School of Civil and Environmental Engineering

Term 1, 2020

# CVEN4404 FUNDAMENTALS OF TRAFFIC ENGINEERING

## COURSE DETAILS

| | | | |
|---|---|---|---|
| **Units of Credit** | **6** | | |
| **Contact hours** | 4 hours per week | | |
| **Class** | Tuesday, | 9:00-11:00 | Colombo Theatre C |
| **Labs** | Weeks 2, 4, 7, 9<br>Tuesday, | <br>11:00 - 13:00 or,<br>13:00 - 15:00 | http://timetable.unsw.edu.au/2020/CVEN4404.html |
| **Workshop** | Weeks 1, 3, 5, 8, 10<br>Tuesday, | <br>11:00 - 12:00 or,<br>12:00 - 13:00 | http://timetable.unsw.edu.au/2020/CVEN4404.html |
| **Course Coordinator and Lecturer** | Dr. Divya J. Nair<br>Email: divya.nair@unsw.edu.au<br>Office: H20, Level 1, CE 103 | | |
| **Lecturer** | Prof. Vinayak V. Dixit<br>Email: v.dixit@unsw.edu.au | | |
| **Lecturer** | Dr. David Rey<br>Email: d.rey@unsw.edu.au | | |

## INFORMATION ABOUT THE COURSE

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 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.

## HANDBOOK DESCRIPTION

See link to virtual handbook -

https://www.handbook.unsw.edu.au/undergraduate/courses/2020/CVEN4404/

## OBJECTIVES

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 programme 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.

## 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<br>• Do set problems and assignments<br>• Join Moodle discussions of problems<br>• Reflect on class problems and assignments<br>• Download materials from Moodle<br>• Keep up with notices and find out marks via Moodle |
| **Lectures** | • Find out what you must learn<br>• See methods that are not in the textbook<br>• Follow worked examples<br>• Hear announcements on course changes |
| **Workshops** | • Be guided by Demonstrators<br>• Practice solving set problems<br>• Ask questions |
| **Assessments** | • Demonstrate your knowledge and skills<br>• Demonstrate higher understanding and problem solving |
| **Laboratory Work** | • Hands-on work, to set studies in context |

## 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.***

| Learning Outcome | | EA Stage 1 Competencies |
|---|---|---|
| 1. | *Understand relationships between fundamental traffic flow parameters* | *PE1.1, PE1.2, PE1.4* |
| 2. | *Identify and understand current technologies being used in traffic management and control* | *PE1.1, PE1.4, PE1.5, PE2.2, PE 2.4* |
| 3. | *Have a sound understanding of the practical application of basic concepts, methods and techniques in urban traffic management studies.* | *PE2.1, PE2.2, PE2.4* |
| 4. | *Understand the value of traffic design softwares as a tool to evaluate various strategies* | *PE1.1, PE1.2, PE1.5* |
| 5. | *Understand and analyse field survey methodologies and analyse traffic data* | *PE1.1, PE1.2, PE2.1, PE2.2, PE2.4* |
| 6 | *Recognise and remediate existing and potential traffic management problems* | *PE1.1, PE1.2, PE2.1, PE2.2, PE2.4* |
| 7 | *Develop appropriate management and control strategies to achieve these goals* | *PE2.1, PE2.2, PE2.4, PE3.1, PE3.2* |

**COURSE PROGRAM**

**Term 1 2020**

| Date | Topic (Lecturer) | Lecture Content | Demonstration Content |
|---|---|---|---|
| 18/02/2020 (Week 1) | Traffic flow theory (Divya Nair) | Fundamentals of traffic flow theory | Fundamentals of traffic flow theory: practice problems |
| 25/02/2020 (Week 2) | Traffic flow theory (Divya Nair) | Introduction to traffic studies, traffic flow elements and data collection | **Lab:** Introduction to SIDRA: guidelines, data Inputs, setting up a base model, calibrating and validating |
| 03/03/2020 (Week 3) | Traffic flow theory (Vinayak Dixit) | Microscopic approaches to describe traffic flow theory, shock waves | Shockwaves: practice problems |
| 10/03/2020 (Week 4) | Signalised Intersection (David Rey) | Concepts and design | **Lab:** Design and optimize intersection: traffic signal model |
| 17/03/2020 (Week 5) | Signalised intersection (David Rey) | Optimisation, coordination and adaptive signal control | Signal design: practice problems |
| 24/03/2020 (Week 6) | | ***Non-teaching week for all courses*** | |
| 31/03/2020 (Week 7) | Mid-Session Exam (Divya Nair) | | **Lab:** Evaluation of signalised intersection |
| 07/04/2020 (Week 8) | Capacity and Level of Service (Divya Nair) | Road segments: uninterrupted flow facilities | Capacity and level of service: practice problems |
| 14/04/2020 (Week 9) | Capacity and level of Service (Divya Nair) | HCM approach: uninterrupted flow facilities | **Lab:** Traffic flow parameter sensitivity analysis: calibration and optimisation |
| 21/04/2020 (Week 10) | Interrupted traffic flow (Divya Nair) | Interrupted traffic flow facilities, capacity and level of service | Capacity and level of service: practice problems |

