# CVEN4404

## Fundamentals of Traffic Engineering

Term 1, 2023

# Course Overview

## Staff Contact Details

### Convenors

| Name | Email | Availability | Location | Phone |
|---|---|---|---|---|
| Divya J. Nair | divya.nair@unsw.edu.au | Wednesday 10am to 6pm | Office: H20, Level 1, CE 103 | (+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

CVEN4404: Fundamentals of Traffic Engineering aims to provide undergraduate and postgraduate students with the knowledge and skills necessary to contribute as a practicing traffic engineer. Traffic engineering professionals are tasked with the responsibility of ensuring the safe and efficient movement of people and goods through the provision and maintenance of transportation systems. The effectiveness of the transport system defines the economic development and quality of life for the entire community.  This course offers students to understand the technical expectations required by both public and private sector employees in the discipline.

The course will cover the broad topics of traffic flow theory and modelling, traffic control device design and implementation and traffic management practices. The fundamentals of traffic flow theory and the tools necessary to assess capacity and level of service for road segments and intersections are discussed in detail during the first half of the course. The second half of the course covers the application of the theory and use of the tools to conduct traffic studies and manage and control traffic related issues. Students will have the opportunity to analyse real traffic data, develop traffic management plans and design traffic control devices using industry prevalent modelling software such as "SIDRA Intersection", developing necessary practical skills as a traffic engineer.

## Course Aims

This course is designed to develop students' understanding, skills and knowledge in the field of traffic and transport engineering. While the focus of the course is clearly on the design, analysis and management of road transport facilities on both the supply and demand side, importance is also placed on the reporting and presentation of technical material that can be used by high level decision makers.

List of program attributes:

- An in-depth knowledge of fundamentals of traffic engineering
- Capacity for analytical and critical thinking and for creative problem solving in traffic engineering
- Ability to engage independent and reflective learning
- Skills for collaborative and multi-disciplinary work
- Learn management methods related to traffic engineering.

## 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. Apply basic concepts, methods, and techniques in urban traffic management studies. | PE1.1, PE1.2, PE1.6, PE2.1, PE2.2, PE2.4 |
| 3. Identify and apply current technologies in traffic management | PE1.1, PE1.4, PE1.5, PE2.2, |

| Learning Outcome | EA Stage 1 Competencies |
|---|---|
| and control | PE2.4 |
| 4. Critically analyse field survey methodologies and traffic data | PE1.1, PE1.2, PE2.1, PE2.2, PE2.4 |
| 5. Solve complex existing and potential traffic management problems | PE1.1, PE1.2, PE2.1, PE2.2, PE2.4, PE3.1, PE3.2, PE3.3, PE3.4, PE3.5, PE3.6 |

## Teaching Strategies

The teaching strategies that will be used and their rationale.  Give some suggested approaches to learning in the course.

**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

**Demonstrations**

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

**Assessments**

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

**Computer labs**

- Hands-on work, to set studies in context

## Assessment

| Assessment task | Weight | Due Date | Course Learning Outcomes Assessed |
|---|---|---|---|
| 1. Moodle Quiz | 5% | 01/03/2023 03:00 PM | 1 |
| 2. Mid-Term Exam | 25% | 29/03/2023 02:00 PM | 1, 2, 3 |
| 3. Group Project | 20% | 19/04/2023 11:59 PM | 3, 4, 5 |
| 4. Final Exam | 50% | Not Applicable | 1, 2, 3, 4, 5 |

### Assessment 1: Moodle Quiz

**Start date:** 01/03/2023 02:00 PM
**Assessment length:** 1 hour
**Submission notes:** This assignment will be submitted on Moodle (Quiz)
**Due date:** 01/03/2023 03:00 PM
**Deadline for absolute fail:** Failure to attend the Moodle quiz will result in a mark of zero. Students who miss the assessment as a result of illness or unforeseen circumstances must apply for special considerations and contact the course coordinator
**Marks returned:** 08/03/2023

This assignment focuses on students "Understanding Traffic Flow Theory" that has been presented during the first 2 weeks of the semester. The assignment will involve solving a series of problems,
extending from the problems discussed during the lectures.

This is not a Turnitin assignment

**Assessment criteria**

The assignment will assess the expected learning outcomes and will be assessed based on technical accuracy.

### Assessment 2: Mid-Term Exam

**Start date:** 29/03/2023 12:00 PM
**Assessment length:** 2 hours
**Submission notes:** This assignment will be submitted on Moodle (Quiz)
**Due date:** 29/03/2023 02:00 PM
**Deadline for absolute fail:** Failure to attend the mid-term exam will result in a mark of zero. Students who miss the assessment as a result of illness or unforeseen circumstances must apply for special considerations and contact the course-coordinator.
**Marks returned:** 14/04/2023

The Mid-Term exam will cover all the material until and including Week 5 of the course, and is intended to assess students' knowledge of the expected learning outcomes, prepare students for the final exam, and discourage last minute cramming. The exam will be assessed on technical accuracy.

Students will be provided individual feedback concerning performance and exam solutions will be provided for review prior to the final exam.

This is not a Turnitin assignment

**Assessment criteria**

Students will be provided individual feedback concerning performance and exam solutions will be provided for review prior to the final exam. Students who perform poorly in the mid-term exam are recommended to discuss their progress with the lecturer during the term.

