UNSW SYDNEY | Australia's Global University

Mechanical and Manufacturing Engineering

Course Outline

Term 1 2020

AERO3630

AERODYNAMICS

Contents

1. Staff contact details

Contact details and consultation times for course convenor

Name: Professor Con Doolan
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Name: Dr Danielle Moreau
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For any course administrative matters or to arrange an appointment outside of scheduled teaching and consultation times, please contact Dr Moreau via email.

Contact details and consultation times for additional lecturers/demonstrators/lab staff

Additional lecturers:
Name: Dr Yendrew Yauwenas
Email: yendrew@unsw.edu.au

Name: Dr Manuj Awasthi
Email: m.awasthi@unsw.edu.au

Name: Dr Jeoffrey Fischer
Email: jeoffrey.fischer@unsw.edu.au

Please see the course Moodle for demonstrator and lab staff information.

2. Important links

- Moodle
- Lab Access
- Health and Safety
- Computing Facilities
- Student Resources
- Course Outlines
- Engineering Student Support Services Centre
- Makerspace
- UNSW Timetable
- UNSW Handbook
- UNSW Mechanical and Manufacturing Engineering

3. Course details

Credit points

This is a 6 unit-of-credit (UoC) course and involves 6 hours per week (h/w) of face-to-face contact.

The normal workload expectations of a student are approximately 25 hours per term for each UOC, including class contact hours, other learning activities, preparation and time spent on all assessable work.

You should aim to spend about 15 h/w on this course. The additional time should be spent in making sure that you understand the lecture material, completing the set assignments, further reading, and revising for any examinations.

Contact hours

	Day	**Time**	**Location**
Lectures	Tuesday	2pm – 4pm	Ainsworth G02
	Wednesday	9am – 10am	Ainsworth 202
Demonstrations	Wednesday	10am – 12pm	Ainsworth 202
	Wednesday	10am – 12pm	Ainsworth G02
Lab	Tuesday	4pm – 6pm	UTL (weeks 2, 5, 8, 9 only)

Please refer to your class timetable for the learning activities you are enrolled in and attend only those classes.

Summary and Aims of the course

This course will focus on the fundamental principles and application of aerodynamics – the science and engineering of flight. The course aims to (1) provide the understanding you need to communicate with other aerospace engineers regarding aerodynamic matters, (2) analyse the aerodynamic performance of aerospace vehicles and (3) provide the basis for further advanced study of aerodynamics in your career. If I can give you an appreciation of the excitement and beauty of aerodynamics, then I will regard this course as a success.

Student 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.	Use the basic principles of fluid motion to describe aerodynamic phenomenon	PE 1.1, 1.2, 3.4
2.	Analyse and predict the low speed aerodynamic performance of wings	PE 1.3, 2.1, 2.2, 3.4
3.	Analyse and predict the high-speed aerodynamic performance of objects (wings and other relevant devices)	PE 1.3, 2.1, 2.2, 3.4
4.	Describe and analyse viscous flow over aerodynamic surfaces	PE 1.1, 1.2, 2.1, 2.2, 3.4

4. Teaching strategies

The course is taught using a combination of face-to-face and on-line instruction: workshops, where worked examples are provided to students in an interactive environment, and demonstrations, where students work on problems in an environment where they can ask teaching staff for guidance and feedback. Practical experience in aerodynamic measurements is provided in the laboratory component of the course.

The teaching philosophy of the course can be summarised as “learning by doing”: instruction is provided for core material which is reinforced through regular assignments. Students are provided support to learn the material via worked examples (face-to-face and on-line), and through demonstrations where support is given and feedback provided. Laboratories provide practical, hands-on learning of the course material. A small design project allows students to combine technical and creative skills.

