



# ENEC12012 Stress Analysis

## Term 3 - 2022

Profile information current as at 30/04/2024 06:31 pm

All details in this unit profile for ENEC12012 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

In this unit, you will develop skills to analyse the stresses in a structural member subjected to various actions such as axial force, torsion, bending moments, and shear force using the principles of mechanics of materials. You will learn how individual structural members resist and transfer the stresses as well as ways in which they can fail. You will document the process of modeling, testing, and analysis and communicate, work and learn, both individually and in teams in a professional manner. In this unit, you must complete compulsory practical activities. Refer to the Engineering Undergraduate Course Moodle site for proposed dates.

#### Details

Career Level: *Undergraduate*

Unit Level: *Level 2*

Credit Points: 6

Student Contribution Band: 8

Fraction of Full-Time Student Load: 0.125

#### Pre-requisites or Co-requisites

Prerequisites: (ENEG11006 Engineering Statics OR ENEC12007 Analysis of Structures) AND (MATH11219 Engineering Mathematics) AND (ENEG11008 Materials for Engineers OR ENEC12005 Materials Science and Engineering)

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 3 - 2022

- Mixed Mode

#### 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. **Online Quiz(zes)**

Weighting: 20%

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

Weighting: 20%

#### 3. **Practical and Written Assessment**

Weighting: 10%

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

Weighting: 50%

### 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 Survey

**Feedback**

Tutorials provide adequate instruction on how to approach questions and problems.

**Recommendation**

Continue this good practice.

#### Feedback from Students Feedback

**Feedback**

Students appreciate the exemplars provided for quizzes but these resources could be expanded.

**Recommendation**

Continue to expand these exemplars to give greater clarity to students when completing their assessments.

## Unit Learning Outcomes

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

1. Apply the fundamental theories and analytical techniques to solve problems in mechanics of materials
2. Analyse the behaviour of structural members subjected to axial force, torsion, bending moment and shear force
3. Determine principal stresses and discuss failure criteria for a range of engineering materials
4. Demonstrate a professional level of communication and teamwork.

**The Learning Outcomes for this unit are linked with the Engineers Australia Stage 1 Competency Standards for Professional Engineers in the areas of 1. Knowledge and Skill Base, 2. Engineering Application Ability and 3. Professional and Personal Attributes at the following levels:**

**Introductory** 1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline. (LO: 2N ) 2.2 Fluent application of engineering techniques, tools, and resources. (LO: 3N 4N ) 3.4 Professional use and management of information. (LO: 4N ) 3.6 Effective team membership and team leadership. (LO: 4N )

**Intermediate** 1.1 Comprehensive, theory-based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline. (LO: 1I 2I 3I ) 1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline. (LO: 1I 2I 3I ) 1.4 Discernment of knowledge development and research directions within the engineering discipline. (LO: 2N 3I ) 2.1 Application of established engineering methods to complex engineering problem-solving. (LO: 2I 3I ) 2.3 Application of systematic engineering synthesis and design processes. (LO: 2N 3I ) 3.2 Effective oral and written communication in professional and lay domains. (LO: 4I ) 3.5 Orderly management of self, and professional conduct. (LO: 4I )

### Advanced

1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline. (LO: 3A )

**Note:** LO refers to the Learning Outcome number(s) which link to the competency and the levels: N - Introductory, I - Intermediate and A - Advanced. <https://moodle.cqu.edu.au/course/view.php?id=1511>

**Refer to the Engineering Undergraduate Course Moodle site for further information on the Engineers Australia's Stage 1 Competency Standard for Professional Engineers and course level mapping information**

## Alignment of Learning Outcomes, Assessment and Graduate Attributes



### Alignment of Assessment Tasks to Learning Outcomes

Assessment Tasks	Learning Outcomes			
	1	2	3	4
<b>1 - Online Quiz(zes) - 20%</b>	•		•	

Assessment Tasks	Learning Outcomes			
	1	2	3	4
2 - Written Assessment - 20%		•		
3 - Practical and Written Assessment - 10%				•
4 - Online Test - 50%		•	•	

## 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				

## Alignment of Assessment Tasks to Graduate Attributes

Assessment Tasks	Graduate Attributes									
	1	2	3	4	5	6	7	8	9	10
1 - Online Quiz(zes) - 20%	•	•	•	•		•				
2 - Written Assessment - 20%	•	•	•	•						
3 - Practical and Written Assessment - 10%	•	•		•		•				
4 - Online Test - 50%	•	•	•	•						

## Textbooks and Resources

### Textbooks

ENEC12012

#### Prescribed

#### **MECHANICS OF MATERIALS**

10th Edition (SI Units) (2018)

Authors: R.C. Hibbeler

Pearson

London , UK

ISBN: 9781292178202

Binding: Hardcover

[View textbooks at the CQUniversity Bookshop](#)

### 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

**Hassan Baji** Unit Coordinator

[h.baji@cqu.edu.au](mailto:h.baji@cqu.edu.au)

