



# ENEM14011 *Energy Conversion*

## Term 1 - 2021

Profile information current as at 28/04/2024 01:35 am

All details in this unit profile for ENEM14011 have been officially approved by CQUUniversity 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.

### Corrections

#### Unit Profile Correction added on 25-02-21

To align with CQURenew vision of reducing invigilated exams for senior students, the invigilated exam for this unit has been replaced with online exam. More details will be available in Moodle. The learning outcomes assessed will be unchanged.

## General Information

### Overview

This unit introduces you to key concepts and principles required to analyse problems involving heat exchange and energy conversion. You will analyse and design heat exchangers and analyse the performance of compressors, internal combustion engines, gas turbines and jet propulsion. You will analyse combustion processes and estimate pollutant emissions, and analyse and design nozzles to promote safe and efficient combustion. You will prepare professional documents that demonstrate critical evaluation of results. You will be required to show your ability to work productively to solve problems, and document and communicate your work clearly in a professional manner. On-campus students will be required to attend laboratory sessions to promote development of unit learning outcomes. Mixed Mode (online) students will be required to attend a residential school to attend laboratory sessions and an in-class test to promote development of unit learning outcomes.

### Details

Career Level: *Undergraduate*

Unit Level: *Level 4*

Credit Points: 6

Student Contribution Band: 8

Fraction of Full-Time Student Load: 0.125

### Pre-requisites or Co-requisites

Prereq: ENEM13014 Thermodynamics or ENEM12003 Thermodynamics

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 - 2021

- Bundaberg
- Cairns
- Gladstone
- Mackay
- Mixed Mode
- 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).

### Residential Schools

This unit has a Compulsory Residential School for distance mode students and the details are:

Click here to see your [Residential School Timetable](#).

### 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. **In-class Test(s)**

Weighting: 15%

#### 2. **Laboratory/Practical**

Weighting: 15%

#### 3. **Online Test**

Weighting: 15%

#### 4. **Examination**

Weighting: 55%

### 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 Unit evaluation

##### Feedback

Online quizzes are to be introduced rather than on-campus tests,

##### Recommendation

Online quizzes will be introduced in the next delivery.

#### Feedback from Unit evaluation

##### Feedback

The subject matter and textbook were brilliant and are thoroughly connected with the unit.

##### Recommendation

This practice will be continued.

#### Feedback from Unit evaluation

##### Feedback

The unit coordinator's communication with students needs to be improved with timely responses.

##### Recommendation

The communication with students will be improved with timely responses.

## Unit Learning Outcomes

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

1. Analyse and explain the principles of heat transfer and conversion between heat energy and mechanical power
2. Analyse and evaluate the performance of heat exchangers and internal combustion engines
3. Analyse and explain combustion calculations and processes
4. Analyse and evaluate the performance of gas turbines with respect to jet propulsion
5. Analyse and evaluate the performance of nozzles with respect to jet propulsion
6. Analyse and evaluate the performance of compressors.

This unit in the Mechanical Engineering course helps students meet the Engineers Australia's stage one competencies.

## 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	5	6
1 - In-class Test(s) - 15%	•	•				
2 - Laboratory/Practical - 15%	•	•				
3 - Online Test - 15%			•	•		

Assessment Tasks	Learning Outcomes					
	1	2	3	4	5	6
4 - Examination - 55%			•	•	•	•

## 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						

## Alignment of Assessment Tasks to Graduate Attributes

Assessment Tasks	Graduate Attributes									
	1	2	3	4	5	6	7	8	9	10
1 - In-class Test(s) - 15%	•	•	•	•						
2 - Laboratory/Practical - 15%	•	•	•	•		•				
3 - Online Test - 15%	•	•	•	•		•				
4 - Examination - 55%	•	•	•	•						

## Textbooks and Resources

### Textbooks

ENEM14011

#### Prescribed

**Applied Thermodynamics for Engineering Technologists 5th (1993) Authors: Eastop, T.D. and McConkey, A.**

Edition: 5 (1993)

Authors: Eastop, T.D. and McConkey, A.

Peason

Sydney , nsw , Australia

ISBN: 9780582091931

Binding: Paperback

[View textbooks at the CQUniversity Bookshop](#)

### IT Resources

**You will need access to the following IT resources:**

- CQUniversity Student Email
- Internet
- Unit Website (Moodle)
- Access to a scanner.
- Video and audio equipment to join online tutorials
- MATLAB and Simulink Suite Software

## Referencing Style

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

For further information, see the Assessment Tasks.

