



ENTG13003 *Advanced Materials in Aviation*

Term 2 - 2024

Profile information current as at 12/07/2025 05:30 pm

All details in this unit profile for ENTG13003 have been officially approved by CQUniversity and represent a learning partnership between the University and you (our student). The information will not be changed unless absolutely necessary and any change will be clearly indicated by an approved correction included in the profile.

General Information

Overview

Materials used in the aviation industry have become ever diverse, more sophisticated, and very important as aerospace technologies developed rapidly. The selection of materials in the aircraft industry has a significant impact on all stages of aircraft life from the initial design phase, to manufacturing, flight operations, and maintenance, and when decommissioning. In this unit, you will learn about the principles and fundamentals of materials science and engineering. You will apply this knowledge to various types of advanced materials in aviation.

Details

Career Level: *Undergraduate*

Unit Level: *Level 3*

Credit Points: 6

Student Contribution Band: 8

Fraction of Full-Time Student Load: 0.125

Pre-requisites or Co-requisites

Aircraft Maintenance Practices

Important note: Students enrolled in a subsequent unit who failed their pre-requisite unit, should drop the subsequent unit before the census date or within 10 working days of Fail grade notification. Students who do not drop the unit in this timeframe cannot later drop the unit without academic and financial liability. See details in the [Assessment Policy and Procedure \(Higher Education Coursework\)](#).

Offerings For Term 2 - 2024

- Brisbane
- Online
- Rockhampton

Attendance Requirements

All on-campus students are expected to attend scheduled classes – in some units, these classes are identified as a mandatory (pass/fail) component and attendance is compulsory. International students, on a student visa, must maintain a full time study load and meet both attendance and academic progress requirements in each study period (satisfactory attendance for International students is defined as maintaining at least an 80% attendance record).

Website

[This unit has a website, within the Moodle system, which is available two weeks before the start of term. It is important that you visit your Moodle site throughout the term. Please visit Moodle for more information.](#)

Class and Assessment Overview

Recommended Student Time Commitment

Each 6-credit Undergraduate unit at CQUniversity requires an overall time commitment of an average of 12.5 hours of study per week, making a total of 150 hours for the unit.

Class Timetable

[Regional Campuses](#)

Bundaberg, Cairns, Emerald, Gladstone, Mackay, Rockhampton, Townsville

[Metropolitan Campuses](#)

Adelaide, Brisbane, Melbourne, Perth, Sydney

Assessment Overview

1. **Online Quiz(zes)**

Weighting: 20%

2. **Written Assessment**

Weighting: 15%

3. **Group Work**

Weighting: 30%

4. **Online Test**

Weighting: 35%

Assessment Grading

This is a graded unit: your overall grade will be calculated from the marks or grades for each assessment task, based on the relative weightings shown in the table above. You must obtain an overall mark for the unit of at least 50%, or an overall grade of 'pass' in order to pass the unit. If any 'pass/fail' tasks are shown in the table above they must also be completed successfully ('pass' grade). You must also meet any minimum mark requirements specified for a particular assessment task, as detailed in the 'assessment task' section (note that in some instances, the minimum mark for a task may be greater than 50%). Consult the [University's Grades and Results Policy](#) for more details of interim results and final grades.

CQUniversity Policies

All University policies are available on the [CQUniversity Policy site](#).

You may wish to view these policies:

- Grades and Results Policy
- Assessment Policy and Procedure (Higher Education Coursework)
- Review of Grade Procedure
- Student Academic Integrity Policy and Procedure
- Monitoring Academic Progress (MAP) Policy and Procedure – Domestic Students
- Monitoring Academic Progress (MAP) Policy and Procedure – International Students
- Student Refund and Credit Balance Policy and Procedure
- Student Feedback – Compliments and Complaints Policy and Procedure
- Information and Communications Technology Acceptable Use Policy and Procedure

This list is not an exhaustive list of all University policies. The full list of University policies are available on the [CQUniversity Policy site](#).

Previous Student Feedback

Feedback, Recommendations and Responses

Every unit is reviewed for enhancement each year. At the most recent review, the following staff and student feedback items were identified and recommendations were made.

