UNSW SYDNEY | Australia's Global University

Mechanical and Manufacturing Engineering

Course Outline

Term 2 2019

AERO3110

Aerospace Design 1

Contents

1. Staff contact details

Contact details and consultation times for course convenor

Name: Dr Sonya A Brown
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Moodle: https://moodle.telt.unsw.edu.au/login/index.php

I will attend the first half-hour of each tutorial session. It is preferred for any queries to be addressed in this time. If this is not possible, please email me.

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

Name: Rick Reid
Role: CATIA Facilitator
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Name: Jarred (Junyan) Chen
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Name: Christie Lau
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2. Important links

- Moodle
- Lab Access
- 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 6 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 14 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	Monday	9am - 10am	Ainsworth 102 (Weeks 1, 3-10)
	Wednesday	9am - 11am	Ainsworth 202 (Weeks 1-7)
	Wednesday	10am - 11am	Ainsworth 202 (Weeks 8-10)
Tutorials	Thursday	10am - 12midday	Old Main Building (K15) G31 (Weeks 1-7)
CATIA	Wednesday	5pm - 6pm	Ainsworth 204 (Weeks 1-10)
Workshop / Lab	Tuesday	12pm - 3pm	Willis Annexe J18 116A UTL (Weeks 8-10)
	Thursday	9am - 12midday	
	Thursday	1pm - 4pm	

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 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 groups by designing a representative aerospace part to meet a set of requirements, manufacturing the part, and testing it to failure.

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.

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.	Design an aerospace structure to meet regulatory requirements and a given design brief.	PE 1.3, PE 1.5, PE 2.3, PE 3.2
2.	Evaluate and justify systems selection and implementation for a variety of aerospace systems.	PE 1.3, PE 1.4, PE 2.3, PE 3.2
3.	Apply computer-aided design tools to model an aerospace design.	PE 1.5, PE 2.2
4.	Identify appropriate engineering data sources and regulations and apply in the context of aerospace design.	PE 1.6, PE 3.1

4. Teaching strategies

The course is divided into 4 modules:

- 1: Aerospace Structural Design
- 2: Aerospace Systems Design
- 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. Lecture recordings will also be available online. Team Based Learning (TBL) sessions will be used in three systems lectures to encourage additional interaction with the content.

Tutorials

Tutorial time will be used as time 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. Each session will include introductory remarks and demonstrations of the content, and 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.

5. Course schedule

Note: As this course has been newly re-developed, topics and order are subject to change.

Week	Modules	Topic	Suggested Readings
0		Video - Introduction to Aerospace Design, Design Process and Reviews	
1	1: Aerospace Structural Design	Regulations and Load Factors	FAR 23
		Structural Loads and Free Body Diagrams	
		Aerospace Structural Design	
2		Failure Types and Material Data	MMPDS CMH-17
		Trusses	Bruhn A2.9 & A2.10 Flabel 1.10
3		Beams	Flabel 1.4, 1.5, 1.6, 1.7, Ch 2
		Cut Outs & Doublers	Niu Ch 6 Flabel Ch 9
		Quiz - Structural Design	
4		Joints & Fasteners	Bruhn D1 Flabel Ch 3
		Shear & Tension Clips	Flabel Ch 5
		Lugs	Bruhn D1
5		Structural Design Review	
		Types of Aircraft Systems	Moir & Seabridge 2013 Ch 2

Week	Modules	Topic	Suggested Readings
	2: Aerospace Systems Design	Systems Design Considerations	FAR §23.2510 & FAR §23.1309 Moir & Seabridge 2013 §6.5 Moir & Seabridge 2008 Ch 8
6		Hydraulic Systems **TBL Quiz**	Moir & Seabridge 2008 Ch 4
		Flight Control Systems	Moir & Seabridge 2008 Ch 1
		Electrical Systems	Moir & Seabridge 2008 Ch 5
7		Avionics Systems **TBL Quiz**	Moir & Seabridge 2008 Ch 12
		Power / Engine Control Systems	Moir & Seabridge 2008 Ch 2
		Fuel Systems	Moir & Seabridge 2008 Ch 3
8		Communication Systems **TBL Quiz**	Pisacane Ch 9
	4: Design-Build-Test	DBT Support – Manufacture + Consultation	Bruhn D1 FAA-H-8083
9		DBT Support – Testing + Consultation	
	2: Aerospace Systems Design	Case Study – Boeing 737 MAX	Lion Air Flight 610 Preliminary Report Ethiopian Airlines Flight 302 Preliminary Report
10		Guest Lecture / Consultation	
		Consultation	
1-10	3: CATIA	CATIA	CATIA notes

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
Design Problems (3)	No	TBA	30%	1, 2 & 4	FBDs, diagrams and drawings, calculations, reasoning, results and discussion.	1: 11:50pm Monday Week 4 2: 11:50pm Monday Week 6 3: 11:50pm Monday Week 8	Two (2) days after each respective due date	Two weeks after submission
Quizzes	No	20 mins	20%	1, 2 & 4	FBDs, diagrams, calculations, reasoning and results.	1: Week 3 [1]	N/A	Two weeks after quiz
	Mixed	TBL sessions				2: Week 6 [1]; Week 7 [1]; Week 8 [1]		One week after quiz
CATIA Assignment	No	CATIA package	20%	3	All CATIA course content	11:50pm Thursday Week 10	11:50pm Monday 12th August	Upon release of final results
Design-Build-Test (Group [2, 3, 4]) [5]	Yes (3-4)	20 pages max [6]	30%	1 & 4	Design report working and results; drawings; strength, weight and cost of structure. Peer evaluation.	Test Article: Start of your Week 10 workshop Report: 4:00pm Monday 19th August	Test Article: N/A Report: 4:00pm Saturday 24th August	Upon release of final results

Notes:

1. Quizzes will occur in-class during one of the lecture sessions in the listed week.
2. The group assessment mark will be moderated by academic review and peer evaluation to give an individual mark for the assessment.
3. For the group 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.

4. For the group assessment, a peer evaluation must be completed electronically. Peer evaluations for the Design-Build-Test project must be completed by 4:00pm Thursday 22nd August. 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.
5. The Design-Build-Test Report is required to be submitted in hard copy, as well as electronically.
6. Maximum page numbers exclude front matter, references and appendices.

Further assessment details may be found on the course Moodle once released.

Assignments

Attendance

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.

Presentation

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 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 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.

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 available 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 Engineering Student Supper Services Centre prior to the examination. Calculators not bearing an “Approved” sticker will not be allowed into the examination room.

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 sit 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

Required Texts

- 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 Reading

- 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

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:

- Development of an introductory tutorial activity for each design problem.
- CATIA content each week will be presented via videos, to enable students to review content as they work through the exercises.

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
- Computing Facilities
- Special Consideration
- Exams
- Approved Calculators
- Academic Honesty and Plagiarism
- Student Equity and Disabilities Unit
- Health and Safety
- Lab Access

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