks via Moodle
Lectures	• Find out what you must learn • See methods that are not in the textbook • Follow worked examples • Hear announcements on course changes
Group Work	• Exchange ideas with team members • Collaboratively solve problems • Reflect on project results
Assessments	• Demonstrate your knowledge and skills • Demonstrate higher understanding and problem solving

EXPECTED LEARNING OUTCOMES

This course is designed to address the learning outcomes below and the corresponding Engineers Australia Stage 1 Competency Standards for Professional Engineers as shown. The full list of Stage 1 Competency Standards may be found in Appendix A.

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

Learning Outcome		**EA Stage 1 Competencies**
1.	*Recognise and be familiar with concepts from queuing theory.*	*PE1.1, PE1.2, PE1.3, PE1.6*
2.	*Understand the fundamental assumptions in modelling queues in transport systems.*	*PE1.1, PE1.2, PE1.3, PE1.6*
3.	*Describe stochastic characteristics of traffic flow in road network.*	*PE1.1, PE1.2, PE1.3, PE2.1, PE2.2*
4.	*Utilise queueing models to evaluate existing conditions and transport policy alternatives.*	*PE1.1, PE1.2, PE1.3, PE2.1, PE2.2, PE3.6*

5.	*Design a research question, methodology and data approach for a real-world problem.*	*PE1.1, PE2.3, PE2.4, PE3.6*
6.	*Apply statistical methods to analyse real-world data.*	*PE1.1, PE1.2, PE1.3, PE2.2*
7.	*Solve transport system problems in a team environment.*	*PE2.1, PE2.2, PE2.3, PE2.4, PE3.6*

For each hour of contact it is expected that you will put in at least 1.5 hours of private study.

COURSE PROGRAM

Term 2 2020

Date	Topic	Lecture Content	Demonstration Content
03/06/2020 (Week 1)	Basics of Queueing Theory (I)	- Course outline, - Queuing Theory Introduction, - Queuing Model Notation, - Variables and Performance Metrics for Queue	Practice problems on Basics of Queueing Theory (I)
10/06/2020 (Week 2)	Basics of Queueing Theory (II)	- Queuing Theory Basics, - Graphical Approach, - Deterministic Queue (D/D/1)	Practice problems on Basics of Queueing Theory (II)
17/06/2020 (Week 3)	Basics of Queueing Theory (III)	- Stochastic Process & Queuing	Practice problems on Basics of Queueing Theory (III)
24/06/2020 (Week 4)	Analysing Real-world Data	- Introduction to Traffic Data and SQL, - Real-world Transport Problem	Using SQLite + practice problems on SQL
01/07/2020 (Week 5)	Simulation Methods Part (I)	- Random events, - Monte Carlo Simulation - Halton Sequence	Practice problems on Monte Carlo Simulation + Q/A on Assignment 1
08/07/2020 (Week 6)	***No Lecture***	- ***Flexibility week for all courses (non-teaching)***	
15/07/2020 (Week 7)	Guest Lecturer Dr. Kasun De Silva Wijayaratna from UTS	- Applications of Queueing Models	Exploring data for Group Project + Q/A on Assignment 2
22/07/2020 (Week 8)	Simulation Methods Part (II)	- Interval-oriented Simulation Model - Event-oriented Simulation Model	Practice problems on Deterministic Queueing Models + Q/A on Group Project
29/07/2020 (Week 9)	Queueing Models	- Deterministic and Stochastic queueing models	Practice problems on Stochastic Queueing Models + Q/A on Group Project
05/08/2020 (Week 10)	Policy Implications of Queueing Models	- ***Review of the course,*** - Transport planning and management p***olicy implication examples***	Q/A on Group Project

ASSESSMENT

Things to note:

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 below on the individual assignment briefs to understand the breakdown between individual and group marks for each assessment task. For group assessments, only one version (the first submitted) will be marked. Disputes within groups must be resolved by the group members. ***There is no final exam for this course****. The lecturers reserve the right to adjust the final scores by scaling if agreed by the Head of School.*

