AERO3110

Aerospace Design 1

Term Three // 2020

School of Mechanical and Manufacturing Engineering // UNSW Engineering

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Dr Sonya A Brown	sonya.brown@unsw.edu.au		Ainsworth 408D	

Demonstrators

Name	Email	Availability	Location	Phone
Benjamin Tynan	b.tynan@unsw.edu.au			
Justin (Quang) Tran	justin.tran1@unsw.edu.au			
Jarred (Junyan) Chen	junyan.chen@unsw.edu.au			

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

Course Details

Credit Points 6

Summary of the Course

This course aims to provide students with a grounding in aerospace design, in terms of both structural design and systems design. The course includes the design process, aerospace load cases, margins of safety, international units, regulations, detailed aerospace structural design, and an introduction to aerospace systems design. CATIA is taught in parallel to develop skills in a common computer aided design tool used in the aerospace industry. The final project aims to provide an experiential learning opportunity and develop team work skills, with students completing a Design-Build-Test project in small teams by designing a representative aerospace part to meet a set of requirements, manufacturing the part, and testing it to failure.

Course Aims

This course aims to provide students with a grounding in aerospace design, in terms of both structural design and systems design. The course includes the design process, aerospace load cases, margins of safety, international units, regulations, detailed aerospace structural design, and an introduction to aerospace systems design. CATIA is taught in parallel to develop skills in a common computer-aided design tool used in the aerospace industry. The final project aims to provide an experiential learning opportunity and develop team work skills, with students completing a Design-Build-Test project in small teams by designing a representative aerospace part to meet a set of requirements, manufacturing the part, and testing it to failure.

Course Learning Outcomes

After successfully completing this course, you should be able to:

Learning Outcome	EA Stage 1 Competencies
1. Design an aerospace structure to meet regulatory requirements and a given design brief.	PE1.3, PE1.5, PE2.3, PE3.2
2. Evaluate and justify systems selection and implementation for a variety of aerospace systems.	PE1.3, PE1.4, PE2.3, PE3.2
3. Apply computer-aided design tools to model an aerospace design.	PE1.5, PE2.2
4. Identify appropriate engineering data sources and regulations and apply in the context of aerospace design.	PE1.6, PE3.1

Teaching Strategies

The course is divided into 4 modules:

- 1: Aerospace Structural Design
- 2: Aerospace Systems
- 3: CATIA

- 4: Design-Build-Test

Lectures will cover the main theoretical course content for Modules 1 and 2, with Tutorials providing time to work through the design problems relating to the lecture material with demonstrator support provided to assist understanding. CATIA content for Module 3 will be provided prior to each CATIA laboratory session via a video, with each lab having set exercises each week to take you through the range of functions available for modelling in the software. Module 4 consists of a design-build-test activity, linking back to the structural design lecture material, but giving students the opportunity to develop further understanding via an experiential project. Team work will also form part of Module 4 to assist in developing the communication and interpersonal skills critical for industry.

Lectures

Lectures will cover the main theoretical course content. Team Based Learning (TBL) sessions will be used in some systems classes to encourage additional interaction with the content.

Tutorials

Tutorials will include an example problem or exercise, with the majority of time available to work through the required design problems, with demonstrator support available to answer questions.

CATIA

CATIA labs will have set exercises each week to take you through the range of functions available for modelling in the software. CATIA is selected as it is used by a large number of aerospace companies. Introductory remarks and demonstrations of the content will be provided via video. During lab times demonstrators will be available to assist with modelling questions.

Design-Build-Test

The Design-Build-Test project is focused on experiential learning techniques. Each team will design an aircraft part to meet a detailed set of requirements. Each team will need to manufacture their own part, and this will be tested to failure, and hence allow teams to review the structural performance of their design.

Additional Course Information

Prerequisites

DESN2000 Engineering Design and Professional Practice ***OR*** MMAN2100 Engineering Design 2
AND
ENGG2400 ***OR*** MMAN2400 Mechanics of Solids 1

Assumed Knowledge

Students are expected to have a sound understanding of engineering design and drawing, statics and free body diagrams, manufacturing, aerospace structural analysis, and flight performance prior to attempting this course.

Platforms and Communication

Aerospace Design 1 will use a combination of Moodle and Microsoft Teams. The primary communication channel will be Microsoft Teams. Please ensure you check Teams regularly for any important announcements. Questions are best addressed in class or via Teams. I will do my best to respond to all queries in one business day.

Class Times

Please refer to your class timetable for the learning activities you are enrolled in and attend only those classes.

