UNSW Course Outline

AERO4620 Dynamics of Aerospace Vehicles, Systems and Avionics - 2024

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General Course Information

Course Code : AERO4620
Year : 2024
Term : Term 1
Teaching Period : T1
Is a multi-term course? : No
Faculty : Faculty of Engineering
Academic Unit : School of Mechanical and Manufacturing Engineering
Delivery Mode : Multimodal
Delivery Format : Standard
Delivery Location : Kensington
Campus : Sydney
Study Level : Undergraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

AERO4620 is one of the core courses in the Aerospace Engineering degree. it consists of three

distinct modules:

Module A deals with all systems onboard flying vehicles that are necessary for their proper functioning.

Module B covers avionics, as well as all other non-electronic systems that are integrated with the avionic ones.

Module C is about dynamics of aerospace vehicles.

Topics include: Fluidic, mechanical and electrical systems in aerospace vehicles; environment control; avionics and advanced aircraft systems; computer-aided vehicle management; avionics requirements; avionics integration; airborne sensors; navigation; stability and control systems; cockpit environment; static and dynamic stability of atmospheric vehicles; flight control; handling and flying qualities

Course Aims

Dynamics of Aerospace Vehicles, Systems and Avionics is a higher level Aerospace Engineering course in which the fundamental concepts grasped in 3rd year are integrated, applied and extended.

This course focuses on how the aircraft behaves as a time-dependent SYSTEM. It aims to teach you about aerospace vehicles' static and dynamic stability as well as the impact that on-board systems and avionics have on the determination and control of the vehicle dynamics. Other systems critical for aircraft performance will also be covered. The course builds heavily on the foundations learnt in Flight Performance, Linear Systems and Control and Aerodynamics.

Relationship to Other Courses

Much of the concepts in Module C build on linear systems and control methods from MMAN3200.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Learn the analytical aspects of static and dynamic stability
CLO2 : Understand the regulatory aspects of static stability
CLO3 : Establish the connection between the aircraft’s mission and the selection of systems and components
CLO4 : Learn how to apply methodologies learnt in MMAN3200 to aerospace applications

Course Learning Outcomes	Assessment Item
CLO1 : Learn the analytical aspects of static and dynamic stability	• Final exam • Tests • Lab Report
CLO2 : Understand the regulatory aspects of static stability	• Final exam • Tests • Lab Report
CLO3 : Establish the connection between the aircraft's mission and the selection of systems and components	• Flight simulation • Final exam • Tests • Lab Report
CLO4 : Learn how to apply methodologies learnt in MMAN3200 to aerospace applications	• Final exam • Lab Report

Learning and Teaching Technologies

Moodle - Learning Management System | Microsoft Teams

Additional Course Information

This is a 6 unit-of-credit (UoC) course and involves seven 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 12 h/w on this course. The additional time, outside the scheduled classes, should be spent in making sure that you understand the lecture material, completing the set assignments, further reading, and revising for any examinations.

For ease of management, the course is organised into three separate parts: Aerospace Systems, Avionics and Flight Dynamics; they will form Modules A, B and C respectively. Module A will run in Weeks 1 – 5, Module B will run in Weeks 7 to 10. Module C will run in Weeks 1 – 10 concurrently with Modules A and B.

The Aerospace Systems part (Module A) deals with the so-called airframe systems as well as their effect on aircraft's performance. The Avionics segment (Module B) studies aircraft electronic systems as well as other systems that directly interface with electronics. The Flight

Dynamics part (Module C) covers different aspects of aircraft stability and the parameters that affect it. The wind tunnel experiment demonstrates the longitudinal stability, understanding of which is crucial for flight control systems. It also provides a link between the Flight Dynamics and Avionics modules. Finally, the flight simulation experiment demonstrates the operations of auto-pilots and various navigation and communication systems.

AERO4620 is an important stepping stone in aerospace engineering education. The knowledge acquired during this course is directly applicable to the group design in AERO4110. On the other hand, Module C of this course directly relates to the performance part of AERO3660; at the same time the stability analysis of flying vehicles presented in this module is based on methods learned in MMAN3200. All these components largely contribute to developing necessary engineering skills and knowledge.

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Flight simulation Assessment Format: Individual	2%	Start Date: Not Applicable Due Date: Not Applicable
Final exam Assessment Format: Individual	44%	Start Date: Not Applicable Due Date: Not Applicable
Tests Assessment Format: Individual	42%	Start Date: Not Applicable Due Date: Not Applicable
Lab Report Assessment Format: Individual	12%	Start Date: Not Applicable Due Date: 18/04/2024 11:55 PM

Assessment Details

Flight simulation

Assessment Overview

Flight simulation will be emphasising the use of displays, auto-pilots and navigation systems.