5. Course schedule

WK	Topic	Location	Laboratory topic	Laboratory location
1	Introduction to course; Fundamentals, governing equations, fluid motion, experimental/wind tunnel testing *(Prof Doolan/Dr Yauwenas)*	Ainsworth G02 Ainsworth 202		
2	Potential flow *(Prof Doolan)* *Take-home test on assumed knowledge + week 1*	Ainsworth G02 Ainsworth 202	1. Flow visualisation 2. Pressure distribution over cylinder	UTL
3	Incompressible flow over airfoils *(Prof Doolan)*	Ainsworth G02 Ainsworth 202		

WK	Topic	Location	Laboratory topic	Laboratory location
4	Incompressible flow over wings *(Prof Doolan)* *In-class test on weeks 2 & 3*	Ainsworth G02 Ainsworth 202		
5	Fundamentals of aeroacoustics *(Dr Moreau)*	Ainsworth G02 Ainsworth 202	3. Pressure Distribution over a 2D airfoil	UTL
6	Flexibility Week			
7	Compressible flow, shock and expansion waves *(Dr Awasthi)* *In-class test on weeks 4 + 5*	Ainsworth G02 Ainsworth 202		
8	Nozzle flows, linearised compressible flow *(Dr Awasthi)*	Ainsworth G02 Ainsworth 202	4. Drag of an airfoil	UTL
9	Hypersonic aerodynamics *(Dr Awasthi)* *In-class test on weeks 7 + 8*	Ainsworth G02 Ainsworth 202	5. Compressible nozzle flow	UTL
10	Viscous flow *(Dr Fischer)*	Ainsworth G02 Ainsworth 202	*Lab report due*	

6. Assessment

Assessment overview

Task	Assessment	Group Project? (# Students per group)	Length	Weight	Learning outcomes assessed	Assessment criteria	Due date and submission requirements	Deadline for absolute fail	Marks returned
T1	Take-home Test*	No	1, 50 mins	7.5%	1 through 4	Solution process and correct numerical answer	Friday Week 2 at 5pm via Moodle	5 working days after submission	Two weeks after submission
	In-Class Tests*	No	4, each 50 mins	22.5%	1 through 4	Solution process and correct numerical answer	In-Class Weeks 4, 7 and 9	N/A	Two weeks after submission
T2	Laboratory*	No (but you will perform the laboratory as a group)	Two reports as per instructions on Moodle	25%	1 through 4	Rubric	End Week 10, via Moodle	5 working days after submission	Two weeks after submission
T3	Final exam	No	2 hours	45%	1 through 4	All course content	Exam period, date TBC	N/A	Upon release of final results

*Please make sure you read instructions carefully and complete ALL components of each Assessment. You MUST attend the laboratory to be eligible to submit a laboratory report.

Assignments

Assignments will be due regularly throughout the term. Each assignment will provide challenges that will enable you to understand the material, your skill at applying it and your ability to communicate it effectively.

The take-home test will be placed on the course Moodle page in Week 2. The in-class tests will be provided during class in Weeks 4, 7 and 9. The laboratory report requirements may be found on Moodle.

Presentation

Some submissions will be electronic via Moodle. Some will be via in-class test.

All non-electronic submissions should have a standard School cover sheet, which is available from this course's Moodle page.

All submissions are expected to be neat and clearly set out. Your results are the pinnacle of all your hard work and should be treated with due respect. Presenting results clearly gives the marker the best chance of understanding your method; even if the numerical results are incorrect.

Submission

Work submitted late without an approved extension by the course coordinator or delegated authority is subject to a late penalty of 20 percent (20%) of the maximum mark possible for that assessment item, per calendar day.

The late penalty is applied per calendar day (including weekends and public holidays) that the assessment is overdue. There is no pro-rata of the late penalty for submissions made part way through a day.

Work submitted after the 'deadline for absolute fail' is not accepted and a mark of zero will be awarded for that assessment item.

