



# ENEC13017 *Advanced Structural Analysis*

## Term 2 - 2021

Profile information current as at 21/04/2024 01:45 am

All details in this unit profile for ENEC13017 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

You will learn analysis of indeterminate structures and the implications this has for structural analysis. You will also determine reactions, internal forces, and displacements of structures and analyse truss and beams with moving loads. You will be introduced to the fundamentals of the structural analysis using the matrix method and you will use commercially available software to analyse structures.

### 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

Prerequisites: ENEG11006 Engineering Statics and ENEC12012 Stress Analysis

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 - 2021

- Bundaberg
- Cairns
- Gladstone
- Mackay
- 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: 20%

#### 3. **Written Assessment**

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](#).

## 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 Have Your Say Survey

**Feedback**

The number of tutorials, additional video training and example workings were great.

**Recommendation**

This practice will continue.

#### Feedback from Have Your Say Survey

**Feedback**

There were too many assessments for a 6pc unit.

**Recommendation**

The number of assessments will be reduced. More feedback will be provided to students to increase the students satisfaction with the assessment feedback.

#### Feedback from Have Your Say Survey

**Feedback**

The concepts are very interesting and the way the unit is broken up into blocks is logical.

**Recommendation**

This practice will continue.

## Unit Learning Outcomes

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

1. Conduct structural idealisation of practical structures
2. Analyse statically indeterminate structures to determine support reactions, internal forces, and nodal displacements
3. Solve structural analysis problems using software packages
4. Analyse indeterminate structure using the direct stiffness method
5. Demonstrate a professional level of communication.

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** 2.4 Application of systematic approaches to the conduct and management of engineering projects. (LO: 3N 4N ) 3.4 Professional use and management of information. (LO: 4N ) 3.5 Orderly management of self, and professional conduct. (LO: 3N 4N )

### Intermediate

1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline. (LO: 2N 3I 4I ) 1.4 Discernment of knowledge development and research directions within the engineering discipline. (LO: 3N 4I ) 2.3 Application of systematic engineering synthesis and design processes. (LO: 1N 2I ) 3.2 Effective oral and written communication in professional and lay domains. (LO: 5I )

### Advanced

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 4A ) 1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline. (LO: 2I 4A ) 1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline. (LO: 1N 2I 3I 4A ) 2.1 Application of established engineering methods to complex engineering problem solving. (LO: 1N 2I 3A 4A ) 2.2 Fluent application of engineering techniques, tools, and resources. (LO: 3A 4A )

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

## Alignment of Learning Outcomes, Assessment and Graduate Attributes



### Alignment of Assessment Tasks to Learning Outcomes

Assessment Tasks	Learning Outcomes				
	1	2	3	4	5
1 - Online Quiz(zes) - 20%	•	•			
2 - Written Assessment - 20%	•	•	•		•
3 - Written Assessment - 20%		•	•		•

Assessment Tasks	Learning Outcomes				
	1	2	3	4	5
4 - Online Test - 40%		•		•	

### Alignment of Graduate Attributes to Learning Outcomes

Graduate Attributes	Learning Outcomes				
	1	2	3	4	5
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 - Written Assessment - 20%	•	•	•	•						
4 - Online Test - 40%	•	•	•	•						

## Textbooks and Resources

### Textbooks

ENEC13017

#### Prescribed

##### Structural Analysis in SI Units

Edition: 10th edn (2019)

Authors: Hibbeler, R

Pearson

Harlow, Essex, UK

ISBN: 9781292247137

Binding: Paperback

#### Additional Textbook Information

Both paper and eBook versions can be purchased at the CQUni Bookshop here: <http://bookshop.cqu.edu.au> (search on the Unit code).

[View textbooks at the CQUniversity Bookshop](#)

### IT Resources

You will need access to the following IT resources:

- CQUniversity Student Email
- Internet
- Unit Website (Moodle)
- Structural analysis software SpaceGass
- Matlab

## 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 - 12 Jul 2021

Module/Topic	Chapter	Events and Submissions/Topic
Introduction, Review on Analysis of Determinate Trusses and Beams Determinacy and Stability	Chapter 2: Analysis of Statically Determinate Structures Chapter 3: Analysis of Statically Determinate Trusses Chapter 4: Internal Loadings Developed in Structural Members	

### Week 2 - 19 Jul 2021

Module/Topic	Chapter	Events and Submissions/Topic
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Influence Lines for Beams  
 Qualitative Influence Lines  
 Influence Lines for Floor Girders  
 Influence Lines for Trusses  
 Maximum Influence at a Point due to a Series of Concentrated Loads

Chapter 6: Influence Lines for Statically Determinate Structures

### Week 3 - 26 Jul 2021

Module/Topic	Chapter	Events and Submissions/Topic
The Double Integration Method Moment Area Theorems Conjugate-Beam Method	Chapter 7: Deflections	

### Week 4 - 02 Aug 2021

Module/Topic	Chapter	Events and Submissions/Topic
Method of Virtual Work and Castigliano's Theorem: Trusses	Chapter 8: Deflections Using Energy Methods	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 5 - 09 Aug 2021

Module/Topic	Chapter	Events and Submissions/Topic
Method of Virtual Work and Castigliano's Theorem: Beams and Frames	Chapter 8: Deflections Using Energy Methods	Progressive Test #2: The test opens at 9:00 AM Monday of this week and closes at 9:00 PM Monday of next week.

