AVEN1920

Introduction to Aircraft Engineering

Term Two // 2021

School of Mechanical and Manufacturing Engineering // UNSW Engineering

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
J. Olsen	j.olsen@unsw.edu.au	During Lecture Periods	311C	9385 5217

School Contact Information

Location

UNSW Mechanical and Manufacturing Engineering

Ainsworth building J17, Level 1

Above Coffee on Campus

Hours

9:00–5:00pm, Monday–Friday*

*Closed on public holidays, School scheduled events and University Shutdown

Web

School of Mechanical and Manufacturing Engineering

Engineering Student Support Services

Engineering Industrial Training

UNSW Study Abroad and Exchange (for inbound students)

UNSW Future Students

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)

(+61 2) 9385 4097 – School Office**

**Please note that the School Office will not know when/if your course convenor is on campus or available

Email

Engineering Student Support Services – current student enquiries

- e.g. enrolment, progression, clash requests, course issues or program-related queries

Engineering Industrial Training – Industrial training questions

UNSW Study Abroad – 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

School Office – School general office administration enquiries

- NB: the relevant teams listed above must be contacted for all student enquiries. The School will only be able to refer students on to the relevant team if contacted

Course Details

Credit Points 6

Summary of the Course

Introduction to the course

Students of AVEN1920 are either trainee pilots or people hoping to become administrators in the aviation sector. In this course, I would like you to gain an appreciation of how aerospace engineers manage to keep aircraft in the sky, safely.

Course description as an invitation to learn

If you are a trainee pilot, I would like you to think about how gaining knowledge about the performance of aircraft might enable you to become a better pilot. I hope that this introduction to aerospace engineering might stimulate a life long interest in flight performance.

If you are hoping to become an administrator in the aviation sector, I would like you to think about the role you may play in aircraft safety. I hope that this introduction to aerospace engineering will enable you will glimpse the power of mathematical analysis to describe the behaviour of aircraft, and I hope this remains with you for life. I hope that you really appreciate that what you have is only a glimpse and not the full story. That is the domain of aerospace engineers.

Course Aims

Students will be able to:

- offer a reasonable description of how a wing develops lift and explain why this lift force is associated with various components of drag. Students will be able to extend thee ideas to propellers,
- write mathematical expressions for lift and drag and extend these equations so as to specify the power required by an aircraft for cruise, climb, descent, turn take-off and landing,
- describe the operation of a reciprocating-piston, spark-ignition, internal combustion engine and be able to write mathematical expressions that describe the power available at the propeller, remembering that to maintain airspeed in any mode of flight, the power available must match the power required,
- appreciate the operation of a gas turbine engine and be able to state why the high-bypass turbofan configuration is associated with high propulsive efficiency.

Course Learning Outcomes

1. Describe and use the core principles of engineering mechanics to solve basic problems related to aeronautical engineering
2. Describe the basic concepts related to the aerodynamic efficiency of an aircraft, and solve basic problems in aerodynamics as they relate to aircraft performance and airfoil design
3. Demonstrate an understanding of the historical processes that led to the current state of aircraft engineering and technology

4. Apply basic engineering concepts to the analysis of aircraft systems: structures, powerplants, stability and control, avionics and materials

This is not an engineering course and so the course learning outcomes are not linked to Engineers Australia Stage One Competencies.

Teaching Strategies

“Give a man a fish and you feed him for a day. Teach him how to fish and you feed him for a lifetime.” **Lao Tzu**

- Presentation of the material in lectures and discussions so that the students know how to approach complex engineering calculations required in industry.
- The problems I suggest you look at are intended to provide you with feedback and to allow you to investigate topics in greater depth. This is to ensure that you understand what you are being taught.

Additional Course Information

Students will be able to:

- offer some views on how a wing develops lift and identify causes of drag,
- show the connection between a propeller and a wing and explain why a propeller twists along its length,
- employ mathematical expressions for lift and drag and extend these equations so as to specify the power required by an aircraft in cruise,
- plot lift and drag (as well as drag components) as a function of airspeed,
- convert the power from an internal combustion engine into the power available to drive an aircraft as a function of airspeed from understanding the relationship between a propeller’s propulsive efficiency and its advance ratio,
- plot power required and power available against airspeed on the same graph,
- employ equations to predict the density of the air at some altitude,
- plot power required and power available against airspeed at different altitudes and use this to determine the absolute ceiling of the aircraft,
- extend this analysis to predict the maximum climb rate and the maximum climb angle and explain the difference between the two,
- extend this analysis to predict the minimum descent rate and the maximum glide angle during descent and explain the difference between the two,
- estimate the minimum length of runway required for an aircraft to safely take-off and the minimum length of runway to safely land, and
- identify the major components of a gas turbine engine, particularly the turbofan engine and describe the role of the fan in increasing the propulsive efficiency of the engine.

