

School of Civil and Environmental Engineering UNSW Engineering

ENGG2500

Fluid Mechanics for Engineers

Term 1, 2023



Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Stefan Felder	<u>s.felder@unsw.edu.au</u>	by appointment	UNSW Water Research Laboratory, Manly Vale	+61280719 861

Lecturers

Name	Email	Availability	Location	Phone
Mahmood Sadat- Noori	<u>m.sadat-noori@unsw.edu.au</u>	by appointment	UNSW Water Research Laboratory, Manly Vale	+61280719 879

School Contact Information

<u>Engineering Student Support Services</u> – The Nucleus - enrolment, progression checks, clash requests, course issues or program-related queries

Engineering Industrial Training – Industrial training questions

<u>UNSW Study Abroad</u> – 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

The objective of ENGG2500 is to introduce engineering students to the principles of fluid mechanics. Topics discussed include Fluid properties. Hydrostatics. Buoyancy. Pressures in fluid systems. Principles of mass conservation. Steady flow energy equations. Flow measurement. Forces and momentum in flowing fluids. Dimensional analysis, similarity and physical modelling. Pipe flow. Incompressible laminar and turbulent flow in pipes; friction factor. Elementary boundary layer flow; skin friction and drag. Pumps and turbines. Pump and pipeline system characteristics.

Course Aims

The objectives of this course are to:

- Introduce students to the practice of water engineering and fluid mechanics.

- Introduce students to the theory of two quite different steady flows: closed conduit or pipe flow (i.e. pressurised flow) and briefly, to free surface flow (i.e. flows where the water surface is subject to atmospheric pressure).

- Give students an understanding of the properties of fluids, manometry, hydrostatics, the principles of mass and energy conservation, the forces and momentum in flowing fluids, flow in pipes, laminar and turbulent flow.

- Enable students to apply the fundamental principles of mass conservation, energy conservation and the momentum equation to the analysis of flows in different scenarios.

- Enable students to carry out a dimensional analysis and carry out the scaling for a physical model.

- Enable students to make estimates of boundary layer thickness and velocities over flat plates, and to estimate the forces on 2D and 3D bodies in submerged flows.

- Enable students to quantify pipe friction losses and to introduce you to some of the associated real-life problems of pipe flow calculations.

Course Learning Outcomes

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

Learning Outcome	EA Stage 1 Competencies
1. Explain and apply the basic properties of fluids and how these relate to fluid flow.	PE1.1, PE1.2, PE2.1, PE2.2
2. Explain the fundamental principles of fluid flow in pipes and free surface flows namely continuity, momentum and energy, and know to what situations these principles can be applied.	PE1.1, PE1.2, PE2.1, PE2.2
3. Explain and describe the conditions for flows in pipes under which various flow regimes will occur: (i) laminar and turbulent flows, (ii) turbulent flows which are hydraulically rough or hydraulically smooth.	PE1.1, PE1.2, PE2.1, PE2.2
4. Calculate flow through pipes, including assessing energy losses and identify relevant supporting data requirements.	PE1.1, PE1.2, PE2.1, PE2.2

Learning Outcome	EA Stage 1 Competencies
5. Undertake dimensional analysis, make estimates of drag force and carry out computations related to boundary layers.	PE1.1, PE1.2, PE2.1, PE2.2
6. Solve real-world fluid mechanic problems by performing lab experiments.	PE1.1, PE1.2, PE2.1, PE2.2, PE3.2, PE3.6

At the end of this course, you will be familiar with the engineering techniques used to analyse and design the basic components of water engineering infrastructure.

You will develop capacity for analytical and critical thinking and for creative problem solving. You will be exposed to, and be required to solve, numerous hydraulics problems in the Lectures, the Workshops and the lab classes - "the learning is in the doing". All these problems will cover a variety of scenarios, and where possible, will be drawn from engineering practice.

