



# ENTA13024 Thermofluid Engineering for Aviation

## Term 1 - 2023

Profile information current as at 02/05/2024 05:41 pm

All details in this unit profile for ENTA13024 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

This unit introduces you to the concepts of thermodynamics and fluid mechanics in the context of the aviation and aerospace industries. You will begin with the ideal gas law and the first and second laws of thermodynamics for open and closed systems. You will then investigate the energy conversion and work done in engineering processes, and concepts and processes in thermodynamics to analyse energy and heat transfer in liquid and gas. You will study the physics of phase change processes for pure substances, conduct energy analysis of closed systems, and perform mass and energy analysis of control volumes. A key objective of the unit is improving your problem-solving skills by applying common theorems in fluid mechanics such as Bernoulli and energy equations to solve aerospace vehicle problems. You will study internal and external (drag and lift) fluid flows in the context of aviation systems and their impact on aerodynamics. You will use Computational Fluid Dynamics modelling software to solve complex aerodynamic problems.

#### 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

Prerequisite: Aerodynamics and Airframe Systems

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 1 - 2023

- 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. **Written Assessment**

Weighting: 20%

#### 2. **Written Assessment**

Weighting: 20%

#### 3. **Project (applied)**

Weighting: 20%

#### 4. **Online Test**

Weighting: 40%

### 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](#).

## Unit Learning Outcomes

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

1. Apply energy equations and thermodynamics laws to solve energy conversion problems
2. Analyse various phase change processes, heat transfer mechanisms, and thermodynamics and heat energy cycles for a variety of heat engines
3. Apply fluid properties and fluid statics theory to calculate hydrostatic pressures and forces
4. Analyse flow regimes using laminar and turbulent flow theories for different systems
5. Analyse the behaviour and fluid dynamics using equations of conservation of mass, motion, and momentum for liquid and gas with the aid of appropriate computational tools
6. Apply relevant terminology, diagrams and standard symbols in the documentation of solutions to analyses of processes

## Alignment of Learning Outcomes, Assessment and Graduate Attributes

 N/A Level	 Introductory Level	 Intermediate Level	 Graduate Level	 Professional Level	 Advanced Level
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### Alignment of Assessment Tasks to Learning Outcomes

Assessment Tasks	Learning Outcomes					
	1	2	3	4	5	6
1 - Written Assessment - 20%	•	•				
2 - Written Assessment - 20%			•			•
3 - Project (applied) - 20%				•	•	•
4 - Online Test - 40%	•	•	•	•	•	

### Alignment of Graduate Attributes to Learning Outcomes

Graduate Attributes	Learning Outcomes					
	1	2	3	4	5	6
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

There are no required textbooks.

### 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

**Nur Hassan** Unit Coordinator  
[n.hassan@cqu.edu.au](mailto:n.hassan@cqu.edu.au)

## Schedule

### Week 1 - 06 Mar 2023

Module/Topic	Chapter	Events and Submissions/Topic
Unit information, Introduction, Basics of Thermodynamics, Properties of pure substances	Lecture notes.	Lecture and Tutorial.

### Week 2 - 13 Mar 2023

Module/Topic	Chapter	Events and Submissions/Topic
Energy and energy transfer; Energy analysis of open and closed systems; Mass and energy analysis of control volumes	Lecture notes.	Lecture and Tutorial.

### Week 3 - 20 Mar 2023

Module/Topic	Chapter	Events and Submissions/Topic
The Second Law of Thermodynamics	Lecture notes.	Lecture and Tutorial.

### Week 4 - 27 Mar 2023

Module/Topic	Chapter	Events and Submissions/Topic
Thermodynamic cycles and Power cycles	Lecture Notes	Lecture and Tutorial.

### Week 5 - 03 Apr 2023

Module/Topic	Chapter	Events and Submissions/Topic
Introduction to the Refrigeration and Steam cycle	Lecture Notes	Lecture and Tutorial.