	Day	Time	Location
Lectures	Monday	2pm - 3pm	Online (Weeks 1-5, 7-10)
	Tuesday	10am - 12pm	Online (Weeks 1-5, 7-8)
	Tuesday	10am - 11am	Online (Weeks 9-10)
Tutorials (*)	Wednesday	3pm - 5pm	Mathews Theatre A (D23-201) (Weeks 1-7)
	Wednesday	3pm - 5pm	Webster Theatre B (G15-290) (Weeks 1-7)
	Wednesday	3pm - 5pm	Online (Weeks 1-7)
CATIA (*)	Wednesday	5pm - 6pm	Ainsworth 204 (Weeks 1-10)
	Wednesday	5pm - 6pm	Ainsworth 203 (Weeks 1-10)
	Thursday	12pm - 1pm	Online (Weeks 1-10)
Workshop / Lab (*)	Thursday	10am - 1pm	Willis Annexe J18 214 UTL (Weeks 8-10)
	Friday	9am - 12midday	
	Friday	1pm - 4pm	
	TBA	TBA	Online (Weeks 8-10)

***** Note: If you are unwell or have been asked to self-isolate - please do not attend campus or class. Advise the course convenor (Dr Sonya Brown) **prior**, and you will be added to the online class for that week.

Assessment

Assessment Tasks

Assessment task	Weight	Due Date	Student Learning Outcomes Assessed
Design Problems	40%	See below	1, 2, 4
Quizzes	20%	See below	1, 2, 4
CATIA Labs	10%	Weekly during class	3
Design-Build-Test (Team)	30%	01/12/2020 11:50 PM	1, 4

Assessment Details

Assessment 1: Design Problems

Start date: Not Applicable

Details:

Design Problem 1 (15%) - Truss Structure - Due *11:50pm Wednesday Week 4*

Design Problem 2 (10%) - Doubler - Due *11:50pm Wednesday Week 7*

Design Problem 3 (15%) - Systems - Due *11:50pm Wednesday Week 10*

Additional details:

Marks returned two weeks after submission.

Assessment 2: Quizzes

Start date: Not Applicable

Details:

Structures (10%) - *Tuesday Week 3* during the scheduled lecture

Systems (10%) - Team based learning (TBL) sessions during scheduled lectures:

Tuesday Week 5, *Tuesday Week 7*, *Tuesday Week 8*

Additional details:

Quizzes will occur in-class during one of the lecture sessions in the listed week.
For Structures Quiz - Marks returned two weeks after quiz.
For Systems TBL Quizzes - Marks returned by one week after quiz.

Assessment 3: CATIA Labs

Start date: Not Applicable

Details:

CATIA labs will have set exercises *each week (1-5, 7-10)* to take you through the range of functions available for modelling in the software. Labs will be marked based on exercise completion and understanding.

CATIA labs will be marked off weekly during the set computer lab tutorial time.

Assessment 4: Design-Build-Test (Team)

Start date: Not Applicable

Length: 20 pages (maximum)

Details:

In small teams of 3-4 students, you will undertake a Design-Build-Test project of a typical aerospace structure.

Due *11:50pm Tuesday 1st of December*

Additional details:

The team assessment mark will be moderated by academic review and peer evaluation to give an individual mark for the assessment.

For the team assessment, an individual statement of claim of contributions must be submitted electronically by the assessment due date. Failure to submit an individual statement of claim for the assessment will result in an individual penalty of 10% of the maximum mark possible for the assessment.

For the team assessment, a peer evaluation must be completed electronically. Peer evaluations for the Design-Build-Test project must be completed by 4:00pm Friday 4th December. Failure to complete the peer evaluation by the required deadline for the assessment will result in an individual penalty of 10% of the maximum mark possible for the assessment.

Maximum page numbers exclude front matter, references and appendices.

Attendance Requirements

Students are strongly encouraged to attend all lectures or review lecture recordings.
Attendance is required at all tutorials, workshops/labs and computer labs. If your absence equates to more than 20% of tutorials, workshops/labs and computer labs, you may fail the course, or be denied special consideration. Note that for Term 3, 2020 there will be an online class available for tutorials, workshops/labs and computer labs.

Course Schedule

View class timetable

Timetable

Date	Type	Content
Week 1: 14 September - 18 September	Lecture	A: Introduction to Aerospace Design, Design Process and Reviews B: Structures - Regulations and Load Factors (FAR 23) C: Structures - Structural Loads and Free Body Diagrams (FAR 23)
Week 2: 21 September - 25 September	Lecture	A: Structures - Aerospace Structural Design (FAR 23) B: Structures - Failure Types and Material Data (MMPDS & CMH-17) C: Structures - Trusses (Bruhn A2.9 & A2.10 & Flabel 1.10)
Week 3: 28 September - 2 October	Lecture	A: Structures - Beams (Flabel 1.4, 1.5, 1.6, 1.7, Ch 2) B: Structures - Cut Outs & Doublers (Niu Ch 6 & Flabel Ch 9) C: Structures - **Quiz** - Structural Design
Week 4: 5 October - 9 October	Lecture	A: Structures - Joints & Fasteners (Bruhn D1 & Flabel Ch 3) B: Structures - Lugs (Bruhn D1) C: Structures - Structural Design Review
Week 5: 12 October - 16 October	Lecture	A: Systems - Types of Aircraft Systems (Moir & Seabridge 2013 Ch 2) B: Systems - Systems Design Considerations (FAR §23.2510, FAR §23.1309, Moir & Seabridge 2013 §6.5 & Moir & Seabridge 2008 Ch 8)