It is an individual exercise planned for the second half of the term.

It will take between 30-45 minutes.

The marking criteria will be based on attendance and compliance with WHS requirements for laboratories.

Informal verbal feedback will be provided by the demonstrator at the conclusion of the exercise.

Course Learning Outcomes

- CLO3 : Establish the connection between the aircraft's mission and the selection of systems and components

Assignment submission Turnitin type

Not Applicable

Final exam

Assessment Overview

Final exam testing the entire Module B (28%) as well as the Dynamic Stability part of Module C (16%).

It will be conducted during the standard examination period.

The duration will be approximately two hours.

Moodle will be used for providing individualised questions, while student will write their answers in booklets provided.

Course Learning Outcomes

- CLO1 : Learn the analytical aspects of static and dynamic stability
- CLO2 : Understand the regulatory aspects of static stability
- CLO3 : Establish the connection between the aircraft's mission and the selection of systems and components
- CLO4 : Learn how to apply methodologies learnt in MMAN3200 to aerospace applications

Assessment Length

Two hours

Assignment submission Turnitin type

Not Applicable

Tests

Assessment Overview

There will be two tests during the term.

Test 1 on the entire Module A (30%), Test 2 on static stability (12%).

Test 1 will take approximately 45 minutes while Test 2 will be around 30 minutes.

Both tests will use Moodle to provide students with randomised questions while the answers will be written in the booklets provided.

The feedback will be written in the same booklets that will be returned to students.

Course Learning Outcomes

- CLO1 : Learn the analytical aspects of static and dynamic stability
- CLO2 : Understand the regulatory aspects of static stability
- CLO3 : Establish the connection between the aircraft's mission and the selection of systems and components

Submission notes

Upload your full answers to test questions.

Assignment submission Turnitin type

Not Applicable

Lab Report

Assessment Overview

Wind tunnel measurements of forces and moments acting on a scaled-down aircraft models will be used for assessing the longitudinal stability parameters. Based on the measurements taken, students will be asked to submit the lab report where longitudinal dynamic stability of the aircraft they tested.

The reports will be submitted via Moodle where the feedback will be provided following the review of the reports.

The experiment will take 45-60 minutes while the report will be approximately 6 pages lomg.

Course Learning Outcomes

- CLO1 : Learn the analytical aspects of static and dynamic stability
- CLO2 : Understand the regulatory aspects of static stability
- CLO3 : Establish the connection between the aircraft's mission and the selection of systems and components
- CLO4 : Learn how to apply methodologies learnt in MMAN3200 to aerospace applications

Assignment submission Turnitin type

This assignment is submitted through Turnitin and students do not see Turnitin similarity reports.

General Assessment Information

Marks will be returned 2 weeks after each in-term test.

HURDLE REQUIREMENT

In order to pass the course, you also have to obtain a total of at least 50% (20 marks) for the Module C: Test 1 (12%) + Lab report (12%) + Module C part of the final exam (16%).

Grading Basis

Standard

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 12 February - 18 February	Lecture	Module A: Aerodynamic controls, cockpit controls. Module C: Definitions of aircraft stability
Week 2 : 19 February - 25 February	Lecture	Module A: Transmission media, hydraulics and pneumatics Module C: Analysis of static stablity parameters.
Week 3 : 26 February - 3 March	Lecture	Module A: Fuel systems and components. Module C: Analysis of static stablity parameters (continued).
Week 4 : 4 March - 10 March	Lecture	Module A: Environmental controls Module C: Analysis of static stablity parameters (contingency time) Module C: Flying and handling qualities
	Assessment	Test 1: Module C: Static Stability
Week 5 : 11 March - 17 March	Lecture	Module A: Electrical systems and components Module C: Mathematical model of longitudinal dynamics
Week 6 : 18 March - 24 March	Other	Flexibility Week Consultations, flight simulation
Week 7 : 25 March - 31 March	Lecture	Module B: What qualifies as avionics? Aircraft Sensors Module C: Mathematical model of lateral dynamics
	Assessment	Test 2: Module A
	Laboratory	Lab briefing
Week 8 : 1 April - 7 April	Lecture	Module B: Navigation systems Module C: State variable technique
	Laboratory	Determination of longitudinal stability using static wind-tunnel measurements.
Week 9 : 8 April - 14 April	Lecture	Module B: Automatic flight control. Autopilots. Cockpit electronics. Module C: State variable technique
	Tut-Lab	Lab de-briefing
Week 10 : 15 April - 21 April	Lecture	Module B: Avionics standardisation. Block diagrams of flight control systems Module C: Contingency time and Revision
	Assessment	Lab Report Due (Wednesday)

Attendance Requirements

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

General Schedule Information

The schedule of lecture topics is indicative only and may be modified as appropriate. The schedule for assessments items such as Tests, and Laboratories has been set.