Feedback from Verbal feedback

Feedback

The literature review assessment item could be challenging for those that have not done a similar assessment item or those that have not done a thesis unit.

Recommendation

More thorough information should be provided and discussed about the nature of the literature review and the purpose of the assessment item.

Unit Learning Outcomes

On successful completion of this unit, you will be able to:

1. Develop equations for the governing theories of material failures in aviation
2. Evaluate applications of advanced materials in electrical and mechanical components of aviation systems
3. Investigate material selection for aviation systems by applying international standards and industry regulations
4. Discuss advanced techniques for structural monitoring, non-destructive testing, and sustainable aircraft materials.

Alignment of Learning Outcomes, Assessment and Graduate Attributes

| | | | | | |
|---|--|--|--|--|--|
|  N/A Level |  Introductory Level |  Intermediate Level |  Graduate Level |  Professional Level |  Advanced Level |
|---|--|--|--|--|--|

Alignment of Assessment Tasks to Learning Outcomes

| Assessment Tasks | Learning Outcomes | | | |
|------------------------------|-------------------|---|---|---|
| | 1 | 2 | 3 | 4 |
| 1 - Online Quiz(zes) - 20% | • | | | • |
| 2 - Written Assessment - 15% | | • | | • |
| 3 - Group Work - 30% | | • | • | |
| 4 - Online Test - 35% | • | | • | |

Alignment of Graduate Attributes to Learning Outcomes

| Graduate Attributes | Learning Outcomes | | | |
|---|-------------------|---|---|---|
| | 1 | 2 | 3 | 4 |
| 1 - Communication | | | • | |
| 2 - Problem Solving | • | | • | • |
| 3 - Critical Thinking | • | • | • | • |
| 4 - Information Literacy | | • | • | • |
| 5 - Team Work | | | • | |
| 6 - Information Technology Competence | | | | |
| 7 - Cross Cultural Competence | | | | |
| 8 - Ethical practice | | | | |
| 9 - Social Innovation | | | | |
| 10 - Aboriginal and Torres Strait Islander Cultures | | | | |

Textbooks and Resources

Textbooks

ENTG13003

Supplementary

Civil Avionics System

(2013)

Authors: Ian Moir, Allan Seabridge, Malcolm Jukes

ISBN: 978-0470029299

Binding: eBook

ENTG13003

Supplementary

Introduction to Aerospace Materials

(2012)

Authors: Adrian Mouritz

ISBN: 978-1-85573-946-8

Binding: eBook

IT Resources

You will need access to the following IT resources:

- CQUniversity Student Email
- Internet
- Unit Website (Moodle)

Referencing Style

All submissions for this unit must use the referencing style: [Harvard \(author-date\)](#)

For further information, see the Assessment Tasks.

Teaching Contacts

Jay Sul Unit Coordinator

j.sul@cqu.edu.au

Schedule

Week 1 - 08 Jul 2024

| Module/Topic | Chapter | Events and Submissions/Topic |
|---|---------|------------------------------|
| Introduction to materials engineering and materials in aviation | | |
| - Introduction to the unit | | |
| - What is Materials Science and Engineering? | | |
| - Importance of materials in aviation | | |
| - Main types of aerospace materials | | |
| - History of aerospace materials | | |

Week 2 - 15 Jul 2024

| Module/Topic | Chapter | Events and Submissions/Topic |
|--------------|---------|------------------------------|
|--------------|---------|------------------------------|

Microstructural aspects of aerospace materials

- Importance of atomic structures
- Crystalline structures of aerospace materials

Week 3 - 22 Jul 2024

| Module/Topic | Chapter | Events and Submissions/Topic |
|--|---------|------------------------------|
| Mechanical properties of aerospace materials and testing standards | | |
| - Stress and strain | | |
| - Elastic and plastic deformation of aerospace materials | | |
| - Standards in aerospace materials testing | | |

Week 4 - 29 Jul 2024

| Module/Topic | Chapter | Events and Submissions/Topic |
|---|---------|------------------------------|
| Failure of general engineering and aviation materials | | |
| - Why failure studies (case study)? | | |
| - Fracture modes | | |
| - Crack propagation in aerospace materials | | |
| - Factor of safety in aircraft design | | |