Teaching Strategies

The teaching strategies that will be used include:

- Lectures: Teaching in this course is centred on the Lectures which are technical in content. Students will develop analytical skills in hydraulics and fluid flows by applying the theory to problems. Lectures will also emphasise the relationship of the content to engineering practice and will provide an opportunity for reflection on learning. The lectures are recorded and should be available on the Moodle course page.
- **Workshops:** The workshops will focus on application of the theoretical concepts when students start to solve problems themselves.
- **Moodle Online lab class modules:** Student learning will be encouraged during parctial lab classes where students can observe theoretical fluid flow concepts in lab experiments. The lab classes encourage group work and the integration of the lab classes with a Moodle online module link the lab classes with the course lectures and course assessments.
- **Moodle course page**: The Moodle course page provides a step by step guide on the course. There is a discussion forum to help provide interaction and help from peers. Links to video recordings and learning modules to help students learn the solution techniques for many of the subject areas. Moodle practice Online Quizzes with automated feedback come available in parallel to the lecture content to allow students to practice fluid mechanics problems as often as they like while receiving feedback on how they are going.

Assessment

The final grade for this course will normally be based on the sum of the scores from each of the assessment tasks. The Final Exam is worth 60% of your Final Mark if class work is included and 100% if your class work is not included.

The class work is worth 40% of the Final Mark if included. A mark of at least 40% in the final examination is required before the class work (Online quizzes and lab class assessments) is included in the final mark. The formal exam scripts will not be returned but you are permitted to view the marked script.

Note: The lecturer reserves the right to adjust the final scores by scaling if agreed by the Head of School.

Students who perform poorly in the quick quizzes and workshops are recommended to discuss progress with the lecturer during the term.

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Online Quizzes	16%		1, 2, 3, 4, 5
2. Lab class and postlab online assessments	24%	Weeks 3,4,7	1, 2, 3, 4, 5, 6
3. Final Examination	60%	Not Applicable	1, 2, 3, 4, 5

Assessment 1: Online Quizzes

Start date: Weeks 5 and 10, Thursday: 6:00-8:00 pm **Assessment length:** 2 hours **Submission notes:** The quizzes will take place on Moodle during a set 2 hour period

Two open book online quizzes will encourage continuous student learning throughout the course. The quizzes are done either at home, library or on campus. Marks are awarded for correct answers. The topics covered in each online quiz are listed on the Moodle course page. The purpose of online Quiz will be to provide a clear study framework. It will also provide the opportunity to develop self-learning and problem solving skills.

This is not a Turnitin assignment

Additional details

2 Online Quizzes will be completed on the Moodle course page. They will account for 8% of the course mark each and will take place:

Quiz 1: Week 5; Thursday 16th March from 6:00-8:00 pm for a 2 hours duration. Quiz 2: Week 10; Thursday 20th April from 6:00-8:00 pm for a 2 hours duration.

Other assessment information:

Deadline for absolute fail of Quizzes: at the close of the quiz (8:00 pm Thursday) Date of marks returned: 48 hrs after close of Online Quiz

Penalty for late submission: no late submissions are allowed for these timed quizzes.

For further details please see the Moodle course under Tab "Online Quizzes".

Assessment 2: Lab class and postlab online assessments

Start date: Weeks 1,3,5 **Due date:** Weeks 3,4,7

Several online lab modules integrate the lab classes of the course with fundamental understanding of the course concepts as well as pre- and postlab assessments. Prior to the lab classes, students will study the theory of the lab class and instruction videos of the experiments in the lab classes on the Moodle course page. During the compulsory lab classes (which students complete in small groups), students will get insights into the fluid mechanics concepts in hands-on experiments. After the lab class, a set of random individual lab data will be provided to each student in an online assessments on the Moodle course page. Students will perform a series of guided calculation questions.

