UNSW SYDNEY | Australia's Global University

Mechanical and Manufacturing Engineering

Course Outline

Semester 2 2017

AERO3630

AERODYNAMICS

Contents

1. Staff contact details

Contact details and consultation times for course convenor

Name: A/Prof Con Doolan
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Please contact A/Prof Doolan by email to arrange an appointment outside of scheduled teaching times.

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

Name: Dr Jeoffrey Fischer
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Email individual teaching staff to arrange an appointment outside of scheduled teaching times.

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

Please see the course Moodle.

2. Important links

- Moodle
- UNSW Mechanical and Manufacturing Engineering
- Course Outlines
- Student intranet
- UNSW Mechanical and Manufacturing Engineering Facebook
- UNSW Handbook

3. Course details

Credit Points

This is a 6 unit-of-credit (UoC) course, and involves **4** hours per week (h/w) of face-to-face contact.

The UNSW website states “The normal workload expectations of a student are approximately 25 hours per semester for each UoC, including class contact hours, other learning activities, preparation and time spent on all assessable work. Thus, for a full-time enrolled student, the normal workload, averaged across the 16 weeks of teaching, study and examination periods, is about 37.5 hours per week.”

This means that you should aim to spend about 9 h/w on this course. The additional time should be spent in making sure that you understand the lecture material, completing the set assignments, preparing for laboratories, further reading, and revising for assessment.

There is no parallel teaching in this course.

Contact hours

	Day	**Time**	**Location**
Lectures	Monday	4pm-6pm	Civil Engineering G1
Lecture/Demonstration	Wednesday	11am-1pm	Ainsworth Building 102
Laboratory	Friday (TBC), weeks 7-8	1pm-5pm	Willis Annexe 116C UG Lab

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 fortnightly 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 via formative assessment. 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	Topics	Assessment/Experiment	Chapters
1	Introduction to course; Fundamentals, governing equations, fluid motion	-	1,2
2	Potential Flow	Assignment 1 Due	3
3	Incompressible flow over airfoils	-	4
4	Incompressible flow over wings	Assignment 2 Due	5,6
5	Compressible flow, Shock and Expansion Waves, Experimental/Wind Tunnel Testing	-	7,8,9
6	Nozzle Flows, Linearised compressible flow	Assignment 3 Due	10, 11,12,13
7	Project work/tutorials/special lectures Labs	1. Flow Visualisation 2. Pressure distribution over cylinder	
8	Project work/tutorials/special lectures Labs	Assignment 4 Due ---------- 3. Pressure Distribution over a 2D wing 4. Drag of an airfoil 5. Compressible Nozzle flow	
9	Hypersonic aerodynamics (and propulsion)	Low-Speed Aero Group Project Due	14
Mid-semester break			
10	Fundamental equations of viscous flow, Laminar and turbulent boundary layers	Assignment 5 Due	15, 16
11	Flow separation, compressible boundary layers, turbulent flow	-	17,19
12	Review/Catchup	Assignment 6 Due	-
13	Review/Catchup (if needed)	Lab Reports Due	-

6. Assessment

Assessment overview

Assessment	Length	Weight	Learning outcomes assessed	Assessment criteria	Due date and submission requirements	Deadline for absolute fail	Marks returned
Assignments	6 (as per above table)	30%	1 through 4	Solution process and correct numerical answer	End of week nominated in Section 4, on-line via Connect	5 working days after submission	Two weeks after submission
Group Project: Design of low-speed airfoil section	10-page report (5 students per group)	10%	1 through 3	Design requirements achieved.	Week 9	5 working days after submission	Two weeks after submission
Laboratory Report	Two reports as per instructions on Moodle	20%	2 and 3	Rubric	End Week 13, via Moodle	5 working days after submission	Two weeks after submission
Final exam	2 hours	40%	1 through 4	All course content.	Exam period, date TBC	N/A	Upon release of final results

The assessment tasks will be placed on the course Moodle homepage.

Assignments

Presentation

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

On-line submissions should be made as per instructions provided during semester.

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

Submission

Late submissions will be penalised 5 marks per calendar day (including weekends). An extension may only be granted in exceptional circumstances. Where an assessment task is worth less than 20% of the total course mark and you have a compelling reason for being unable to submit your work on time, you must seek approval for an extension from the course convenor ***before the due date***. Special consideration for assessment tasks of 20% or greater must be processed through student.unsw.edu.au/special-consideration.

It is always worth submitting late assessment tasks when possible. Completion of the work, even late, may be taken into account in cases of special consideration.

Group Project

A group airfoil design project is required. Full details are on Moodle.

Examinations

The final exam is the final summative assessment for the course and will assess how well you have integrated the course material into your own learning. It will test your ability to solve applied aerodynamic problems.

You must be available for all tests and examinations. Final examinations for each course are held during the University examination periods, which are June for Semester 1 and November for Semester 2.

Provisional Examination timetables are generally published on myUNSW in May for Semester 1 and September for Semester 2

For further information on exams, please see the Exams section on the intranet.

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 shown 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 School Office or the Engineering Student Centre prior to the examination. Calculators not bearing an “Approved” sticker will not be allowed into the examination room.

Special consideration and supplementary assessment

For details of applying for special consideration and conditions for the award of supplementary assessment, see the School intranet, and the information on UNSW’s Special Consideration page.

7. Attendance

You are required to attend a minimum of 80% of all classes, including lectures, labs and seminars. It is possible to fail the course if your total absences equal to more than 20% of the required attendance. Please see the School intranet and the UNSW attendance page for more information.

8. 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: https://www.library.unsw.edu.au/

Moodle: https://moodle.telt.unsw.edu.au/login/index.php

9. 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.

In this course, recent improvements resulting from student feedback include:

1. Complete overhaul of course material
2. New and more worked examples
3. The use of a new textbook as a basis for the course
4. New laboratory projects
5. New fortnightly formative assessment tasks, with timely feedback
6. New group design project
7. Realignment of marks with assessment times to reflect student effort

10. 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: 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

Further information on School policy and procedures in the event of plagiarism is available on the intranet.

11. Administrative matters and links

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

- Attendance, Participation and Class Etiquette
- UNSW Email Address
- Computing Facilities
- Assessment Matters (including guidelines for assignments, exams and special consideration)

- Academic Honesty and Plagiarism
- Student Equity and Disabilities Unit
- Health and Safety
- Student Support 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