## Teaching Contacts

**Ramadas Narayanan** Unit Coordinator

[r.narayanan@cqu.edu.au](mailto:r.narayanan@cqu.edu.au)

## Schedule

### Week 1 - 08 Mar 2021

Module/Topic	Chapter	Events and Submissions/Topic
Heat Transfer - Conduction, convection, radiation, Fourier's law of conduction, Newton's law of cooling, composite walls and the electrical analogy, heat flow through a cylinder and sphere.	Chapter 16 - Pages 561-576	Tutorial Problems for week 1: 16.1, 16.5, 16.6, 16.8,

### Week 2 - 15 Mar 2021

Module/Topic	Chapter	Events and Submissions/Topic
Heat Transfer - Forced convection, natural convection, heat exchangers, heat exchanger effectiveness, extended surfaces.	Chapter 16 - Pages 599-632	Tutorial Problems for week 2: 16.16, 16.18, 16.20, 16.21, 16.22, 16.30. Week 2 Quiz

### Week 3 - 22 Mar 2021

Module/Topic	Chapter	Events and Submissions/Topic
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Heat Transfer- Radiation, black body radiation, grey body, Stefan-Boltzmann law, Lambert's law and the geometric factor, radiant interchange between grey bodies, heat transfer coefficient for radiation.

Chapter 16 - Pages 633-651

Tutorial Problems for week 3:16.37, 16.38, 16.44, 16.46  
Week 3 Quiz

#### Week 4 - 29 Mar 2021

Module/Topic	Chapter	Events and Submissions/Topic
Internal Combustion Engines - Four-stroke cycle, two-stroke cycle, other types of engines, criteria of performance, engine output and efficiency, performance characteristics.	Chapter 13 - Pages 419-442	Tutorial Problems for weeks 4 & 5: 13.1, 13.2, 13.6, 13.8, 13.9, 13.10, 13.11,13.13 Week 4 Quiz Lab Activity 1

#### Week 5 - 05 Apr 2021

Module/Topic	Chapter	Events and Submissions/Topic
Internal Combustion Engines - Factors influencing performance, real cycles and the air standard cycle, properties of fuels for IC engines, fuel systems, measurement of air and fuel flow rates, supercharging, engine emissions.	Chapter 13 - Pages 442 - 475	Tutorial Problems for weeks 4 & 5: 13.1, 13.2, 13.6, 13.8, 13.9, 13.10, 13.11,13.13 Week 5 Quiz Lab Activity 2

#### Vacation Week - 12 Apr 2021

Module/Topic	Chapter	Events and Submissions/Topic
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#### Week 6 - 19 Apr 2021

Module/Topic	Chapter	Events and Submissions/Topic
Combustion - Basic chemistry, fuels, combustion equations, stoichiometric air-fuel ratio, Exhaust and flue gas analysis.	Chapter 7 - Pages 176-192	Tutorial Problems for weeks 6 &7: 7.1, 7.3, 7.5, 7.6, 7.8, 7.9, 7.12 Week 6 Quiz

#### Week 7 - 26 Apr 2021

Module/Topic	Chapter	Events and Submissions/Topic
Combustion - Practical analysis of combustion products, Enthalpy of formation, calorific value of fuels, power plant thermal efficiency, practical determination of calorific values, air and fuel-vapour mixtures	Chapter 7 - Pages 192-230	Tutorial Problems for weeks 6 &7: 7.1, 7.3, 7.5, 7.6, 7.8, 7.9, 7.12 Week 7 Quiz

#### Week 8 - 03 May 2021

Module/Topic	Chapter	Events and Submissions/Topic
Gas Turbines - Practical gas turbine cycle, modifications to the basic cycle, combustion,	Chapter 9 - Pages 260-283	Tutorial Problems: 9.1, 9.2, 9.3, 9.5 Week 8 Quiz Lab activity 3

#### Week 9 - 10 May 2021

Module/Topic	Chapter	Events and Submissions/Topic
Nozzles and Jet Propulsion - Nozzle shape, critical pressure ratio, maximum mass flow, Nozzles off the design pressure ratio, nozzle efficiency	Chapter 10 - Pages 287-298	Tutorial Problems for weeks 9&10: 10.1, 10.2, 10.3, 10.4, 10.7, 10.8, 10.9 Week 9 Quiz

#### Week 10 - 17 May 2021

Module/Topic	Chapter	Events and Submissions/Topic
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Nozzles and Jet Propulsion - Steam  
Nozzles, Jet Propulsion

Chapter 10 - Pages 298-325

Tutorial Problems for weeks 9-11:  
10.1, 10.2, 10.3, 10.4, 10.7, 10.8, 10.9  
Week 10 Quiz

**Assignment** Due: Week 10 Monday  
(17 May 2021) 11:55 pm AEST

### Week 11 - 24 May 2021

Module/Topic	Chapter	Events and Submissions/Topic
Compressors - Positive displacement machines, reciprocating compressors, reciprocating compressors including clearance, multistage compression, steady-flow analysis, rotary machines, vacuum pumps, air motors.	Chapter 12 - Pages 381-415	Tutorial Problems: 12.3, 12.5, 12.9 Week 11 Quiz

### Week 12 - 31 May 2021

Module/Topic	Chapter	Events and Submissions/Topic
Revision	All chapters previously stated	Revise all tutorial problems and worked examples from the textbook.