For some assessment items, a late penalty may not be appropriate. These are clearly indicated in the course outline, and such assessments receive a mark of zero if not completed by the specified date. Examples include:

a. Weekly online tests or laboratory work worth a small proportion of the subject mark, or
b. Online quizzes where answers are released to students on completion, or
c. Professional assessment tasks, where the intention is to create an authentic assessment that has an absolute submission date, or
d. Pass/Fail assessment tasks.

Marking

Marking guidelines for assignment submissions will be provided at the same time as assignment details to assist with meeting assessable requirements. Submissions will be marked according to the marking guidelines provided.

Examinations

You must be available for all quizzes, tests and examinations.

Final examinations for each course are held during the University examination periods: February for Summer Term, May for T1, August for T2, and November/December for T3.

Please visit myUNSW for Provisional Examination timetable publish dates.

For further information on exams, please see the Exams webpage.

Calculators

You will need to provide your own calculator of a make and model approved by UNSW for the examinations. The list of approved calculators is available at student.unsw.edu.au/exam-approved-calculators-and-computers

It is your responsibility to ensure that your calculator is of an approved make and model, and to obtain an "Approved" sticker for it from the Engineering Student Supper Services Centre prior to the examination. Calculators not bearing an "Approved" sticker will not be allowed into the examination room.

Special consideration and supplementary assessment

If you have experienced an illness or misadventure beyond your control that will interfere with your assessment performance, you are eligible to apply for Special Consideration prior to submitting an assessment or sitting an exam.

Please note that UNSW now has a Fit to Sit / Submit rule, which means that if you sit an exam or submit a piece of assessment, you are declaring yourself fit enough to do so and cannot later apply for Special Consideration.

For details of applying for Special Consideration and conditions for the award of supplementary assessment, please see the information on UNSW's Special Consideration page.

7. Expected resources for students

It is strongly recommended that you purchase the textbook:
Anderson, J D, *Fundamentals of Aerodynamics*, 5th/6th Ed, McGraw Hill, 2016

Course materials will also be provided on Moodle.

I recommend that you search the resources on aerodynamics in the UNSW Library.

UNSW Library website: https://www.library.unsw.edu.au/
Moodle: https://moodle.telt.unsw.edu.au/login/index.php

8. Course evaluation and development

Feedback on the course is gathered periodically using various means, including the UNSW myExperience process, informal discussion in the final class for the course, and the School's Student/Staff meetings. Your feedback is taken seriously, and continual improvements are made to the course based, in part, on such feedback.

Feedback from 2019 and improvements implemented in 2020 will be summarised and posted on the course Moodle page.

9. Academic honesty and plagiarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. *Plagiarism at UNSW is defined as using the words or ideas of others and passing them off as your own.*

Plagiarism is a type of intellectual theft. It can take many forms, from deliberate cheating to accidentally copying from a source without acknowledgement. UNSW has produced a website with a wealth of resources to support students to understand and avoid plagiarism, visit: student.unsw.edu.au/plagiarism. The Learning Centre assists students with understanding academic integrity and how not to plagiarise. They also hold workshops and can help students one-on-one.

You are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting and the proper referencing of sources in preparing all assessment tasks.

If plagiarism is found in your work when you are in first year, your lecturer will offer you assistance to improve your academic skills. They may ask you to look at some online resources, attend the Learning Centre, or sometimes resubmit your work with the problem fixed. However more serious instances in first year, such as stealing another student's work or paying someone to do your work, may be investigated under the Student Misconduct Procedures.

Repeated plagiarism (even in first year), plagiarism after first year, or serious instances, may also be investigated under the Student Misconduct Procedures. The penalties under the

procedures can include a reduction in marks, failing a course or for the most serious matters (like plagiarism in an honours thesis) even suspension from the university. The Student Misconduct Procedures are available here: www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf

10. Administrative matters and links

All students are expected to read and be familiar with UNSW guidelines and polices. In particular, students should be familiar with the following:

- Attendance
- UNSW Email Address
- Special Consideration
- Exams
- Approved Calculators
- Academic Honesty and Plagiarism
- Equitable Learning Services

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