Assessment

All assessment materials can be found on Moodle. Assignment 1 will uploaded to Moodle in Week One, while Assignment 2 will uploaded to Moodle in Week Seven. The length of the assignment solutions will depend on you, but you need to show all working.

You will be assessed by a final examination as well as your continuous participation in completing two assignments. They will involve calculations. The assessments are based to allow you to obtain an understanding of the material being taught and will allow you to apply the concepts learnt in the course. In order to achieve a PASS (PS) in this course, you need to achieve a total mark of at least 50%.

Assessment Tasks

Assessment task	Weight	Due Date	Student Learning Outcomes Assessed
Final Class Test	30%	11/08/2021 01:00 PM	1, 2, 3
Mechanics class test	30%	14/07/2021 01:00 PM	1, 2, 3
Assignment 1	20%	16/06/2021 12:00 PM	1, 2, 3
Assignment 2	20%	28/07/2021 12:00 PM	1, 2, 3

Assessment Details

Assessment 1: Final Class Test

Start date: 11/08/2021 12:00 PM

Length: 1 hr

Details:

Class test

Additional details:

You will be assessed on the learning outcomes.

Must be handed in within 30 minutes of the official test end time or fail.

Marks posted within a fortnight.

Submission notes: Moodle Hand In Box

Turnitin setting: This is not a Turnitin assignment

Assessment 2: Mechanics class test

Start date: 14/07/2021 12:00 PM

Length: 1 hr

Details:

Mechanics class test

Additional details:

You will be assessed on the learning outcomes.

Must be handed in within 30 minutes of the official test end time or fail.

Marks posted within a fortnight.

Submission notes: Moodle Hand In Box

Turnitin setting: This is not a Turnitin assignment

Assessment 3: Assignment 1

Start date: 02/06/2021 12:00 PM

Length: Short

Details:

Short Assignment

Additional details:

Must be handed in within 7 days or due date or fail.

You lose 10% of your mark for everyday you are late.

You will be assessed on the learning outcomes.

Marks posted within a fortnight.

Submission notes: Moodle Hand In Box

Turnitin setting: This is not a Turnitin assignment

Assessment 4: Assignment 2

Start date: 14/07/2021 12:00 PM

Length: Long

Details:

Long Assignment

Additional details:

Must be handed in within 7 days or due date or fail.

You lose 10% of your mark for everyday you are late.

You will be assessed on the learning outcomes.

Marks posted within a fortnight.

Submission notes: Moodle Hand In Box

Turnitin setting: This is not a Turnitin assignment

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

Course Schedule

View class timetable

Timetable

Date	Type	Content
O Week: 25 May - 28 May		
Week 1: 31 May - 4 June	Lecture	WEDNESDAY Introduction to flight physics, lift and drag, straight and level flight.
	Lecture	THURSDAY Mechanics (forces)
Week 2: 7 June - 11 June	Lecture	WEDNESDAY The atmosphere and airspeeds
	Lecture	THURSDAY Mechanics (forces)
Week 3: 14 June - 18 June	Lecture	WEDNESDAY Wings
	Lecture	THURSDAY Mechanics (moments)
Week 4: 21 June - 25 June	Lecture	WEDNESDAY Range and endurance equations
	Lecture	THURSDAY Mechanics (equilibrium)
Week 5: 28 June - 2 July	Lecture	WEDNESDAY Climbing flight
	Lecture	THURSDAY Mechanics (rigid body mechanics)
Week 6: 5 July - 9 July		FLEXIBILITY WEEK
Week 7: 12 July - 16 July	Lecture	WEDNESDAY Weight and balance, Turning flight
	Lecture	THURSDAY Mechanics class test (1st hour), Take-off and landing (2nd hour)
Week 8: 19 July - 23 July	Lecture	WEDNESDAY and THURSDAY Reciprocating piston engines
Week 9: 26 July - 30 July	Lecture	WEDNESDAY and THURSDAY Propellers and helicopter rotors
Week 10: 2 August - 6 August	Lecture	WEDNESDAY and THURSDAY Introduction to gas turbines, net thrust, propulsive & component efficiencies

Resources

Prescribed Resources

Required

A.Tewari, 2016, Basic Flight Mechanics, Springer.

