



# ENEC20001 Concrete Design

## Term 1 - 2023

Profile information current as at 02/05/2024 09:24 am

All details in this unit profile for ENEC20001 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

Concrete Design is an advanced civil engineering unit that introduces the analysis and design of complex reinforced and prestressed concrete structures. In this unit, you will develop knowledge of state-of-the-art construction materials and design technologies in the context of structural engineering and environmental sustainability. You will be expected to conceptualise the vertical and horizontal load resisting mechanism of concrete structural systems, interpret and apply the relevant Australian Standards, and ensure the designed structure/structural components also meet the serviceability and stakeholder requirements. The use of commercial computer software is required to analyse and design these structures. In this unit, you will document the processes involved in modelling, analysis, design, and communication, and work and learn, both individually and in teams in a professional manner.

#### Details

Career Level: *Postgraduate*

Unit Level: *Level 9*

Credit Points: 12

Student Contribution Band: 8

Fraction of Full-Time Student Load: 0.25

#### Pre-requisites or Co-requisites

There are no requisites for this unit.

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

- Melbourne
- 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 12-credit Postgraduate unit at CQUniversity requires an overall time commitment of an average of 25 hours of study per week, making a total of 300 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. **Project (applied)**

Weighting: 30%

#### 2. **Project (applied)**

Weighting: 30%

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

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 Moodle

**Feedback**

Well organised and delivered unit.

**Recommendation**

This standard will be kept in future offerings.

#### Feedback from Moodle

**Feedback**

Assessment could be returned early.

**Recommendation**

This issue was acknowledged by the teaching staff during the term and improved from the previous year. Still, some students received their feedback after 2 weeks. This issue will be resolved in 2022 by managing the workload of teaching staff.

## Unit Learning Outcomes

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

1. Determine various types of loads acting on a structural system, provide a rationale for load combinations applied, and conceptualise the load resisting concrete structural systems
2. Formulate, plan, manage, and complete projects, individually or in teams, in an ethical and professional manner considering stakeholder requirements and principals of sustainable development
3. Design complex reinforced concrete structural components using appropriate Australian Standards
4. Design prestressed concrete structural components using appropriate Australian Standards
5. Use appropriate software to analyse and/or design the structural components subjected to different load combinations
6. Demonstrate a professional level of communication and leadership.

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:

#### Intermediate

- 1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline. (LO: 1I 3I 4I )
- 1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline. (LO: 3I 4I )
- 3.1 Ethical conduct and professional accountability. (LO: 2I 6N )
- 3.2 Effective oral and written communication in professional and lay domains. (LO: 2I 6I )
- 3.4 Professional use and management of information. (LO: 1I 2I 3I 4I 6I )
- 3.5 Orderly management of self, and professional conduct. (LO: 2I 6I )

#### 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 3A 4A )
- 1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline. (LO: 1A 3A 4A 5I )
- 1.4 Discernment of knowledge development and research directions within the engineering discipline. (LO: 1A 3A 4A 5I )
- 1.6 Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline. (LO: 1I 3A 4A 5A )
- 2.1 Application of established engineering methods to complex engineering problem solving. (LO: 1I 2I 3A 4A 5I )
- 2.2 Fluent application of engineering techniques, tools and resources. (LO: 1I 5A )
- 2.3 Application of systematic engineering synthesis and design processes. (LO: 1I 3A 4A 5I )
- 2.4 Application of systematic approaches to the conduct and management of engineering projects. (LO: 1A 2A 3I 4I 5I )
- 3.6 Effective team membership and team leadership. (LO: 2A 3I 4I 6I )

*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 Postgraduate Units 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=11382>

## Alignment of Learning Outcomes, Assessment and Graduate Attributes



### Alignment of Assessment Tasks to Learning Outcomes

Assessment Tasks	Learning Outcomes					
	1	2	3	4	5	6
<b>1 - Project (applied) - 30%</b>	•	•	•		•	•
<b>2 - Project (applied) - 30%</b>	•	•		•	•	•

Assessment Tasks	Learning Outcomes					
	1	2	3	4	5	6
3 - In-class Test(s) - 40%			•	•		