Additional details

The lab assessments have three components comprising:

- **Lab lessons** complement the lab classes introducing the lab content and setup while providing useful information for your lab assessments. They will become available on your Moodle course page (Lab 1: Start of Week 1; Lab 2: Start of Week 4; Lab 3: Start of Week 5). Once you have completed the lab lesson, the pre-lab assessment will become available on your Moodle course page.

- **Pre-lab assessment** becomes available on your Moodle page once you have completed the "Lab lesson". The pre-lab Quiz is to be completed on your Moodle page of the course prior to the start of the lab classes (i.e. Lab 1: before 9am on Wednesday 1st March (Week 3); Lab 2: before 9am on Wednesday 8th March (Week 4); Lab 3: before 9am on Wednesday 29th April (Week 7). You have 4 hours to complete each of the pre-lab online quizzes and each quiz accounts for 4% of the course mark (i.e. .12% in total).

Deadline for absolute fail of prelabs : 9am Wednesday of lab week (i.e. week 3, 4, 7) Date of marks returned: 9am Wednesday of lab week Penalty for late submission: no late submissions are accepted.

- The **post-laboratory assessment** must be completed after the final laboratory class has finished. During a 72 hour time period (between Thursday 6pm of the respective lab week and Sunday 6pm of the lab class week), your post-lab assessment must be completed on Moodle. You have 5 hours to complete each of the post-lab assessments and each assessment accounts for 4% of the course mark (i.e. .12% in total).

Date of marks returned: 1 week post due date

Further details on the assessments and due dates are available on the Moodle course page under the Tab "Laboratory Classes".

Assessment 3: Final Examination

Assessment length: 2 hrs

The final exam is given because the course learning outcomes include a significant level of technical

learning that can be effectively assessed in an exam environment and because exams have high reliability.

Hurdle requirement

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

Additional details

The exam will take place during the official exam period. We will provide details on the Moodle course page during the course.

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	Туре	Content
O-Week: 6 February -	Presentation	Welcome Video!
TOTEDIDATy		In O-week we'll provide you with a general welcome video and walkthrough of the ENGG2500 course. This will include going over the assessment structure, labs, workshops, field trip and expectations of the course. We will also walk you through the Moodle course page.
Week 1: 13 February - 17 February	Lecture	In Week 1 we start getting into the basics of what is a fluid and why, as Engineers, it's something we must consider in our design. We'll then start to look at the first of 4 topics covered by Dr Sadat- Noori in the first half of this course (weeks 1-4), Hydrostatics - which is the forces exerted by fluids at rest.
		Monday 13 Feb: Fluid Properties
		Friday 17 Feb: Hydrostatics
	Workshop	Workshop location and time as per your enrollment.
		Your demonstrator this week will guide you in your workshop which covers Fluid Properties and Hydrostatics.
	Online Activity	Your lab lesson and pre-lab for the Hydrostatics lab (Lab 1 in Week 3) will open this week on Monday for you to start to work through.
		Test your skills in the Fluid Mechanics Practice Questions in Moodle for week 1.
		Q01 Dimensions