## Schedule

### Week 1 - 07 Nov 2022

Module/Topic	Chapter	Events and Submissions/Topic
Concepts of Stress and Strain	Chapter 1: Stress Chapter 2: Strain	

### Week 2 - 14 Nov 2022

Module/Topic	Chapter	Events and Submissions/Topic
Tension/Compression Tests Stress-Strain Behavior of Ductile and Brittle Materials Poisson's ratio Saint-Venant's Principal Principal of Superposition Elastic Deformation of Axially Loaded Member Statically Indeterminate Axially-Loaded Members	Chapter 3: Mechanical Properties of Materials Chapter 4: Axial Load	

### Week 3 - 21 Nov 2022

Module/Topic	Chapter	Events and Submissions/Topic
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Torsional Deformation of Circular Shaft  
The Torsion Formula  
Angle of Twist  
Statically Indeterminate Torque-Loaded Members  
Solid Noncircular Shafts  
Thin-Walled Tubes Having Closed Cross Sections

Chapter 5: Torsion

Progressive Test #1: The test opens at 9:00 AM Monday of this week and closes at 9:00 PM Monday of next week.

#### Week 4 - 28 Nov 2022

Module/Topic	Chapter	Events and Submissions/Topic
Shear and Moment Diagrams Bending Deformation of Straight Member The Flexural Formula	Chapter 6: Bending	

#### Vacation Week - 05 Dec 2022

Module/Topic	Chapter	Events and Submissions/Topic
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#### Week 5 - 12 Dec 2022

Module/Topic	Chapter	Events and Submissions/Topic
Bending in Unsymmetrical Sections Bending Composite Sections	Chapter 6: Bending	Progressive Test #2: The test opens at 9:00 AM Monday of this week and closes at 9:00 PM Monday of next week.

#### Week 6 - 19 Dec 2022

Module/Topic	Chapter	Events and Submissions/Topic
Shear in Straight Members The Shear Formula Shear Flow in Built-up Sections Shear Flow in Thin-Walled Members Shear Centre for Open Thin-Walled Members	Chapter 7: Transverse Shear	

#### Vacation Week - 26 Dec 2022

Module/Topic	Chapter	Events and Submissions/Topic
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#### Week 7 - 02 Jan 2023

Module/Topic	Chapter	Events and Submissions/Topic
Thin-Walled Pressure Vessels State of Stress Caused by Combined Loadings	Chapter 8: Combined Loading	Progressive Test #3: The test opens at 9:00 AM Monday of this week and closes at 9:00 PM Monday of next week.

#### Week 8 - 09 Jan 2023

Module/Topic	Chapter	Events and Submissions/Topic
Plane Stress Transformation General Equations for Plane-Stress Transformation Principal Stresses and Maximum In-Plane Shear Stress Mohr's Circle-Plane Stress	Chapter 9: Stress Transformation	

#### Week 9 - 16 Jan 2023

Module/Topic	Chapter	Events and Submissions/Topic
Strain Transformation General Equations for Plane-Strain Transformation Strain Rosettes Failure Criteria	Chapter 10: Strain Transformation and Failure Criteria	

**Week 10 - 23 Jan 2023**

Module/Topic	Chapter	Events and Submissions/Topic
The Elastic Curve Slope and Displacement by Integration	Chapter 12: Deflection of Beams	

**Week 11 - 30 Jan 2023**

Module/Topic	Chapter	Events and Submissions/Topic
Critical Load Ideal Column with Different End Supports The Secant Formula	Chapter 13: Buckling of Columns	<b>Assignment</b> Due: Week 11 Monday (30 Jan 2023) 11:59 pm AEST

**Week 12 - 06 Feb 2023**

Module/Topic	Chapter	Events and Submissions/Topic
Review		<b>Practical Report</b> Due: Week 12 Monday (6 Feb 2023) 11:59 pm AEST

**Exam Week - 13 Feb 2023**

Module/Topic	Chapter	Events and Submissions/Topic
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## Assessment Tasks

### 1 Progressive Tests

**Assessment Type**

Online Quiz(zes)

**Task Description**

This assessment task consists of three "Progressive Tests". First, second and third tests carry 6%, 7%, and 7% marks, respectively. Each test consists of a number of numerical questions.

Important Notes:

- Each Test is set for 90 minutes. You have 90 minutes from when you start your attempt to submit your answers.
- If you start but leave a test and come back to it later, your 90 min time may have lapsed and you will be scored zero for that attempt.
- You can attempt each test up to three (3) times within the given time frame as specified in the schedule.
- The test will be automatically closed after the end of the given time frame.
- The final mark will be the highest of all the attempts.
- Even though the tests are open for a few days, it is expected that your first attempt would be on the first day.
- The Tests cannot generally be deferred. However, under exceptional circumstances, if you have valid reasons to defer the test(s), please contact the Unit Coordinator with documents of proof before the due date.