Week 5 - 05 Aug 2024

| Module/Topic | Chapter | Events and Submissions/Topic |
|--|---------|------------------------------|
| Principles of materials selection and materials selection in aerospace | | |
| - Materials selection in design | | |
| - Ashby's materials selection process | | |
| - Economic and manufacturing considerations in materials selection | | |
| - Durability and environmental considerations in materials selection | | |

Vacation Week - 12 Aug 2024

| Module/Topic | Chapter | Events and Submissions/Topic |
|--------------|---------|------------------------------|
|--------------|---------|------------------------------|

Week 6 - 19 Aug 2024

| Module/Topic | Chapter | Events and Submissions/Topic |
|--|---------|---|
| Imperfection and strengthening mechanism of metals | | |
| - Roles and types of impurities in aerospace materials | | |
| - Specification of compositions in alloys | | |
| - Strengthening mechanisms in metals | | |
| | | Literature review on advanced materials in aviation Due: Week 6 Monday (19 Aug 2024) 11:59 pm AEST |

Week 7 - 26 Aug 2024

| Module/Topic | Chapter | Events and Submissions/Topic |
|--|---------|------------------------------|
| Phase diagram, phase transformation, and metal alloys in aerospace engineering | | |
| - Diffusion and types of diffusion | | |
| - Phase, phase diagram, and phase transformation | | |
| - Microstructure of steel | | |
| - Applications and processing of metal alloys | | |

Week 8 - 02 Sep 2024

| Module/Topic | Chapter | Events and Submissions/Topic |
|--------------|---------|------------------------------|
|--------------|---------|------------------------------|

Thermal and electrical properties of aerospace materials

- Thermal properties and heat
- Heat capacity and coefficient of thermal expansion
- Thermal conductivity and thermal stress

Week 9 - 09 Sep 2024

| Module/Topic | Chapter | Events and Submissions/Topic |
|--|---------|------------------------------|
| Metal alloys in aviation and their corrosion - Steel, aluminium, titanium, and magnesium alloys - Superalloys; Nickel, iron-nickel, and cobalt superalloys | | |

Week 10 - 16 Sep 2024

| Module/Topic | Chapter | Events and Submissions/Topic |
|---|---------|--|
| Polymers and polymeric composites in aerospace applications - Types of polymers; thermoplastics, thermosets, and elastomers - Polymers as structural adhesive - Composites | | Materials selection process for aviation materials Due: Week 10 Monday (16 Sept 2024) 11:59 pm AEST |

Week 11 - 23 Sep 2024

| Module/Topic | Chapter | Events and Submissions/Topic |
|---|---------|------------------------------|
| Metal matrix composites, ceramics, and ceramic matrix composites in aerospace engineering - Metal matrix composites - Ceramics - Ceramic matrix composites | | |

Week 12 - 30 Sep 2024

| Module/Topic | Chapter | Events and Submissions/Topic |
|---|---------|------------------------------|
| Non-destructive testing and structural health monitoring - Non-destructive inspection (NDI) and testing (NDT); visual inspecting, ultrasonic, radiography, thermography and magnetic particle test, and acoustic emission - Structural health monitoring; optical fibre sensors, piezoelectric sensors, and comparative vacuum monitoring | | |

Review/Exam Week - 07 Oct 2024

| Module/Topic | Chapter | Events and Submissions/Topic |
|--------------|---------|------------------------------|
|--------------|---------|------------------------------|

Exam Week - 14 Oct 2024

| Module/Topic | Chapter | Events and Submissions/Topic |
|--------------|---------|--|
| | | End-of-term online test Due: Exam Week Monday (14 Oct 2024) 11:45 pm AEST |

Assessment Tasks

1 Tri-Weely Online Quizzes

Assessment Type

Online Quiz(zes)

Task Description

This assessment consists of four tri-weekly online quizzes which can be accessed via the unit's Moodle site. A set of multiple-choice, short-answer, drag-and-drop, and calculation questions is assigned every three weeks (viz. Weeks 3, 6, 9 and 12). Each online quiz will cover the contents in the previous two weeks and the corresponding week (e.g. Online Quiz 1 covers the contents in Weeks 1 to 3).