S. No.	Assessment	Weighting	Assessment Criteria
1	Moodle Quiz (During Week 4 lecture)	20%	An online quiz will be administered via Moodle. The Moodle quiz will be based on the material covered in the first 3 weeks of lectures and workshops. The Moodle quiz will assess students understanding of the basic's tenets of the 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 made accessible at 12:00 pm Wednesday the 17th of June and will close by 11:59 pm on the 19th of June. 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. It is strongly recommended that students attend Week 4 lecture to receive general feedbacks on the online quiz.
2	Assignment 1 (Individual Assessment)	20%	This assignment will be based on the topics covered in the Week 4 lecture and workshop. The assignment tests a student's ability to understand and interpret the available real-world traffic data, which will also be used in the group project assessment later in the course. The questions will be marked based on technical and methodological accuracy. Assignment 1 will be made available at the beginning of Week 5. The last date of submitting assignment 1 is Friday 10th July 2020 11:59AM. The assignment is for individual assessment and must be submitted via the Turnitin link available on the course page in Moodle. The assignment must have a cover sheet according to UNSW template. Late submissions will attract penalty.
3	Assignment 2 (Individual Assessment)	30%	This assignment will be based on the topics covered in the Week 5 lecture and workshop. The assignment tests a student's understanding towards 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. Assignment 2 will be made available at the beginning of Week 5. The last date of submitting assignment 2 is 31st July 2020 11:59AM. The assignment is for individual assessment and must be submitted via the Turnitin link available on the course page in Moodle. The assignment must

S. No.	Assessment	Weighting	Assessment Criteria
			have a cover sheet according to UNSW template. Late submissions will attract penalty.
4	Group Project	30%	This submission will be based on the topics covered in Weeks 7, 8, 9 and 10 lectures and workshops. The project involves developing queueing models to analyse vehicle flow at a traffic intersection using the available real-world dataset used in assignment 1. 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 report will be marked based on technical and methodological accuracy. The report submission link will be made available at the beginning of Week 9. The last date of submitting the group report is 14th August 2020 11:59AM. 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 penalty.

PENALTIES

Late work will be penalised at the rate of 20% per day after the due time and date have expired.

ASSESSMENT OVERVIEW

Item	**Length**	**Weighting**	**Learning outcomes assessed**	**Assessment Criteria** *(this needs to explicitly describe what students are expected to demonstrate in the task)*	**Due date and submission requirements**	**Deadline for absolute fail**	**Marks returned**
Quiz 1	*1 hour*	*20%*	*PE1.1, PE1.2, PE1.3, PE1.6*	The Moodle quiz will assess students understanding of the basic's tenets of the queueing theory which will be applicable to the rest of the assessments in the course. The questions will be marked based on technical accuracy.	19-Jun-2020	19-Jun-2020	24-Jun-2020
Assessment 1	5 pages	20%	*PE1.1, PE1.2, PE1.3, PE2.2*	This assignment will be based on the topics covered in the Week 4 lecture and workshop. The assignment tests a student's ability to understand and interpret the available real-world traffic data, which will also be used in the group project assessment later in the course. The questions will be marked based on technical and methodological accuracy.	10-Jul-2020	17-Jul-2020	24-Jul-2020
Assessment 2	12 pages	30%	*PE1.1, PE1.2, PE1.3, PE2.2*	This assignment will be based on the topics covered in the Week 5 lecture and workshop. The assignment tests a student's understanding towards 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.	31-Jul-2020	7-Aug-2020	14-Aug-2020
Group Project	20 pages	30%	*PE2.1, PE2.2, PE2.3, PE2.4, PE3.6*	This submission will be based on the topics covered in Weeks 7, 8, 9 and 10 lectures and workshops. The project involves developing queueing models to analyse vehicle flow at a traffic intersection using the available real-world dataset used in assignment 1. Students have to form teams comprising a maximum of 4, on Moodle, prior to	14-Aug-2020	21-Aug-2020	28-Aug-2020

				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 report will be marked based on technical and methodological accuracy.			

RELEVANT 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)
- Vukan Vuchic. Urban Transit Operations, Planning and Economics – John Wiley & Sons, 2005;
- 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

DATES TO NOTE

Refer to MyUNSW for Important Dates available at:

https://student.unsw.edu.au/dates

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 ADVICE

For information about:

- Notes on assessments and plagiarism;
- Special Considerations: student.unsw.edu.au/special-consideration;
- General and Program-specific questions: The Nucleus: Student Hub
- Year Managers and Grievance Officer of Teaching and Learning Committee, and
- CEVSOC/SURVSOC/CEPCA

Refer to Academic Advice on the School website available at:

https://www.engineering.unsw.edu.au/civil-engineering/student-resources/policies-procedures-and-forms/academic-advice

Appendix A: Engineers Australia (EA) Competencies

Stage 1 Competencies for Professional Engineers

	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