UNSW SYDNEY | Australia's Global University

Mechanical and Manufacturing Engineering

Course Outline

Term 2 2020

AVEN1920

INTRODUCTION TO AIRCRAFT ENGINEERING

Contents

1. Staff contact details

Contact details and consultation times for course convenor

Name: Dr John Olsen
Office location: J17 Ainsworth Building 311/C
Tel: (02) 9385 5217
Email: j.olsen@unsw.edu.au
Moodle: https://moodle.telt.unsw.edu.au/login/index.php

Consultation with me concerning this course will be available at a time to be decided.
Consultation by email should only be used as a very last resort as it is clumsy and inefficient.

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

Mechanics will be taught by:

Name: Dr Sangarapillai Kanapathipillai
Office Location: J17 Ainsworth Building 408/J
Tel: +61 2 9385 4251
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Please see the course Moodle.

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 4 hours per week (h/w) of scheduled online 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 6 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**	**Delivery Mode**
Lectures	Wednesday	10:00 – 12:00	Moodle Recorded Lectures
	Thursday	14:00 – 16:00	Moodle Recorded Lectures

All classes in T2 2020 will be online. Please consult this course's Moodle module for details about delivery.

Summary and Aims 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.

Student learning outcomes

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.

More detailed

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.

4. 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.

Consultation periods are designed to provide you with feedback and discussion on the problems that I would like you to do.

5. Course schedule

Week Monday	Wednesday All lectures delivered on-line.	Thursday All lectures delivered on-line.
1 1/6/20	Introduction to flight physics, lift and drag, straight and level flight.	Mechanics (forces)
2 8/6/20	The atmosphere and airspeeds	Mechanics (forces)
3 15/6/20	Wings	Mechanics (moments)
4 22/6/20	Range and endurance equations	Mechanics (equilibrium)
5 29/6/20	Climbing flight	Mechanics (rigid body mechanics)
6 6/7/20	Flexibility Week	
7 13/7/20	Weight and balance, Turning flight,	Mechanics class test (1st hour) Take-off and landing (2nd hour)
8 20/7/20	Reciprocating piston engines	Reciprocating piston engines
9 27/7/20	Propellers and helicopter rotors	
10 3/8/20	Introduction to gas turbines, net thrust, propulsive & component efficiencies	
11 10/8/20	Final class test (excluding mechanics)	

The schedule shown may be subject to change at short notice to suit exigencies.

6. Assessment

Assessment overview

Assessment	Group Project? (# Students per group)	Length	Weight	Learning outcomes assessed	Assessment criteria	Due date and submission requirements	Deadline for absolute fail	Marks returned
Mechanics class test	No	One hour	30%	All	All course content up to the date of the assignments.	11th July	There is no supplementary	Two weeks after submission
Assignment 1	No	Roughly 5 pages	20%	All	-	17th June	One week after the due date	1st July
Assignment 2	No	Roughly 10 pages	20%	All	All course content from weeks 1-10 inclusive.	29th July	One week after the due date	10th August
Final class test	No	One hour	30%	All	All course content from weeks 1-10 inclusive.	12th August	There is no supplementary	Upon release of final results
TOTAL			100%					

Assignments

AERO component

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%.

Presentation

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.

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 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.

7. Expected resources for students

Textbooks

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

Suggested reading

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

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.

UNSW Library website: https://www.library.unsw.edu.au/

Additional materials provided in Moodle

This course has a website on UNSW Moodle which includes:

- course notes
- assignments
- consultation notes

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:
Both academics attended the Course Design Institute in December 2019.

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

- *Dr John Olsen*
- *19th April, 2020*