## Alignment of Graduate Attributes to Learning Outcomes

Graduate Attributes	Learning Outcomes					
	1	2	3	4	5	6
1 - Knowledge	○	○	○	○	○	
2 - Communication		○				○
3 - Cognitive, technical and creative skills	○	○	○	○		
4 - Research	○	○	○	○	○	
5 - Self-management		○	○	○	○	
6 - Ethical and Professional Responsibility	○	○	○	○		○
7 - Leadership						○
8 - 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
1 - Project (applied) - 30%	○	○	○	○	○	○	○	
2 - Project (applied) - 30%	○	○	○	○	○	○	○	
3 - In-class Test(s) - 40%	○	○	○		○			

## Textbooks and Resources

## Textbooks

ENEC20001

**Prescribed**

## Reinforced Concrete Basics

3rd Edition (2021)

Authors: Stephen Foster, Andrew Kilpatrick and Robert Warner

Pearson Original Australia

Melbourne , VIC , Australia

ISBN: 9780655703662

Binding: Hardcover

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## Supplementary

## Reinforced and Prestressed Concrete

3rd Edition (2018)

Authors: Yew-Chaye Loo and Sanaul Huq Chowdhury

Cambridge University Press

Melbourne , VIC , Australia

ISBN: 9781108405645

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)

## Referencing Style

No referencing style set.

## Teaching Contacts

**Kumaran Suntharavadivel** Unit Coordinator

[t.suntharavadivel@cgu.edu.au](mailto:t.suntharavadivel@cgu.edu.au)

## Schedule

**Week 1 - 06 Mar 2023**

Module/Topic	Chapter	Events and Submissions/Topic
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### Structural Design Process

- Limit State Design
- Design Action and Load Combinations

### Basics of Concrete Design

- Design Properties of Concrete and Steel (Reinforcement and Tendons) - AS3600:2018
- Durability and Fire Resistance requirements
- Structural Analysis as per AS3600:2018

#### Week 2 - 13 Mar 2023

Module/Topic	Chapter	Events and Submissions/Topic
<b>Design of RC Beam</b> - Analysis and design for Serviceability Limit State requirements <ul style="list-style-type: none"><li>• Deflection limit</li><li>• Crack control requirements</li></ul>		

#### Week 3 - 20 Mar 2023

Module/Topic	Chapter	Events and Submissions/Topic
<b>Design of RC Beam</b> - Analysis and design for Ultimate Limit State requirements <ul style="list-style-type: none"><li>• Flexural strength</li><li>• Shear and Torsional reinforcements</li></ul>		

#### Week 4 - 27 Mar 2023

Module/Topic	Chapter	Events and Submissions/Topic
<b>Design of RC Slab</b> <ul style="list-style-type: none"><li>• Slab supported by beams/walls (One-way and two-way slabs)</li><li>• Slab supported by columns (Flat slabs)</li></ul>		

#### Week 5 - 03 Apr 2023

Module/Topic	Chapter	Events and Submissions/Topic
Design of Columns		

#### Vacation Week - 10 Apr 2023

Module/Topic	Chapter	Events and Submissions/Topic
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#### Week 6 - 17 Apr 2023

Module/Topic	Chapter	Events and Submissions/Topic
<b>Advanced topics in RC Design and Detailing Requirements</b> <ul style="list-style-type: none"><li>• Opening of slabs</li><li>• Staircase design</li><li>• Strut and tie model design as per AS3600:2018</li></ul>		

#### Week 7 - 24 Apr 2023

Module/Topic	Chapter	Events and Submissions/Topic
<b>Introduction to Prestressed Concrete Design</b> <ul style="list-style-type: none"><li>• Principle of prestressing</li><li>• Type of prestressing</li></ul>		<b>REINFORCED CONCRETE DESIGN</b> Due: Week 7 Monday (24 Apr 2023) 5:00 pm AEST

#### Week 8 - 01 May 2023

Module/Topic	Chapter	Events and Submissions/Topic
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### Design of Prestressed Concrete Members

- Analysis PC members
- Determine prestressing force using Magnel Diagram
- Determine the Tendon profiles

#### Week 9 - 08 May 2023

Module/Topic	Chapter	Events and Submissions/Topic
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### Design of Prestressed Concrete Members

- Ultimate Moment Checks
- Check for shear capacity
- Estimation of Losses

#### Week 10 - 15 May 2023

Module/Topic	Chapter	Events and Submissions/Topic
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### Advanced topics in PC Design

- End-block design

#### Week 11 - 22 May 2023

Module/Topic	Chapter	Events and Submissions/Topic
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Design requirements for Walls and Footings