### Vacation Week - 10 Apr 2023

Module/Topic	Chapter	Events and Submissions/Topic
Non Teaching Week		
<b>Week 6 - 17 Apr 2023</b>		
Module/Topic	Chapter	Events and Submissions/Topic
Introduction to the fundamental Heat Transfer	Lecture Notes	Lecture and Tutorial.  <b>Assignment 1</b> Due: Week 6 Wednesday (19 Apr 2023) 11:59 pm AEST
<b>Week 7 - 24 Apr 2023</b>		
Module/Topic	Chapter	Events and Submissions/Topic
Properties of fluids; Fluid statics	Lecture Notes	Lecture and Tutorial.
<b>Week 8 - 01 May 2023</b>		
Module/Topic	Chapter	Events and Submissions/Topic
Bernoulli and energy equations; Momentum analysis of flow systems	Lecture Notes	Lecture and Tutorial.
<b>Week 9 - 08 May 2023</b>		
Module/Topic	Chapter	Events and Submissions/Topic
Internal and External Flows	Lecture Notes	Lecture and Tutorial.
<b>Week 10 - 15 May 2023</b>		
Module/Topic	Chapter	Events and Submissions/Topic
Compressibility, Compressible flow, Turbomachines in aviation	Lecture Notes	Lecture and Tutorial.  <b>Assignment 2</b> Due: Week 10 Wednesday (17 May 2023) 11:59 pm AEST
<b>Week 11 - 22 May 2023</b>		
Module/Topic	Chapter	Events and Submissions/Topic
Introduction to CFD (Aviation applications)	Lecture Notes	Lecture and Tutorial.
<b>Week 12 - 29 May 2023</b>		
Module/Topic	Chapter	Events and Submissions/Topic
Revision	All lecture notes.	Revision and Information will be given related to the online test.  <b>Mini Project based on Problem-solving approach</b> Due: Week 12 Wednesday (31 May 2023) 11:59 pm AEST
<b>Review/Exam Week - 05 Jun 2023</b>		
Module/Topic	Chapter	Events and Submissions/Topic
<b>Exam Week - 12 Jun 2023</b>		
Module/Topic	Chapter	Events and Submissions/Topic
End-of-Term: Online Test		<b>Online Test</b> Due: Exam Week Wednesday (14 June 2023) 11:00 am AEST

## Assessment Tasks

# 1 Assignment 1

## Assessment Type

Written Assessment

## Task Description

This assignment 1 covers the weekly topics from Week 1 to Week 6. Students are required to answer analytical and numerical questions. The assignment tasks will be uploaded on the unit website (Moodle).

## Assessment Due Date

Week 6 Wednesday (19 Apr 2023) 11:59 pm AEST

Online submission through Moodle.

## Return Date to Students

Week 8 Wednesday (3 May 2023)

In two weeks from the date of submission

## Weighting

20%

## Minimum mark or grade

You must get a minimum 40% on this assessment item to secure a Pass in this unit

## Assessment Criteria

Each question in the assignment will be assessed separately against the following criterion:

### 20% of the total marks are for accuracy and correct result

- The correct application of maths and arithmetic.
- The correct answer to the questions.
- Correct use of terminology, units, and conventions

40% for correct method and procedure

- The correct selection and application of formulas and maths.
- Clear presentation of mathematical and arithmetical calculations for the results obtained.
- Evidence of checking results (mathematical, graphical, etc.).

### 30% for evidence of understanding

- Explanation of choices made (why a particular procedure/method is selected).
- Interpretation of results including limitations etc if any.
- Correct and orderly procedures and required steps.

### 10% for a professional presentation

- Clear identification and statement of each problem.
- A logical layout of the analysis.
- Appropriate use of diagrams.

## Referencing Style

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

## Submission

Online

## Submission Instructions

Online submission through Moodle website

## Learning Outcomes Assessed

- Apply energy equations and thermodynamics laws to solve energy conversion problems
- Analyse various phase change processes, heat transfer mechanisms, and thermodynamics and heat energy cycles for a variety of heat engines

# 2 Assignment 2

## Assessment Type

Written Assessment

## Task Description

Assignment 2 covers the weekly topics from Week 7 to Week 10. Students are required to answer analytical and numerical questions. The assignment tasks will be uploaded on the unit website (Moodle).

**Assessment Due Date**

Week 10 Wednesday (17 May 2023) 11:59 pm AEST

Online submission through Moodle

**Return Date to Students**

Week 12 Wednesday (31 May 2023)

In two weeks from the date of submission

**Weighting**

20%

**Minimum mark or grade**

You must get a minimum 40% on this assessemnt item to secure a Pass in this unit

**Assessment Criteria****20% of the total marks are for accuracy and correct result**

- The correct application of maths and arithmetic.
- The correct answer to the questions.
- Correct use of terminology, units, and conventions

40% for correct method and procedure

- The correct selection and application of formulas and maths.
- Clear presentation of mathematical and arithmetical calculations for the results obtained.
- Evidence of checking results (mathematical, graphical, etc.).

