UNSW SYDNEY | Australia's Global University

Mechanical and Manufacturing Engineering

Course Outline

Semester 2 2018

AERO3630

AERODYNAMICS

Contents

1. Staff contact details

Contact details and consultation times for course convenor

Name: Professor Con Doolan
Office location: Ainsworth 408
Tel: (02) 9385 5696
Email: c.doolan@unsw.edu.au

Please contact Professor Doolan by email to arrange an appointment outside of scheduled teaching and consultation 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 plus scheduled laboratories.

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, further reading, and revising for any examinations.

Contact hours

	Day	Time	Location
Lectures	Tuesday	4pm - 6pm	Ainsworth 202
	Thursday	9am – 10am	Ainsworth 202
(Web)	Any	Any	Moodle
Demonstrations	Thursday	10am – 11am	Ainsworth 202
Lab	Friday (Weeks 7-8)	9am – 1pm	UTL

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	Topics	Assessment/Experiment
1	Introduction to course; Fundamentals, governing equations, fluid motion	
2	Potential Flow	Assignment 1 Due
3	Incompressible flow over airfoils	-
4	Incompressible flow over wings	Assignment 2 Due
5	Compressible flow, Shock and Expansion Waves, Experimental/Wind Tunnel Testing	-
6	Nozzle Flows, Linearised compressible flow	Assignment 3 Due
7	Hypersonic aerodynamics Labs	 1. Flow Visualisation 2. Pressure distribution over cylinder
8	Special topics Labs	Assignment 4 Due 3. Pressure Distribution over a 2D wing 4. Drag of an airfoil 5. Compressible Nozzle flow
9	Special topics	Low-Speed Aero Project Due
10	Fundamental equations of viscous flow, Laminar and turbulent boundary layers	Assignment 5 Due
11	Flow separation, compressible boundary layers, turbulent flow	-
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 5, on-line via Connect	5 working days after submission	Two weeks after submission
Project: Design of low-speed airfoil section	Written report	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

Most if not all submissions will be electronic via Moodle.

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 per cent (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 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. 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.

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

Improving Understanding:

- I will continue to devote more time to explaining fundamental concepts and understanding. I will move some of the more repetitive, time-consuming lecture

content on-line, freeing up more face-to-face time for explanations, examples, group discussion and projects
- I will provide detailed derivations and equation lists on-line linked to examples.
- I will slow down.

Improving Fortnightly assignments/quizzes

- The connect on-line system will be abandoned and replaced with my own assignments and quizzes. The number of on-line examples will be expanded.

Improving Tutorials

- I (and each tutor) will attend tutorials and provide assistance with homework problems, and any other aspect of the course. The tutors will focus on running the marked labs, marking assessment items and providing new undergraduate student experiences in the aerodynamics laboratory.

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: 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.

10. 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)
- Exams
- Approved Calculators
- 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