UNSW SYDNEY | Australia's Global University

Mechanical and Manufacturing Engineering

Course Outline

Semester 2 2018

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 last 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
Email: richard.reid@UNSWalumni.com

Demonstrator details will be provided on the course Moodle.

2. Important links

- Moodle
- UNSW Mechanical and Manufacturing Engineering
- Course Outlines
- Student intranet
- UNSW Mechanical and Manufacturing Engineering Facebook
- UNSW Handbook

3. Course details

Credit Points

This is a 6 unit-of-credit (UoC) course, and involves 5 hours per week (h/w) of face-to-face contact.

The UNSW website states “The normal workload expectations of a student are approximately 25 hours per semester for each UoC, including class contact hours, other learning activities, preparation and time spent on all assessable work. Thus, for a full-time enrolled student, the normal workload, averaged across the 16 weeks of teaching, study and examination periods, is about 37.5 hours per week.”

This means that you should aim to spend about 9 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	Tuesday	12pm - 1 hour	Rupert Myers Theatre M15/1001
	Wednesday	4pm - 1 hour	Civil Engineering G1 H20/G1
Tutorial	Tuesday	1pm - 2 hours	Mathews 103 (Weeks 2-10)
CATIA	Wednesday	5pm - 1 hour	Ainsworth 204
Workshop	Tuesday	1pm - 2 hours	J18 116A UTL (Weeks 11-13)

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.

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.	Design an aerospace systems solution incorporating design drivers, systems architecture, integration and aerospace regulations.	PE 1.3, PE 1.5, 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 presented at the start of each CATIA laboratory session, 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.

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
1		Introduction to Aerospace Design, Design Process and Reviews	
2	1: Aerospace Structural Design	Regulations and Load Factors	FAR 23
		Structural Loads and Free Body Diagrams	
		Aerospace Structural Design	
3		Failure Types and Material Data	MMPDS CMH-17
		Trusses	Bruhn A2.9 & A2.10 Flabel 1.10
4		Beams	Flabel 1.4, 1.5, 1.6, 1.7, Ch 2
		Cut Outs & Doublers	Niu Ch 6 Flabel Ch 9
5		Joints & Fasteners	Bruhn D1 Flabel Ch 3
		Shear & Tension Clips	Flabel Ch 5
6		Lugs	Bruhn D1
		Structural Design Review	
7	2: Aerospace Systems Design	Types of Aircraft Systems	Moir & Seabridge 2013 Ch 2
		Systems Design Considerations	FAR 23.1309 Moir & Seabridge 2013 §6.5 Fig 6.21 Moir & Seabridge 2008 Ch 8
8		Systems Design Phase	Moir & Seabridge 2013 Ch 3 & 4
		Systems Architecture	Moir & Seabridge 2013 Ch 5
9		Systems Integration	Moir & Seabridge 2013 Ch 6 + §8.9
		Systems Design Verification	Moir & Seabridge 2013 Ch 7
10		Design for Mechanical & Hydraulic Systems	Moir & Seabridge 2008 Ch 4
		Design for Electrical & Avionics Systems	Moir & Seabridge 2008 Ch 1, 5, 12
11		Design for Power & Fuel Systems	Moir & Seabridge 2008 Ch 2, 3
	4: Design-Build-Test	Design-Build-Test Support	Bruhn D1
12		Design-Build-Test Support	Bruhn D1
		Design-Build-Test Support	Bruhn D1
2-13	3: CATIA	CATIA	CATIA notes

6. Assessment

Assessment overview

Assessment	Length	Weight	Learning outcomes assessed	Assessment criteria	Due date and submission requirements	Deadline for absolute fail	Marks returned
Design Problems (3)	TBA	30%	1, 2 & 4	FBDs, diagrams, calculations, reasoning and results.	1: 11:50pm Monday Week 5 2: 11:50pm Monday Week 8 3: 11:50pm Monday Week 11	Two (2) days after each respective due date	Two weeks after each respective submission
Quiz (2)	TBA	20%	1, 2 & 4	FBDs, diagrams, calculations, reasoning and results.	1: Week 4 [1] 2: Week 9 [1]	N/A	Two weeks after each respective quiz
CATIA Assignment	CATIA package	20%	3	All CATIA course content	11:50pm Friday Week 12	11:50pm Tuesday Week 13	Upon release of final results
Design-Build-Test (Group [2,3,4]) [5]	1 Test Article Report: 20 pages max [6]	30%	1 & 4	Design report working and results; drawings; strength, weight and cost of structure. Peer evaluation.	Test Article: 11:50am Tuesday Week 13 Report: 4:00pm Friday Week 13	Test Article: N/A Report: Six (6) days after due date (4:00pm Thursday Study Period)	Upon release of final results

Notes:

1. Quizzes will occur in-class during the tutorial session 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.
4. For the group assessment, a peer evaluation must be completed electronically. This must be completed by one week after the group assessment due date.
5. The Design-Build-Test Report is required to be submitted in hard copy, as well as electronically.
6. Maximum page numbers excludes front matter, references and appendices.

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

Assignments

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 per cent (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. Quizzes will occur in-class during the tutorial session in weeks 4 and 9.

There is no final examination for this course.

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 shown 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 School Office or the Engineering Student Centre prior to the examination. Calculators not bearing an "Approved" sticker will not be allowed into the examination room.

Special consideration and supplementary assessment

For details of applying for special consideration and conditions for the award of supplementary assessment, 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, Design and Development of Aircraft Systems, Second Edition, AIAA Education Series 2013

Recommended Reading

- E. F. Bruhn, Analysis and Design of Flight Vehicle Structures, Jacobs Publishing, Inc. 1973
- Ian Moir and Allan Seabridge, Aircraft Systems: Mechanical, electrical, and avionics subsystems integration, Third Edition, AIAA Education Series 2008
- 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.

Following an extensive review in 2017, this course has been redesigned for 2018 to focus on aerospace structural design, aerospace systems design and the use of CATIA.

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: 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

Further information on School policy and procedures in the event of plagiarism is available on the intranet.

10. Administrative matters and links

All students are expected to read and be familiar with School guidelines and polices, available on the intranet. In particular, students should be familiar with the following:

- Attendance, Participation and Class Etiquette
- UNSW Email Address
- Computing Facilities
- Assessment Matters (including guidelines for assignments, exams and special consideration)
- Exams
- Approved Calculators
- Academic Honesty and Plagiarism
- Student Equity and Disabilities Unit
- Health and Safety
- Student Support Services

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