		Q02 Fluid Properties - basic understanding
		Q03 Fluid Properties - numerical
		Q04 Hydrostatics - manometer
Week 2: 20 February - 24 February	Lecture	In week 2 we'll continue with Hydrostatics and Introduce Continuity - the concept that fluid mass must be conserved.
		Monday 20 Feb: Hydrostatics
		Friday 24 Feb: Continuity
	Workshop	Workshop location and time as per your enrollment.
		Your demonstrator this week will guide you in your workshop which covers Hydrostatics and Continuity 1 & 2.
	Online Activity	Test your skills in the Fluid Mechanics Practice Questions in Moodle for week 2.
		Q05 Hydrostatics - Forces on submerged bodies
		Q06 Hydrostatics - Miscellaneous
		Q07 Kinematics of Fluid Motion
Week 3: 27 February - 3 March	Lecture	In week 3 we'll continue with Continuity and Introduce Energy - the concept that fluid has energy - potential and kinetic.
		Monday 27 February: Continuity 2 and Energy 1
		Friday 3 March: Energy 2 & 3
	Workshop	Workshop location and time as per your enrollment.
		Your demonstrator this week will guide you in your workshop which covers Energy 1 & 2.
	Laboratory	Laboratory class on Hydrostatics. Date and Time as per your enrollment.
		The lab offers an opportunity for students to enhance their learning via hands on experience in the labs.
		Please see Moodle for further details.
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	Online Activity	Your pre-lab for the Flow meter lab will open this week on Monday for you to work through.
		Test your skills in the Fluid Mechanics Practice Questions in Moodle for week 3.
		Q08 Continuity
		Q09 Bernoulli equation - basic examples
		Q10 Bernoulli equation - applications
	Assessment	Prelab - Lab 1 Hydrostatics
		DUE: Wednesday 1st March 9am
		Weighting: 4% of course grade
		Type: Moodle Quiz
		See Moodle for further details
	Assessment	Post-lab - Lab 1 Hydrostatics
		DUE: Sunday 5 March, 6 pm.
		Weighting: 4% of course grade
		Type: Moodle Quiz
		See Moodle for further details
Week 4: 6 March - 10 March	Lecture	In week 4 we will introduce the final concept of the first half of the course - Momentum.
		Monday 6 March: Momentum 1
		Friday 10 March: Momentum 2
		*Time permitting, we may do a review on the Friday.
	Workshop	Workshop location and time as per your enrollment.
		Your demonstrator this week will guide you in your workshop which covers Momentum 1 & 2.

	Laboratory	Laboratory class on Flow meters. Date and Time as per your enrollment.
		The lab offers an opportunity for students to enhance their learning via hands on experience in the labs.
		Please see Moodle for further details.
	Online Activity	Test your skills in the Fluid Mechanics Practice Questions in Moodle for week 4
		Q11 Momentum Equation
	Assessment	Prelab - Lab 2 Flow meter
		DUE: Wednesday 8 March 9am
		Weighting: 4% of course grade
		Type: Moodle Quiz
		See Moodle for further details
	Assessment	Post-lab - Lab 2 Flow meter
		DUE: Sunday 12 March, 6pm.
		Weighting: 4% of course grade
		Type: Moodle Quiz
		See Moodle for further details
Week 5: 13 March - 17 March	Lecture	In week 5, the second half of the course will commence with a change of lecturer to Dr Stefan Felder. The second half will introduce several new concepts which are based upon the content of the first half of the course. It starts with an introduction into pipe flows. The content of Week 5 will be highly relevant for your "pipe flow" lab class in Week 7.
		Monday 13th March: Pipe flow 1
		Friday 17th March: Pipe flow 2
	Workshop	Workshop location and time as per your enrollment.

		Your demonstrator this week will guide you in your workshop which covers Momentum 2 & Pipe Flow
	Online Activity	Test your skills in the Fluid Mechanics Practice Questions in Moodle for week 5
		Q12 Pipe flow - basic understanding
		Q13 Pipe flow - friction losses
	Assessment	Quiz 1
		The quiz will run for 2hrs (Thursday March 16, 6:00-8:00pm).
		The quiz will be administered online via Moodle.
		Weighting: 8% of course grade.
Week 6: 20 March - 24 March	Reading	No lectures and workshops in Week 6! > Use this week to practice and catch-up with the course content!
Week 7: 27 March - 31 March	Lecture	In week 7, we continue with pipe flow concepts. The lectures will include many examples which will help you to understand the fundamental concepts. We will also start with a new topic "Dimensional Analysis" which will be a useful concept for many engineering courses during your degree. Monday 27 March: Pipe flow 3
		Friay 31 March: Dimensional Analysis 1
	Workshop	Workshop location and time as per your enrollment.
		Your demonstrator this week will guide you in your workshop which covers Pipe flow & Dimensional analysis
	Laboratory	Laboratory class on Pipe flow. Date and Time as per your enrollment.
		The lab offers an opportunity for students to enhance their learning via hands on experience in the labs.
		Please see Moodle for further details.
	Online Activity	Your pre-lab for the pipe flow lab will open this