Recommended Resources

Suggested reading

J.L. Meriam & L.G. Kraige, 2003, Engineering Mechanics, Statics, 5th edition, SI version, John Wiley & Sons, Inc.

D. Gross, W. Hauger, J. Schroder, W.A. Wall and N. Rajapaske, 2013, Engineering Mechanics 1, Statics, 2nd Edition, Springer.

E. Torenbeek & Wittenberg, 2002, *Flight Physics, Essentials of Aeronautical Disciplines and Technology, with Historical Notes*, Springer.

D. F. Anderson & S. Eberhardt, 2010, Understanding flight, 2nd edition, McGraw Hill.

R.H. Barnard & D.R. Philpott, 2004, Aircraft Flight, 3rd Edition, Pearson, Prentice Hall.

A.C. Kermode, 2012, Mechanics of Flight, 12th Edition, Pearson.

N. Cumpsty & A. Heyes, 2015, *Jet Propulsion. A simple guide to the aerodynamic and thermodynamic design and performance of jet engines*, 3rd edition, Cambridge University Press.

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 …

Both academics attended the Course Design Institute in December 2019.

Laboratory Workshop Information

No Labs

Submission of Assessment Tasks

Assessment submission and marking criteria

Should the course have any non-electronic assessment submission, these should have a standard School cover sheet.

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.

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.

Late policy

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:

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

Examinations

You must be available for all quizzes, tests and examinations. For courses that have final examinations, these 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.

Special Consideration

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.

UNSW now has a Fit to Sit / Submit rule, which means that if you attempt 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.

Please note that students will **not** be required to provide **any** documentary evidence to support absences from any classes missed **because of COVID-19 public health measures such as isolation**. UNSW will **not** be insisting on medical certificates from anyone deemed to be a positive case, or when they have recovered. Such certificates are difficult to obtain and put an unnecessary strain on students and medical staff.

Applications for special consideration **will** be required for assessment and participation absences – but no documentary evidence **for COVID 19 illness or isolation** will be required.

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

Academic Information

Credit points

Course credit is calculated in Units-Of-Credit (UOC). The normal workload expectation for one UOC is approximately 25 hours per term. This includes class contact hours, private study, other learning activities, preparation and time spent on all assessable work.

Most coursework courses at UNSW are 6 UOC and involve an estimated 150 hours to complete, for both regular and intensive terms. Each course includes a prescribed number of hours per week (h/w) of scheduled face-to-face and/or online contact. Any additional time beyond the prescribed contact hours should be spent in making sure that you understand the lecture material, completing the set assignments, further reading, and revising for any examinations.

On-campus class attendance

Public distancing conditions must be followed for all face-to-face classes. To ensure this, only students enrolled in those classes will be allowed in the room. No over-enrolment is allowed in face-to-face classes. Students enrolled in online classes can swap their enrolment from online to a **limited** number of on-campus classes by Sunday, Week 1. Please refer to your course's Microsoft Teams and Moodle sites for more information about class attendance for in-person and online class sections/activities.

Your health and the health of those in your class is critically important. You must stay at home if you are sick or have been advised to self-isolate by NSW health or government authorities. Current alerts and a list of hotspots can be found here. **You will not be penalised for missing a face-to-face activity due to illness or a requirement to self-isolate.** We will work with you to ensure continuity of learning during your isolation and have plans in place for you to catch up on any content or learning activities you may miss. Where this might not be possible, an application for fee remission may be discussed. Further information is available on any course Moodle or Teams site.

In certain classroom and laboratory situations where physical distancing cannot be maintained or there is a high risk that it cannot be maintained, face masks will be considered **mandatory PPE** for students and staff.

For more information, please refer to the
FAQs: https://www.covid-19.unsw.edu.au/safe-return-campus-faqs

Guidelines

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

Important Links

- Moodle
- Lab Access
- Computing Facilities
- Student Resources
- Course Outlines
- Faculty Transitional Arrangements for COVID-19
- Makerspace
- UNSW Timetable
- UNSW Handbook
- Equitable Learning Services

Image Credit

Synergies in Sound 2016

CRICOS

CRICOS Provider Code: 00098G

Acknowledgement of Country

We acknowledge the Bedegal people who are the traditional custodians of the lands on which UNSW Kensington campus is located.