		C: Systems - **TBL Quiz** Hydraulic Systems (Moir & Seabridge 2008 Ch 4)
Week 7: 26 October - 30 October	Lecture	A: Systems - Flight Control Systems (Moir & Seabridge 2008 Ch 1) B: Systems - Electrical Systems (Moir & Seabridge 2008 Ch 5) C: Systems - **TBL Quiz** Avionics Systems (Moir & Seabridge 2008 Ch 12)
Week 8: 2 November - 6 November	Lecture	A: DBT - DBT Support - Manufacture + Consultation (Bruhn D1 & FAA-H-8083) B: Systems - Fuel Systems (Moir & Seabridge 2008 Ch 3) C: Systems - **TBL Quiz** Communication Systems (Pisacane Ch 9)
Week 9: 9 November - 13 November	Lecture	A: DBT - DBT Support - Testing + Consultation B: Systems - Case Study - Boeing 737 MAX (Lion Air Flight 610 Preliminary Report & Ethiopian Airlines Flight 302 Preliminary Report)
Week 10: 16 November - 20 November	Lecture	Guest Lecture (TBC) Consultation

Resources

Prescribed Resources

- Jean-Claude Flabel, Practical Stress Analysis for Design Engineers, First Edition, Lake City Publishing Company 1997
- Ian Moir and Allan Seabridge, Aircraft Systems: Mechanical, electrical, and avionics subsystems integration, Third Edition, AIAA Education Series 2008

Recommended Resources

- E. F. Bruhn, Analysis and Design of Flight Vehicle Structures, Jacobs Publishing, Inc. 1973
- Ian Moir and Allan Seabridge, Design and Development of Aircraft Systems, Second Edition, AIAA Education Series 2013
- Vincent L. Pisacane, Fundamentals of Space Systems, Second Edition, Oxford University Press 2005
- FAA-H-8083 Aviation Maintenance Technician Handbook - Airframe
- Michael C. Y. Niu, Airframe Structural Design, Second Edition, Hong Kong Conmilit Press Ltd. 2006
- Warren C. Young and Richard G. Budynas, Roark's Formulas for Stress and Strain, Seventh Edition, 2002
- Federal Aviation Regulations, FAR 23, Airworthiness Standards: Normal Category Airplanes
- Federal Aviation Regulations, FAR 25, Airworthiness Standards: Transport Category Airplanes
- DOT/FAA/AR-MMPDS, Metallic Materials Properties Development and Standardization (MMPDS), (previously MIL-HDBK-5)
- CMH-17, Composite Materials Handbook, (previously MIL-HDBK-17)

Leganto Reading List available via the course Moodle.

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 discussions with students inside and outside of class, 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:

- Development of a variety of tutorial activities to support the design problems.
- CATIA content video development, enabling better presentation and review of material.
- CATIA assessment removal and replacement with ongoing CATIA laboratory assessment. Enabling improved spacing of design problems.

Laboratory Workshop Information

An induction will be required for the workshops supporting the Design-Build-Test project. These are

scheduled in Weeks 2-3, with more information provided on the AERO3110 Teams channel.

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, which the course convenor will provide to you.

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 in T3.

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. 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 T3 face-to-face classes. To ensure this, only students enrolled in those classes will be allowed in the room. Class rosters will be attached to corresponding rooms and circulated among lab demonstrators. No over-enrolment is allowed in face-to-face class. Students enrolled in online classes can swap their enrolment from online to other additional, **but 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 1.5 metres 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

Other Matters

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
- Health and Safety
- Computing Facilities
- Student Resources
- Course Outlines
- Engineering Student Support Services Centre
- Makerspace
- UNSW Timetable
- UNSW Handbook
- UNSW Mechanical and Manufacturing Engineering
- Equitable Learning Services

Image Credit

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.

Appendix: Engineers Australia (EA) Professional Engineer Competency Standard

Program Intended Learning Outcomes	
Knowledge and skill base	
PE1.1 Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline	
PE1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline	
PE1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline	✓
PE1.4 Discernment of knowledge development and research directions within the engineering discipline	✓
PE1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline	✓
PE1.6 Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline	✓
Engineering application ability	
PE2.1 Application of established engineering methods to complex engineering 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	
Professional and personal attributes	
PE3.1 Ethical conduct and professional accountability	✓
PE3.2 Effective oral and written communication in 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	