		week on Monday for you to work through
		Test your skills in the Fluid Mechanics Practice Questions in Moodle for week 7
		Q14 Pipe flow - local losses
		Q15 Pipe flow - applications
		Q16 Dimensional analysis - basics
	Assessment	Prelab - Lab 3 Pipe Flow
		DUE: Wednesday 29 March 9am
		Weighting: 4% of course grade
		Type: Moodle Quiz
		See Moodle for further details
	Assessment	Post-lab - Lab 3 Pipe Flow
		DUE: Sunday 2 April, 6pm.
		Weighting: 4% of course grade
		Type: Moodle Quiz
		See Moodle for further details
Week 8: 3 April - 7 April	Lecture	In week 8, we will continue with Dimensional Analysis and its use in fluid mechanics applications. We will start with the topic on "Physical modelling" which makes use of dimensional analysis.
		Monday 3 April: Dimensional Analysis 2 & Physical Modelling 1
		Friday 7 April: Public Holiday (no lecture)!
	Workshop	No workshop this week due to public holiday!
	Online Activity	Test your skills in the Fluid Mechanics Practice Questions in Moodle for week 8
		Q17 Dimensional Analysis - applications
Week 9: 10 April - 14 April	Lecture	In week 9, we will finish the topic on Physical models and will start with aspects on boundary

		layers.
		Monday 10 April: Public Holiday (no lecture)!
		Friday 14 April: Physical models 2 & Boundary Layers
	Workshop	Workshop location and time as per your enrollment.
		Your demonstrator this week will guide you in your workshop which covers Dimensional analysis & Physical models
	Online Activity	Test your skills in the Fluid Mechanics Practice Questions in Moodle for week 9
		Q18 Physical Modelling
	Fieldwork	Field trip to the UNSW Water Research Laboratory
		On Thursday 13 April (week 9), students will have the opportunity to visit Australia's leading Water Engineering facilities - the Water Research Laboratory, located in Manly Vale, NSW.
		Students will get to see water engineering consultancy in action, tour the labs and discuss careers in water engineering with both course lecturers.
		Further details available on Moodle.
Week 10: 17 April - 21 April	Lecture	In the final week of the course, we continue to learn about boundary layers including the calculation of friction forces. In our Friday lecture, we will finish the course with the topic on drag forces, i.e. forces on bluff bodies exposed to fluids in motion.
		Monday 17 April: Boundary Layers
		Friday 21 April: Drag Force
	Workshop	Workshop location and time as per your enrollment.
		Your demonstrator this week will guide you in your workshop which covers Physical models 2,

	Boundary layers and Drag Force
Online Activity	Test your skills in the Fluid Mechanics Practice Questions in Moodle for week 10
	Q19 Boundary Layers/Friction Forces
	Q20 Drag Force
Assessment	Quiz 2
	The quiz will run for 2hrs (Thursday April 20, 6:00-8:00pm).
	The quiz will be administered online via Moodle.
	Weighting: 8% of course grade.

Resources

Prescribed Resources

Lecture notes

The Lecture Notes for the term are available from the University Bookshop. Full versions of the notes will be made available on the Moodle page of the course together with the lecture recording, lecture slides, etc.

Additional materials

Additional materials will be provided on Moodle including additional short videos and practice questions with embedded feedback.

