UNSW Course Outline

AERO9610 The Space Segment - 2024

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General Course Information

Course Code : AERO9610
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 : In Person
Delivery Format : Standard
Delivery Location : Kensington
Campus : Sydney
Study Level : Undergraduate, Postgraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

This course gives the students a basis in the design issues involved in the engineering of the space segment in order to enable to fulfil the mission. This course covers three areas of the space segment design: 1. Design methodology for satellites; 2. Operational environment,

including thermal, structural, electromagnetic environment; 3. Hardware/devices/coomponents introduction of the space segment, incorporating the payload types and satellite supporting subsystems. Examples of current and past space missions are used to illustrate the design process and design implementation associated with the space segment of the mission. Where appropriate, theory associated with the preliminary analysis of the operation and performance of the space segment is also presented. This course delivers to the student a broad overview of the engineering principles involved with the design, development, testing and implementation of the space segment of a space mission.

Course Aims

This course aims give students an understanding of the space segment, its components and the issues and challenges involved in its design for the space environment. Specific aims include:

1. Describe to students the space segment, its components and space systems engineering.
2. Explain in depth the communications links, link budgets and comms systems.
3. Explain critical spacecraft systems, like the strucutre, power management and the attitude determination.
4. Provide a solid understanding of the thermal constraints and thermal control systems.
5. Explain in depth the propulsion system and launch vehicles.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Discuss and apply space systems engineering methodology to the space segment
CLO2 : Assess the impact of the space environment on spacecraft and space mission design
CLO3 : Select and design space power systems, telecommunication links and systems, structures, propulsion systems, attitude determination and control systems and thermal control systems for a space mission
CLO4 : Have a thorough understanding of the different subsystems that make up a spacecraft, and how they function and interact in each stage of development

Course Learning Outcomes	Assessment Item
CLO1 : Discuss and apply space systems engineering methodology to the space segment	• Assignment • Quiz • Final Exam
CLO2 : Assess the impact of the space environment on spacecraft and space mission design	• Assignment • Quiz • Final Exam
CLO3 : Select and design space power systems, telecommunication links and systems, structures, propulsion systems, attitude determination and control systems and thermal control systems for a space mission	• Assignment • Quiz • Final Exam
CLO4 : Have a thorough understanding of the different subsystems that make up a spacecraft, and how they function and interact in each stage of development	• Assignment • Quiz • Final Exam

Learning and Teaching Technologies

Moodle - Learning Management System | Microsoft Teams | Wacom Digital Annotation

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Assignment Assessment Format: Individual	60%	
Quiz Assessment Format: Individual	15%	
Final Exam Assessment Format: Individual	25%	

Assessment Details

Assignment

Assessment Overview

The assignment will have you present a preliminary design of a spacecraft. To support student learning, the assignment will have three deliverables: a proposal, a draft, and the final report.

In the assignment proposal, you will lay out your plan for the assignment: the mission you chose to design, its main goals, and the main systems of the spacecraft (payload and major subsystems). You should also list the sources of information you will be using. This will go on to form the main part of your final report introduction.

The assignment draft will allow you to present your research findings for the subsystems covered so far in the course and receive feedback and suggestions from the demonstrators on your progress and on how to best complete your assignment. It is intended to make sure that you are progressing well with your design project, and to give you feedback on your work.

The final report will include your preliminary spacecraft design, including payload and all subsystems, updated and completed based on your draft feedback, and a conclusion presenting the space segment analysis of your space mission, showing how it addresses the mission requirements and user needs.

A assessment instruction and a marking rubric will be provided.

Proposal Report 5%

Draft Report 15%

Final Report 40%

Feedback after marking will be provided on Moodle for each of the marking criterion.

Course Learning Outcomes

- CLO1 : Discuss and apply space systems engineering methodology to the space segment
- CLO2 : Assess the impact of the space environment on spacecraft and space mission design
- CLO3 : Select and design space power systems, telecommunication links and systems, structures, propulsion systems, attitude determination and control systems and thermal control systems for a space mission
- CLO4 : Have a thorough understanding of the different subsystems that make up a spacecraft, and how they function and interact in each stage of development

Assessment Length

N/A

Submission notes

Submitted via Moodle submission boxes.

Assignment submission Turnitin type

This assignment is submitted through Turnitin and students can see Turnitin similarity reports.

Quiz

Assessment Overview

Assessment length: 1 hours

An online mid-term quiz covering Week 1 - 4.

Assessment criteria:

Understanding the knowledge learned in Week 1 - 4.

Course Learning Outcomes

- CLO1 : Discuss and apply space systems engineering methodology to the space segment
- CLO2 : Assess the impact of the space environment on spacecraft and space mission design
- CLO3 : Select and design space power systems, telecommunication links and systems, structures, propulsion systems, attitude determination and control systems and thermal control systems for a space mission
- CLO4 : Have a thorough understanding of the different subsystems that make up a spacecraft, and how they function and interact in each stage of development

Assessment Length

1 hour

Submission notes

Submitted via Moodle submission box

Assessment information

Please note that those on the Equitable Learning Plan can submit up half an hour more.

Final Exam

Assessment Overview

Assessment length: 2 hours

An online final exam covering all weeks' contents.

Assessment criteria

Demonstrate the understanding of knowledge learned in all weeks.

Course Learning Outcomes

- CLO1 : Discuss and apply space systems engineering methodology to the space segment
- CLO2 : Assess the impact of the space environment on spacecraft and space mission design
- CLO3 : Select and design space power systems, telecommunication links and systems, structures, propulsion systems, attitude determination and control systems and thermal control systems for a space mission
- CLO4 : Have a thorough understanding of the different subsystems that make up a spacecraft, and how they function and interact in each stage of development

Assessment Length

2 hours

Submission notes

Submitted via the Moodle submission box

General Assessment Information

Grading Basis

Standard

Course Schedule

Attendance Requirements

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

General Schedule Information

Tuesday 1400-1600 In-person Lecture Wed 1400-1600 In-person Lecture, both at Colombo Theatre C

We might also use School's Design Next Studio for Wednesday's Lecture and Tutorial.

Course Resources

Prescribed Resources

Textbooks:

Spacecraft attitude and orbit control (4th ed), Paluszek Michael, et al. Princeton Satellite

Systems; 2021

Elements of Spacecraft Design, C. D. Brown.

Spacecraft Systems Engineering (4th ed), Fortescue, Stark and Swinherd

Space Vehicle Design (2nd ed), Griffin, Michael D and French James R, American Institute of Aeronautics and Astronautics

All three books are available at the UNSW library and UNSW book shop (in limited quantity) and are also available for download in PDF format from the UNSW Library's web site.UNSW Library website: https://www.library.unsw.edu.au/Handouts and lecture slides will be provided on Moodle for any subjects covered in the classes which are not taken from the course texts. You are recommended to take your own notes or annotate your own copy of the course text and your handouts.Moodle: https://moodle.telt.unsw.edu.au/login/index.php

Recommended Resources

Space Mission Analysis and Design (SMAD), J.R. Wertz and W.J. Larson

A Guide To Cubesat Mission And Bus Design (1st ed), Frances Zhu

State-of-the-Art Small Spacecraft Technology, Small Spacecraft Systems Virtual Institute, Ames Research Center, Moffett Field, California; 2022

Available in the library and online

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 changes to lecture topics and provision of more feedback to students throughout the course.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Yang Yang		Ainsworth Level 2		On-line or in office by appointment	Yes	Yes
Lecturer	Yang Yang		Ainsworth Level 2		On-line or in office by appointment	Yes	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