## Assessment 3: Group Project (Group)

**Start date:** 29/03/2023 03:00 PM
**Assessment length:** 3 Weeks
**Submission notes:** This assignment will be submitted on Moodle and online individual feedback will be provided to each student
**Due date:** 19/04/2023 11:59 PM
**Marks returned:** 03/05/2023

This assignment allows students to work in a group and display their understanding of how to conduct a traffic study and propose traffic management schemes for realistic scenarios. The assignment will involve investigating a case study and using the knowledge gained within the lectures to develop solutions for the specific case.

This is not a Turnitin assignment

**Assessment criteria**

The assignment will assess the expected learning outcomes and will be assessed based on technical accuracy, clarity in reporting and presentation. Students who perform poorly in the group project are recommended to discuss the progress with the lecturer during the term.

## Assessment 4: Final Exam

**Assessment length:** 2 hours

A 2 hour centrally managed open-book final exam will be administered at the end of the semester. The exam will be cumulative and intended to assess the students' knowledge of the material covered throughout the entire course. The exam will be assessed on technical accuracy.

This is not a Turnitin assignment

**Additional details**

The final grade for this course will be based on the sum of the scores from the assignment, mid-term exam and the final examination.

The pass mark 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 in the final exam, the final exam mark will replace your course mark.

Students *who perform poorly in the group project and mid-session exam are recommended to discuss the progress with the lecturer during the term. The lecturer reserves the right to adjust the final scores by scaling if agreed by the Head of School.*

## Attendance Requirements

Students are strongly encouraged to attend all lectures and workshops and review the recordings. 100% of lab attendance is mandatory for Assessment 3: Practice Project Submission. Failure to attend all the lab sessions will result in a mark of zero for Assessment 3: Practice Project. Students who miss the lab sessions as a result of illness or unforeseen circumstances must contact the course-coordinator.

## Course Schedule

View class timetable

### Timetable

| Date | Type | Content |
|---|---|---|
| Week 1: 13 February - 17 February | Lecture | Traffic Flow Theory: Fundamentals of traffic flow theory |
| | Workshop | Fundamentals of traffic flow theory: practice problems |
| Week 2: 20 February - 24 February | Lecture | Traffic Flow Theory: Microscopic approaches to describe traffic flow theory, shock waves |
| | Workshop | Shockwaves: practice problems |
| Week 3: 27 February - 3 March | Lecture | Traffic Flow Theory: Traffic studies, traffic flow elements and data collection |
| | Tut-Lab | Introduction to SIDRA: guidelines, data Inputs, setting up a base model, calibrating and validating |
| | Assessment | Moodle Quiz : This assignment will be submitted on Moodle (Quiz) |
| Week 4: 6 March - 10 March | Lecture | Signalised Intersections: Concepts and design |
| | Workshop | Traffic studies, traffic flow elements and data collection - practice problems<br><br>Signal design - practice problems |
| Week 5: 13 March - 17 March | Lecture | Signalised Intersection: Optimisation, coordination and adaptive signal control |
| | Tut-Lab | SIDRA- Design and optimize intersection: traffic signal model |
| Week 7: 27 March - 31 March | Lecture | Mid-Term Exam |
| | Tut-Lab | SIDRA - Evaluation of signalised intersection |

| | | |
|---|---|---|
| | Assessment | Mid-Term Exam: This assignment will be submitted on Moodle (Quiz) |
| Week 8: 3 April - 7 April | Lecture | Road segments: uninterrupted flow facilities; Guest Lecture: Capacity and Level of Service (HCM) |
| | Workshop | Capacity and level of service - practice problems |
| Week 9: 10 April - 14 April | Lecture | Capacity and Level of Service: Road segments: uninterrupted flow facilities |
| | Tut-Lab | SIDRA - Traffic flow parameter sensitivity analysis: calibration and optimisation |
| Week 10: 17 April - 21 April | Lecture | Interrupted Traffic Flow: facilities, capacity and level of service |
| | Workshop | Interrupted Traffic Flow - practice problems |
| | Assessment | Group Project: This assignment will be submitted on Moodle and online individual feedback will be provided to each student |

# Resources

## Prescribed Resources

- Roess, Roger P., Elene S. Prassas, William R. McShane. **Traffic Engineering**. Fourth Edition, Upper Saddle River: Pearson Prentice Hall, 2011 (ISBN 0-13-913573-0)
- Daganzo, C. Fundamentals of Transportation and Traffic Operations, Pergamon-Elsevier ,Oxford, U.K. (1997)
- Mannering, F. and Washburn, S. (2013). “Principles of Highway Engineering and Traffic Analysis”. Chapter 5: Fundamentals of Traffic Flow and Queueing Theory.
- **Highway Capacity Manual** (2010) (HCM2010), Transportation Research Board
- Austroads (2008-2015). **Guide to Traffic Management Set** (13 Part Series)
    - Part 2. Traffic Theory
    - Part 3. Traffic Studies Analysis
    - Part 6. Intersections, Interchanges and Crossings
    - Part 8. Local Area Traffic Management
    - Part 7. Traffic Signals

## 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. Workshops are face-to-face sessions and are scheduled on Weeks 1,2,4,8 and 10.

Labs: Labs will be guided by the lecturer, Traffic Engineer (TfNSW) and demonstrators (postgraduate research students/research fellow). Students will have the opportunity to analyse real traffic data, develop traffic management plans and design traffic control devices using industry prevalent modelling software such as "SIDRA Intersection", developing necessary practical skills as a Traffic Engineer. Labs are face-to-face sessions and are scheduled on Weeks 3, 5, 7 and 9.

## 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 T1 2023 will be held on campus between the 28th of April and the11th of May, and Supplementary Exams between the 22nd of May and the 26th of May. You are required to be available on these dates. Please do not to make any personal or travel arrangements during this period.

**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 | ✓ |