Recommended Resources

Textbook

Cengel, Y. A. and Cimbala, J. M., Fluid Mechanics Fundamentals & Applications 4e, McGraw-Hill, 2017, 4th edition, SI version, ISBN-13: 978-1259696534 [UNSW Library – 5 copies]

Other fluid mechanics references

- Street, R.L., Watters, G. Z. and Vennard, J.K., Elementary Fluid Mechanics, John Wiley and Sons, New York, 1996, 7th edition, ISBN 0 471 01310 3. [UNSW Library, Level 6, P532/19 – 5 copies]
- Finnemore, E.J. and Franzini, J.B. (2002) Fluid Mechanics with Engineering Applications, McGraw-Hill, 2002, 10th Edition, ISBN 0 07 112196 X. [UNSW Library, Level 6, 532/28 5 copies]
- Munson, B.R., Young, D.F. and Okiishi, T.H., Fundamentals of Fluid Mechanics, John Wiley and Sons, New York, 2009, 6th edition, ISBN 978 0 470 26284 9. [UNSW Library, Level 8, 620.106/78 – 2 copies]
- White, F. M. (2015) Fluid Mechanics. 8th Edition, McGraw-Hill, ISBN ISBN:9781760420635 [University Bookshop; UNSW Library, Level 8, 620.106/77 – 5 copies]

Course Evaluation and Development

Throughout the course we will welcome feedback during the lectures as well as in the Moodle Online Discussion Forum. As in previous years, we will try to address your comments and concerns as soon as feasible. Any personal feedback or questions (not meant to be seen by all students) can be emailed to us.

We will also run periodic feedback questionnaires via Moodle to get a sense how students are tracking in the course.

Laboratory Workshop Information

Field trip to UNSW Water Research Laboratory in Manly Vale: On the Thursday of Week 9 (13th April), you have the opportunity to participate in a site visit of the UNSW Water Research Laboratory (WRL) to view some physical models being used to solve real engineering problems. We will be guiding you around a multitude of interesting models ranging from coastal structures, to dam spillways and fish ways. We will have plenty of time to discuss your questions and help you better understand the fundamental concpets of the course in practical applications..

The Water Research Laboratory is 22km by road from the Kensington campus.Buses will be provided to take you to WRL and return to Kensington. You can make your own way to and from WRL (110 King Street, Manly Vale) if you choose. We will make sure that the field trip is COVID safe.

We will provide separate notice on Moodle including polls to identify your interest and to schedule the bus allocation and site vist accordingly.

Laboratory Work: The laboratory work is an essential component of this course. Your attendance and participation in ALL laboratory work is a requirement for the course. The lab classes will take place in the Undergraduate Teaching Laboratory Willis Annex J18 214A/B. The lab class is not designed to simply collect data (every student will receive an individual data set for the post-lab assessment), but it is designed as a group activity to better understand the fundamental course concepts.

During the laboratory class you need to adhere to any OH&S requirements or instructions from your laboratory demonstrator or course coordinators. Closed footwear is an OH&S requirement for entry to University Laboratories.

During the lab class you will be split into groups of maximum 5 students. Your group will complete 1 experiment during each laboratory session (3 in total) of 1 hour. The Laboratory classes will be in Weeks 3 (Lab 1), 4 (Lab 2) and 7 (Lab 3) in various time slots as per your enrolment.

Workshops

• Much of your learning will take place during the workshops. If you work actively in this time, it will free you up for other activities outside of class.

- Start solving the problems provided during the lectures.
- Be guided by demonstrators.

• Make sure you understand the solution strategies of any Worked Problems completed by your demonstrators.

• Use your time to ask your demonstrators about any unresolved workshop problems – even if your question relates to matters from previous weeks. Ask questions.

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): <u>https://intranet.civeng.unsw.edu.au/key-staff-to-contact-during-your-studies-at-unsw</u>
- <u>Key UNSW Dates</u> 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): <u>https://intranet.civeng.unsw.edu.au/student-intranet</u>
- Student Life at CVEN, including Student Societies: <u>https://www.unsw.edu.au/engineering/civil-and-environmental-engineering/student-life</u>
- 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.

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CRICOS

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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	1	
PE1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline	1	
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	1	
PE2.2 Fluent application of engineering techniques, tools and resources	1	
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	1	
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	1	