Number of Quizzes

4

Frequency of Quizzes

Other

Assessment Due Date

Four tri-weekly online quizzes are held in Weeks 3, 6, 9 and 12.

Return Date to Students

Sudents will receive their marks immediately after the due date of each quiz.

Weighting

20%

Minimum mark or grade

50%

Assessment Criteria

- The total marks of each of the four online quizzes will be scaled to out of 5 marks for the unit total.
- Numerical answers must be entered to 3 significant figures.

Referencing Style

- [Harvard \(author-date\)](#)

Submission

Online

Learning Outcomes Assessed

- Develop equations for the governing theories of material failures in aviation
- Discuss advanced techniques for structural monitoring, non-destructive testing, and sustainable aircraft materials.

2 Literature review on advanced materials in aviation

Assessment Type

Written Assessment

Task Description

A literature review on aviation materials is a critical component of research in the field of aerospace engineering. It involves gathering, analysing, and synthesising existing knowledge and scholarly work related to the properties, applications, and advancements in materials used in aviation. The aim is to provide a comprehensive overview of the subject, identify gaps in knowledge, and highlight areas for further research and development. Students will choose a topic / area of their interest to summarise and analyse the literature to demonstrate knowledge and understanding of a topic.

Assessment Due Date

Week 6 Monday (19 Aug 2024) 11:59 pm AEST

Students to submit their report to the link provided in the unit's Moodle site.

Return Date to Students

Week 8 Monday (2 Sept 2024)

Students can check their mark and feedback through the link used for submission.

Weighting

15%

Assessment Criteria

Students work will be assessed by the following criteria.

Language (15%) - Very few or no spelling or grammar errors with a professional standard of language and writing.

Structure (20%) - The document commences by briefly introducing the sections which follow. The document concludes with a summary of the primary outcomes from each section of the review. Each topic should include multipled citations to reputable sources that are distinct, if practical.

Presentation (20%) - All but the cover page contains headers, footers, and page numbers. Text font and formatting are consistent throughout. Tables and figures have consistent formatting. All tables are recreated from consistent formatting and to remove superfluous information.

Referencing style (10%) - The in-text citations and reference list are formatted correctly but for a few very minor exceptions. A citation supports all technical points. Where required, multiple sources are grouped correctly for the in-text citations.

Information sources (10%) - A broad range of information types is included (academic journals, conference papers, textbooks, or reports). Papers based on similar projects are included to demonstrate the breath of knowledge.

Comprehension (20%) - The methods applied in the articles reviewed are correctly summarised and are relevant to the project.

Knowledge synthesis (15%) - Connections are made between separate information sources to explain some topics. Most topics include citations from separate information sources to demonstrate knowledge synthesis. Conflicts or varied opinions between separate articles are explained for some topics in the review.

Referencing Style

- [Harvard \(author-date\)](#)

Submission

Online

Learning Outcomes Assessed

- Evaluate applications of advanced materials in electrical and mechanical components of aviation systems
- Discuss advanced techniques for structural monitoring, non-destructive testing, and sustainable aircraft materials.

3 Materials selection process for aviation materials

Assessment Type

Group Work

Task Description

Your task is to complete the materials selection process template by analysing a product / application of your interest and suggesting an alternative material(s) to improve its design for any purpose (e.g. process and/or manufacturing cost, performance, better use and environmental friendliness, improved safety, improved operation conditions, etc.).

Your approach to this task should include (but not be limited to):

- Choose a component within an aircraft of your interest. This can be ANYTHING that is composed of materials
- Investigate the chosen component to identify materials used and select a material (up to two) that has more room to improve
- Analyse the material(s) to identify its design requirements as per the following criteria: Function- What does the component do?, Constraints- What non-negotiable conditions must be met? What are negotiable?, Objective- What is to be maximised or minimised?, and Free variables- What parameters of the problem is the designer free to change?
- Look for possible alternatives and eliminate those that cannot meet the criteria set earlier
- Rank the short-listed materials after screening
- Further investigation into the top-ranked material to support
- Report your findings and the rationale behind your objectives and detail the procedures

Assessment Due Date

Week 10 Monday (16 Sept 2024) 11:59 pm AEST

Students will complete and submit the materials selection process template to the link provided in the unit's Moodle site.