### Review/Exam Week - 07 Jun 2021

Module/Topic	Chapter	Events and Submissions/Topic
Exam	All chapters previously stated	Exam :Revise all tutorial problems and worked examples from the textbook.

### Exam Week - 14 Jun 2021

Module/Topic	Chapter	Events and Submissions/Topic
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## Term Specific Information

In this term (Term 1, 2021), all the laboratory activities will be held via Zoom or through videos. All students including mixed-mode and distance students can join these sessions. There is no residential school for this unit.

## Assessment Tasks

### 1 Weekly Online Quizzes

#### Assessment Type

In-class Test(s)

#### Task Description

These weekly quizzes assess contents from each week. There will be 10 quizzes starting from week 2 extending up to week 11 and all quizzes together will have 15% weighting of the course. The assessment task can be accessed from the unit Moodle site on a weekly basis. Each quiz will be open for a week and students need to attempt within the open period. Weekly due dates will be given in the Moodle.

#### Assessment Due Date

Weekly due dates will be given in the Moodle

#### Return Date to Students

Students will be getting feedback immediately after the submission of the quizzes.

#### Weighting

15%

#### Minimum mark or grade

50%



**Assessment Criteria**

The correct answer will get full marks and the incorrect answer will be given zero marks.

**Referencing Style**

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

**Submission**

Online

**Learning Outcomes Assessed**

- Analyse and explain the principles of heat transfer and conversion between heat energy and mechanical power
- Analyse and evaluate the performance of heat exchangers and internal combustion engines

**Graduate Attributes**

- Communication
- Problem Solving
- Critical Thinking
- Information Literacy

## 2 Practical Assessment

**Assessment Type**

Laboratory/Practical

**Task Description**

Attend all the laboratory sessions and participate in the learning activities and complete related reports. Details of the laboratory activities will be available in Moodle.

**Assessment Due Date**

Due date of each activity will be given in the Moodle.

**Return Date to Students**

Two weeks after the submission

**Weighting**

15%

**Minimum mark or grade**

50%

**Assessment Criteria**

The students will be assessed on attendance, participation, report, test results, presentation skills, discussions and tasks specified in the lab information sheets given in the Moodle.

**Referencing Style**

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

**Submission**

Online Group

**Learning Outcomes Assessed**

- Analyse and explain the principles of heat transfer and conversion between heat energy and mechanical power
- Analyse and evaluate the performance of heat exchangers and internal combustion engines

**Graduate Attributes**

- Communication
- Problem Solving
- Critical Thinking
- Information Literacy
- Information Technology Competence

## 3 Assignment

### Assessment Type

Online Test

### Task Description

This assignment assesses contents from Week 1 to Week 9. The assessment task will be available in the unit Moodle site three weeks prior to its due date. You must provide detailed solutions to the problems given in the assignment in order to demonstrate your knowledge and understanding of the concepts and processes incorporating any assumptions made, relevant sketches, clear step by step solution and conclusion/judgement on the answer

### Assessment Due Date

Week 10 Monday (17 May 2021) 11:55 pm AEST

### Return Date to Students

Two weeks after the submission

### Weighting

15%

### Minimum mark or grade

50%

### Assessment Criteria

The submission will be graded based on the presentation, the method of solution, appropriate explanation and completeness of the solution. A complete solution should include your interpretation of the problem, any assumptions made, relevant sketches, clear step by step solution and conclusion/judgement on the answer.

### Referencing Style

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

### Submission

Online

### Learning Outcomes Assessed

- Analyse and explain combustion calculations and processes
- Analyse and evaluate the performance of gas turbines with respect to jet propulsion

### Graduate Attributes

- Communication
- Problem Solving
- Critical Thinking
- Information Literacy
- Information Technology Competence

## Examination

### Outline

Complete an invigilated examination.

### Date

During the examination period at a CQUniversity examination centre.

### Weighting

55%

### Length

180 minutes

### Minimum mark or grade

50

**Exam Conditions**

Restricted.

**Materials**

Dictionary - non-electronic, concise, direct translation only (dictionary must not contain any notes or comments).

## 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