**30% for evidence of understanding**

- Explanation of choices made (why a particular procedure/method is selected).
- Interpretation of results including limitations etc if any.
- Correct and orderly procedures and required steps.

**10% for a professional presentation**

- Clear identification and statement of each problem.
- A logical layout of the analysis.
- Appropriate use of diagrams.

**Referencing Style**

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

**Submission**

Online

**Submission Instructions**

Online submission through Moodle.

**Learning Outcomes Assessed**

- Apply fluid properties and fluid statics theory to calculate hydrostatic pressures and forces
- Apply relevant terminology, diagrams and standard symbols in the documentation of solutions to analyses of processes

### 3 Mini Project based on Problem-solving approach

**Assessment Type**

Project (applied)

**Task Description**

Students are required to undertake this project which will allow them to exercise and demonstrate their theoretical thermo-fluid knowledge and skills in a practical application in the area of aviation contexts. In particular, they will be required to investigate the aerodynamic effects on a solid body moving through a fluid. The project task and scope will be uploaded on Moodle as per the schedule.

**Assessment Due Date**

Week 12 Wednesday (31 May 2023) 11:59 pm AEST

Online submission through Moodle.

**Return Date to Students**

Exam Week Wednesday (14 June 2023)

In two weeks from the date of submission

**Weighting**

20%



**Minimum mark or grade**

You must get a minimum of 50% on this assessment item to secure a Pass in this unit

**Assessment Criteria**

This project will be assessed separately against the following criterion:

- Elaborate discussion of major steps involved in the project (e.g., Theory, Objective, Problem Statements, Results, etc) (30% of total marks).
- Clarity of expression, including correct grammar, spelling, punctuation, and appropriate referencing of sources (10% of total marks).
- Accurate and correct use and presentation of mathematical equations or graphs, tables, and diagrams (30% of total marks).
- Discussion and logical presentation of ideas and arguments by means of data analysis and synthesis (30% of total marks).

**Referencing Style**

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

**Submission**

Online

**Submission Instructions**

Online submission through Moodle.

**Learning Outcomes Assessed**

- Analyse flow regimes using laminar and turbulent flow theories for different systems
- Analyse the behaviour and fluid dynamics using equations of conservation of mass, motion, and momentum for liquid and gas with the aid of appropriate computational tools
- Apply relevant terminology, diagrams and standard symbols in the documentation of solutions to analyses of processes

## 4 Online Test

**Assessment Type**

Online Test

**Task Description**

An online test will be scheduled during the exam week. The online questions will be uploaded in Moodle and will be available to all students at the same time. Students download the Exam paper and start working on the solution. Students are given three hours to complete the solution. An additional one hour is considered to provide them with downloading, uploading, and perusal of the questions. Students use blank A4 papers to write answers. Students upload their answer booklet as a single pdf file on Moodle.

**Assessment Due Date**

Exam Week Wednesday (14 June 2023) 11:00 am AEST

**Return Date to Students****Weighting**

40%

**Minimum mark or grade**

You must get a minimum 50% on this assessemnt item to secure a Pass in this unit

**Assessment Criteria**

Students can use Dictionary - non-electronic, concise, direct translation only (dictionary must not contain any notes or comments). Students can use a calculator - all non-communicable calculators, including scientific, programmable, and graphics calculators are authorized. Each question in the test will be assessed separately against the following criterion:

- 20% of the total marks are for accuracy and correct results.
- Correct application of maths and arithmetic.
- The correct answer to the questions.
- Correct use of terminology, units, and conventions.
- 50% for correct method and procedure.
- Correct selection and application of formula and maths.
- Clear presentation of mathematical and arithmetical calculations for the results obtained.
- 30% for evidence of understanding.

## Referencing Style

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

## Submission

Online

## Submission Instructions

Students upload their answers as a single pdf file on Moodle.

## Learning Outcomes Assessed

- Apply energy equations and thermodynamics laws to solve energy conversion problems
- Analyse various phase change processes, heat transfer mechanisms, and thermodynamics and heat energy cycles for a variety of heat engines
- Apply fluid properties and fluid statics theory to calculate hydrostatic pressures and forces
- Analyse flow regimes using laminar and turbulent flow theories for different systems
- Analyse the behaviour and fluid dynamics using equations of conservation of mass, motion, and momentum for liquid and gas with the aid of appropriate computational tools

## 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