Course Resources

Prescribed Resources

There is no textbook for the course. PowerPoint slides will be available on Moodle for Modules A and B lectures but students are expected to use various sources to supplement their knowledge, as befits a student of a Level 4 course.

Recommended Resources

Aviation Theory Centre (Melbourne, Vic.) 2012a, “Aircraft general knowledge and aerodynamics for the CASA PPL and CPL day VFR syllabus”, Huntingdale, Vic.: Aviation Theory Centre

Collinson, R. – “Introduction to Avionics”, 1st ed., London; New York: Chapman & Hall

Cook, M.V., “Flight Dynamics Principles”, Arnold Publishers, UK, 1997

Sadraey M. “Aircraft Design: A Systems Engineering Approach”, John Wiley & Sons, UK, 2012

Federal Aviation Administration, "Pilot’s Handbook of Aeronautical Knowledge FAA-H-8083-25C ", United States Department of Transportation, 2023

PowerPoint slides for Modules A and B

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

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

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 in 2022 the feedback was mostly positive, statistically around the School's mean. The most prominent remarks were on the timetabling aspect. Many students indicated that

three-hour lectures were tiring, so longer breaks during lectures will be provided this year.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Jiawei Tan		Room 408, Building J17		TBA	Yes	Yes
Lecturer	Zoran Vulovic		Room 311D, Building J17	(02) 93856261	TBA	No	No
Demonstrator	Ian Mui				TBA	No	No
	Justin Malkki				TBA	No	No
	Rachel Li				TBA	No	No

Other Useful Information

Academic Information

I. 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, or within 3 working days of, submitting an assessment or sitting an exam.

Please note that UNSW has a Fit to Sit rule, which means that if you sit an exam, 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.

II. 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

III. Equity and diversity

Those students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course convener prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equitable Learning Services. Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made.

IV. Professional Outcomes and Program Design

Students are able to review the relevant professional outcomes and program designs for their streams by going to the following link: https://www.unsw.edu.au/engineering/student-life/student-resources/program-design.

Note: This course outline sets out the description of classes at the date the Course Outline is published. The nature of classes may change during the Term after the Course Outline is published. Moodle or your primary learning management system (LMS) should be consulted for the up-to-date class descriptions. If there is any inconsistency in the description of activities between the University timetable and the Course Outline/Moodle/LMS, the description in the Course Outline/Moodle/LMS applies.

Academic Honesty and Plagarism

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.

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 or contract cheating) even suspension from the university. The Student Misconduct Procedures are available here:

www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf

Submission of Assessment Tasks

Work submitted late without an approved extension by the course coordinator or delegated authority is subject to a late penalty of five percent (5%) 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. This is for all assessments where a penalty applies.

Work submitted after five days (120 hours) will not be 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 will be clearly indicated in the course outline, and such assessments will receive a mark of zero if not completed by the specified date. Examples include:

- Weekly online tests or laboratory work worth a small proportion of the subject mark;
- Exams, peer feedback and team evaluation surveys;
- Online quizzes where answers are released to students on completion;
- Professional assessment tasks, where the intention is to create an authentic assessment that has an absolute submission date; and,
- Pass/Fail assessment tasks.

Faculty-specific Information

Engineering Student Support Services – The Nucleus - enrolment, progression checks, 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

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)

School-specific Information

Short Extensions

Short extensions are not currently applicable to Mechanical and Manufacturing Engineering Courses.

Review of Results

The purpose of a review of results is if there was a marking error. Review of results is for when you have cause to believe that there is a marking error. Review of Results cannot be used to get feedback. If you would like feedback for assessments prior to the final exam, you are welcome to contact the course convenor directly. No feedback will be provided on final exams.

Use of AI

The use of AI is prohibited unless explicitly permitted by the course convenor. Please respect this and be aware that penalties will apply when unauthorised use is detected, such as through Turnitin. If the use of generative AI, such as ChatGPT, is allowed in a specific assessment, they must be properly credited, and your submissions must be substantially your own work.

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

Important Links

- Student Wellbeing
- Urgent Mental Health & Support
- Equitable Learning Services
- Faculty Transitional Arrangements for COVID-19
- Moodle
- Lab Access
- Computing Facilities
- Student Resources
- Course Outlines
- Makerspace
- UNSW Timetable
- UNSW Handbook