### Vacation Week - 16 Aug 2021

Module/Topic	Chapter	Events and Submissions/Topic

### Week 6 - 23 Aug 2021

Module/Topic	Chapter	Events and Submissions/Topic
Maxwell's Theorem of Reciprocal Force Method of Analysis: Beams Force Method of Analysis: Trusses	Chapter 9: Analysis of Statically Indeterminate Structures by the Force Method	<b>Assignment 1</b> Due: Week 6 Monday (23 Aug 2021) 11:59 pm AEST

### Week 7 - 30 Aug 2021

Module/Topic	Chapter	Events and Submissions/Topic
Slope-Deflection Equations Analysis of Beams Analysis of Frames: No Sideway Analysis of Frames: Sideway	Chapter 10: Displacement Method of Analysis: Slope-Deflection Equations	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 - 06 Sep 2021

Module/Topic	Chapter	Events and Submissions/Topic
Moment Distribution for Beams Stiffness-Factor Modifications	Chapter 11: Displacement Method of Analysis: Moment Distribution Method	

### Week 9 - 13 Sep 2021

Module/Topic	Chapter	Events and Submissions/Topic
Moment Distribution for Frames: No Sideway Moment Distribution for Frames: Sideway	Chapter 11: Displacement Method of Analysis: Moment Distribution Method	

### Week 10 - 20 Sep 2021

Module/Topic	Chapter	Events and Submissions/Topic

Member Stiffness Matrix  
Displacement and Force  
Transformation Matrices  
Member Global Stiffness matrix  
Truss Stiffness Matrix  
Application of the Stiffness Method for  
Truss Analysis

Chapter 14: Truss Analysis Using the  
Stiffness Method

### Week 11 - 27 Sep 2021

Module/Topic	Chapter	Events and Submissions/Topic
Beam-Member Stiffness Method Beam-Member Global Stiffness matrix Beam-Structure Stiffness Matrix Application of the Stiffness Method for Beam Analysis	Chapter 15: Beam Analysis Using the Stiffness Method	<b>Assignment 2</b> Due: Week 11 Monday (27 Sept 2021) 11:59 pm AEST

### Week 12 - 04 Oct 2021

Module/Topic	Chapter	Events and Submissions/Topic
Revision		

### Review/Exam Week - 11 Oct 2021

Module/Topic	Chapter	Events and Submissions/Topic
		Exam date will be posted on Moodle page of the unit.

### Exam Week - 18 Oct 2021

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 carries 7%, 7%, and 6% marks, respectively. Each test consists of a number of numerical questions.

Important Notes:

- Each Test is set for 60 minutes. You have 60 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 60 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**

- Conduct structural idealisation of practical structures
- Analyse statically indeterminate structures to determine support reactions, internal forces, and nodal displacements

### **Graduate Attributes**

- Communication
- Problem Solving
- Critical Thinking
- Information Literacy

## **2 Assignment 1**

### **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 1 to 5, which include:

- Influence Lines
- Deflection analysis using double Integration, the moment area and Conjugate-Beam method
- Deflection analysis using method of virtual load

Assignment 1 will be available by end of Week 1 through unit Moodle webpage.

### **Assessment Due Date**

Week 6 Monday (23 Aug 2021) 11:59 pm AEST

### **Return Date to Students**

Week 8 Monday (6 Sept 2021)

Feedback will be returned 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**

- Conduct structural idealisation of practical structures
- Analyse statically indeterminate structures to determine support reactions, internal forces, and nodal displacements
- Solve structural analysis problems using software packages
- Demonstrate a professional level of communication.

**Graduate Attributes**

- Communication
- Problem Solving
- Critical Thinking
- Information Literacy

## 3 Assignment 2

**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 6 to 9, which include:

- Analysis of indeterminate structures using force method
- Analysis of beams and frames using the slope-deflection method
- Analysis of beams and frames using the moment distribution method

Assignment 2 will be available by end of Week 6 through unit Moodle webpage.

**Assessment Due Date**

Week 11 Monday (27 Sept 2021) 11:59 pm AEST

**Return Date to Students**

Review/Exam Week Monday (11 Oct 2021)

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 statically indeterminate structures to determine support reactions, internal forces, and nodal displacements
- Solve structural analysis problems using software packages
- Demonstrate a professional level of communication.

**Graduate Attributes**

- Communication
- Problem Solving
- Critical Thinking

- Information Literacy

## 4 Final Exam

### Assessment Type

Online Test

### Task Description

This assessment task is an online test. It consists of a number of numerical questions.

Important Notes:

- The assessment is set for 180 minutes. You have 180 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 180 min time may have lapsed and you will be scored zero for that attempt.
- The time frame to complete the test is 24 hours. The start time will be in the exam week and you will be notified about
- the start time on the Moodle page of the unit.
- You can attempt the test up to two (2) times within the given time frame (24 hours).
- The test will be automatically closed after the end of the given time frame.
- The final mark will be the highest of all the two attempts.
- 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 exam will be during the exam week period. The exact exam date will be posted on Moodle page of the unit.

### Return Date to Students

Online quiz results will be released after completion of the test.

### Weighting

40%

### Minimum mark or grade

50% (20 of 40)

### 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

- Analyse statically indeterminate structures to determine support reactions, internal forces, and nodal displacements
- Analyse indeterminate structure using the direct stiffness method

### 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