## ASSESSMENT

Overall rationale for assessment components and their association with course objectives.

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

## ASSESSMENT OVERVIEW

| Item | Length | Weighting | Learning outcomes assessed | Due date and submission requirements | Deadline for absolute fail | Marks returned |
|---|---|---|---|---|---|---|
| Moodle Quiz | 2 hours | 5% | 1, 2, 3 | Tuesday, 3rd March, 3PM | Tuesday, 3rd March, 3PM | Tuesday , 10th March |
| Mid-session Exam | 1.5 hours | 25% | 1, 2, 3, 5 | Tuesday, 31st March | Tuesday, 31st March | Friday, 17th April |
| Practical Project | 8 Weeks | 20% | 1, 2, 3, 4, 5, 6, 7 | Tuesday, 28th April, 9AM | Friday, 1st May, 11:59PM | Friday, 8th May |
| Final Exam | 2 hours | 50% | 1, 2, 3, 4, 5, 6, 7 | TBD (Refer to myUNSW) | N/A | N/A |

Details of each assessment component, the marks assigned to it, the criteria by which marks will be assigned, and the dates of submission are set out below.

| Assessment | Assessment Criteria |
|---|---|
| Moodle Quiz | The Moodle Quiz focuses on students "Understanding Theory" that has been presented during the first 3 weeks of the semester. The quiz will involve solving a series of problems, extending from the problems discussed during the lectures. The quiz will assess the expected learning outcomes and will be assessed based on technical accuracy, clarity in reporting and presentation.<br><br>**Date of Quiz: 3rd of March 1PM-3PM**<br>**Grades Returned: 10th March**<br>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 through the School of Civil and Environmental Engineering and contact the course-coordinator.<br>The performance in the assignment will contribute to **5% of the final grade**. |

| Assessment | Assessment Criteria |
|---|---|
| Mid-session Exam | A mid-session exam will be administered during the first 90 minutes of the Week 7 Lecture (31st of March). The exam will cover all the material until and including Week 6 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.<br><br>**Date of Exam: 31st of March 9AM-11AM**<br>**Grades Returned: 17th of April**<br>Failure to attend the mid-session 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 through the School of Civil and Environmental Engineering and contact the course-coordinator.<br>The performance in the mid-session exam will contribute to **25% of the final grade**. |
| Assignment: Practical Project (Group) | Assignment 2 (group project) will be released on 25th of February (Week 2) and will be due on 28th of April (Week 11). This assignment allows students to 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. The assignment will assess the expected learning outcomes and will be assessed based on technical accuracy, clarity in reporting and presentation.<br><br>**Deadline: 28th of April 9AM**<br>Penalties: A late penalty of 10% 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.<br>**Absolute Deadline: 1st of May 11:59PM**<br>**Grades Returned: 8th of May**<br>The performance in the assignment will contribute to **20% of the final grade.** |
| Final Exam | A 2-hour 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.<br><br>The performance in the final exam will contribute to **50% of the final grade**. In order to pass the course, a student MUST achieve a mark greater than 40% in the final exam to demonstrate a holistic understanding of the course material.<br>The formal exam scripts will not be returned but you are permitted to view the marked script. |

Supplementary Examinations for Term 1 2020 will be held on Monday 25th May – Friday 29th May (inclusive) should you be required to sit one. You are required to be available during these dates. Please do not to make any personal or travel arrangements during this period.

## PENALTIES

A late penalty of 10% 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.

## RELEVANT 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

## 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

(Formerly known as Common School Information)

For information about:

- Notes on assessments and plagiarism,
- School policy on Supplementary exams,
- Special Considerations: student.unsw.edu.au/special-consideration
- Solutions to Problems,
- Year Managers and Grievance Officer of Teaching and Learning Committee, and
- CEVSOC.

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 |