**Number of Quizzes**

3

**Frequency of Quizzes**

Other

**Assessment Due Date**

Tests opening and closing details are given on the unit schedule.

**Return Date to Students**

Immediately after the test completion.

**Weighting**

20%



### Assessment Criteria

- Full marks allocated to a question will be awarded for each correct answer.
- No penalty for wrong answers.

### Referencing Style

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

### Submission

Online

### Learning Outcomes Assessed

- Apply the fundamental theories and analytical techniques to solve problems in mechanics of materials
- Determine principal stresses and discuss failure criteria for a range of engineering materials

### Graduate Attributes

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

## 2 Assignment

### Assessment Type

Written Assessment

### Task Description

The aim of this assignment is to allow the students to demonstrate their understanding of various concepts, theories and processes studied/developed in weeks 7-9.

Clear detailed solution to all questions in the assignment should be submitted in a single PDF file via Moodle.

The assignment will be available by end of Week 6 through unit Moodle webpage.

### Assessment Due Date

Week 11 Monday (30 Jan 2023) 11:59 pm AEST

### Return Date to Students

Feedback will be returned within two weeks after assignment due date.

### Weighting

20%

### Assessment Criteria

Each solution should have the following items:

- Accurate drawing of assumed Sign Conventions, Free-Body and other diagrams as required for the solution. [20%]
- Accuracy in Calculations. [80%]
- All the steps should be explained in full detail.
- A single PDF file with clear and readable working should be submitted.

### Referencing Style

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

### Submission

Online

### Learning Outcomes Assessed

- Analyse the behaviour of structural members subjected to axial force, torsion, bending moment and shear force

### Graduate Attributes

- Communication
- Problem Solving
- Critical Thinking

- Information Literacy

## 3 Practical Report

### Assessment Type

Practical and Written Assessment

### Task Description

- Students required to complete the laboratory activities as per instruction given in the [Practical Instruction Sheets](#).
- The Practical Instruction Sheets and report requirements will be given on the Moodle site.
- There are three tests in the lab work: Shear Centre, Buckling and Unsymmetrical bending.
- Students should collect the experimental data during the residential school.
- A report summarizing the experimental data with analysis of the results should be prepared.
- A single PDF file containing three parts (a part for test) should be submitted.

### Assessment Due Date

Week 12 Monday (6 Feb 2023) 11:59 pm AEST

### Return Date to Students

Feedback will be returned within two weeks after assignment due date.

### Weighting

10%

### Minimum mark or grade

50% (5 of 10)

### Assessment Criteria

(1) Each report will be assessed separately for the criterion accuracy and correct procedure as required in the Instruction.

- Correct application of mathematics and arithmetic
- Results clearly identified and explained
- Correct results/explanation

(2) The report as a whole will be assessed against the following criteria:

#### Evidence of correct procedures

- All necessary steps in experiment and reporting are followed in the correct order
- Clear presentation of results obtained
- Evidence of checking results (mathematical, graphical, logic-common sense)

#### Evidence of understanding of the topic

- Explanation of possible error in the experiment
- Interpretation of results

#### Professional presentation

- Appropriate use of diagrams, clear diagrams
- Correct use of terminology, conventions
- Clear English in the explanation of procedure and interpretation of results

(3) A single PDF should be submitted for the whole report.

### Referencing Style

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

### Submission

Online

### Learning Outcomes Assessed

- Demonstrate a professional level of communication and teamwork.

### Graduate Attributes

- Communication

- Problem Solving
- Information Literacy
- Information Technology Competence

## 4 End of Term Test

### Assessment Type

Online Test

### Task Description

This assessment task is an online test that consists of several numerical questions. Students have three hours to complete their solution. An extra half an hour is provided for scanning and uploading and submitting the assessment. Important Notes:

- The test will be during the exam week.
- The assessment duration is set for 180 minutes with an additional 30 minutes for scanning and uploading.
- The test will be automatically closed after the end of the given time frame.
- The tests cannot generally be deferred. However, under exceptional circumstances, if you have valid reasons to defer the test, you can apply for exam deferral with documents of proof before the due date.

### Assessment Due Date

The test will be during the exam week.

### Return Date to Students

### Weighting

50%

### Minimum mark or grade

50% (25 of 50)

### Assessment Criteria

Each solution should have the following items:

- Accurate drawing of assumed Sign Conventions, Free-Body and other diagrams as required for the solution. [20%]
- Accuracy in Calculations. [80%]
- All the steps should be explained in full detail.
- A single PDF file with clear and readable working should be submitted.

### Referencing Style

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

### Submission

Online

### Learning Outcomes Assessed

- Analyse the behaviour of structural members subjected to axial force, torsion, bending moment and shear force
- Determine principal stresses and discuss failure criteria for a range of engineering materials

### Graduate Attributes

- Communication
- Problem Solving
- Critical Thinking
- Information Literacy

## 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