Return Date to Students

Week 12 Monday (30 Sept 2024)

Students can check their mark and feedback through the link used for submission.

Weighting

30%

Assessment Criteria

- Report language (15%)
- Justification (15%)
- Methodology (20%)
- Results and discussion (25%)
- Conclusions and recommendations (15%)
- References (10%)

Referencing Style

- [Harvard \(author-date\)](#)

Submission

Online

Submission Instructions

Students will complete and submit it to the link provided in the unit's Moodle site.

Learning Outcomes Assessed

- Evaluate applications of advanced materials in electrical and mechanical components of aviation systems
- Investigate material selection for aviation systems by applying international standards and industry regulations

4 End-of-term online test

Assessment Type

Online Test

Task Description

This end-of-term online test as a summative assessment will test your achievement of the learning outcomes. It will consist of various types of questions, including calculation questions, drag-and-drop questions, multiple-choice questions, short & long description questions, etc. This final online test will cover all contents from Week 1 to Week 12, including the assignment items. You could sit for this online test wherever you want while it is a synchronous timed online test for three hours which means every student starts simultaneously. Only one attempt is allowed and it will be a three-hour online test. After you finish the test, you must upload your workings for calculation questions to the unit's Moodle page.

Assessment Due Date

Exam Week Monday (14 Oct 2024) 11:45 pm AEST

Students will be notified of the exact date and time for this assessment towards the end of the term.

Return Date to Students

Students will be able to access their results on the grade certification day.

Weighting

35%

Minimum mark or grade

50%

Assessment Criteria

Students will be assessed for the correctness of their answers to the questions given in the final test. Drag-and-drop and multiple-choice questions will be marked automatically while short and long description questions will be marked manually. Your understanding and own interpretation of the topics will be sought. You will need to present your answer for the calculation questions with correct units and relevant significant figures. You are required to upload your workings for the calculation questions after the test to prove your genuine attempt and to receive partial marks where applicable.

Referencing Style

- [Harvard \(author-date\)](#)

Submission

Online

Learning Outcomes Assessed

- Develop equations for the governing theories of material failures in aviation
- Investigate material selection for aviation systems by applying international standards and industry regulations

Academic Integrity Statement

As a CQUniversity student you are expected to act honestly in all aspects of your academic work.

Any assessable work undertaken or submitted for review or assessment must be your own work. Assessable work is any type of work you do to meet the assessment requirements in the unit, including draft work submitted for review and feedback and final work to be assessed.

When you use the ideas, words or data of others in your assessment, you must thoroughly and clearly acknowledge the source of this information by using the correct referencing style for your unit. Using others' work without proper acknowledgement may be considered a form of intellectual dishonesty.

Participating honestly, respectfully, responsibly, and fairly in your university study ensures the CQUniversity qualification you earn will be valued as a true indication of your individual academic achievement and will continue to receive the respect and recognition it deserves.

As a student, you are responsible for reading and following CQUniversity's policies, including the [Student Academic Integrity Policy and Procedure](#). This policy sets out CQUniversity's expectations of you to act with integrity, examples of academic integrity breaches to avoid, the processes used to address alleged breaches of academic integrity, and potential penalties.

What is a breach of academic integrity?

A breach of academic integrity includes but is not limited to plagiarism, self-plagiarism, collusion, cheating, contract cheating, and academic misconduct. The Student Academic Integrity Policy and Procedure defines what these terms mean and gives examples.

Why is academic integrity important?

A breach of academic integrity may result in one or more penalties, including suspension or even expulsion from the University. It can also have negative implications for student visas and future enrolment at CQUniversity or elsewhere. Students who engage in contract cheating also risk being blackmailed by contract cheating services.

Where can I get assistance?

For academic advice and guidance, the [Academic Learning Centre \(ALC\)](#) can support you in becoming confident in completing assessments with integrity and of high standard.

What can you do to act with integrity?



Be Honest

If your assessment task is done by someone else, it would be dishonest of you to claim it as your own



Seek Help

If you are not sure about how to cite or reference in essays, reports etc, then seek help from your lecturer, the library or the Academic Learning Centre (ALC)



Produce Original Work

Originality comes from your ability to read widely, think critically, and apply your gained knowledge to address a question or problem