#### Week 12 - 29 May 2023

Module/Topic	Chapter	Events and Submissions/Topic
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Revision

**Prestressed Concrete Beam Design** Due: Week 12 Monday (29 May 2023) 5:00 pm AEST

#### Review/Exam Week - 05 Jun 2023

Module/Topic	Chapter	Events and Submissions/Topic
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#### Exam Week - 12 Jun 2023

Module/Topic	Chapter	Events and Submissions/Topic
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**Class Test** Due: Exam Week Wednesday (14 June 2023) 12:00 pm AEST

## Assessment Tasks

### 1 REINFORCED CONCRETE DESIGN

#### Assessment Type

Project (applied)

#### Task Description

This assignment aims to allow you to demonstrate your understanding of basic concepts, theories, and processes related to reinforced concrete design studied/developed in this unit.

You will work as a team to solve a modified real-world design example. To successfully complete the project you will undertake the following tasks.

- structural analysis (using both simplified approaches and software)
- design of main elements of an RC structure (Slab, Beam and Column) as per the stakeholders' requirements
- structural drawing

Project Brief will be available on Monday Week 2.

#### Assessment Due Date

Week 7 Monday (24 Apr 2023) 5:00 pm AEST



**Return Date to Students**

Week 9 Tuesday (9 May 2023)

**Weighting**

30%

**Minimum mark or grade**

40%

**Assessment Criteria**

Each question will be assessed based on the following criteria.

- Correct application of mathematics and arithmetic
- The problem clearly identified and explained in the answer
- Correct results/explanation

In addition, the following criteria will be considered:

Evidence of correct procedures

- All necessary steps in the analysis are presented in the correct order
- Clear presentation of mathematical work

Evidence of an understanding of the topic

- Use of correct principles and theories
- Interpretation of results as necessary

Professional presentation

- Appropriate use of diagrams, clear diagrams
- Use of correct terminologies and conventions

**Submission**

Online Group

**Learning Outcomes Assessed**

- Determine various types of loads acting on a structural system, provide a rationale for load combinations applied, and conceptualise the load resisting concrete structural systems
- Formulate, plan, manage, and complete projects, individually or in teams, in an ethical and professional manner considering stakeholder requirements and principals of sustainable development
- Design complex reinforced concrete structural components using appropriate Australian Standards
- Use appropriate software to analyse and/or design the structural components subjected to different load combinations
- Demonstrate a professional level of communication and leadership.

**Graduate Attributes**

- Knowledge
- Communication
- Cognitive, technical and creative skills
- Research
- Self-management
- Ethical and Professional Responsibility
- Leadership

## 2 Prestressed Concrete Beam Design

**Assessment Type**

Project (applied)

**Task Description**

This assignment aims to allow you to demonstrate your understanding of basic concepts, theories, and processes related to prestressed concrete design studied/developed in this unit.

You will work as a team to design a long-span PC beam. To successfully complete the project you will undertake the following tasks.

- structural analysis
- design of main elements of a PC member (Prestressing force and tendon details) as per the stakeholders' requirements

Project Brief will be available on Monday Week 7.

**Assessment Due Date**

Week 12 Monday (29 May 2023) 5:00 pm AEST

**Return Date to Students**

Exam Week Monday (12 June 2023)

**Weighting**

30%

**Minimum mark or grade**

40%

**Assessment Criteria**

Each question will be assessed based on the following criteria.

- Correct application of mathematics and arithmetic
- The problem clearly identified and explained in the answer
- Correct results/explanation

In addition, the following criteria will be considered:

Evidence of correct procedures

- All necessary steps in the analysis are presented in the correct order
- Clear presentation of mathematical work

Evidence of an understanding of the topic

- Use of correct principles and theories
- Interpretation of results as necessary

Professional presentation

- Appropriate use of diagrams, clear diagrams
- Use of correct terminologies and conventions

**Submission**

Online Group

**Learning Outcomes Assessed**

- Determine various types of loads acting on a structural system, provide a rationale for load combinations applied, and conceptualise the load resisting concrete structural systems
- Formulate, plan, manage, and complete projects, individually or in teams, in an ethical and professional manner considering stakeholder requirements and principals of sustainable development
- Design prestressed concrete structural components using appropriate Australian Standards
- Use appropriate software to analyse and/or design the structural components subjected to different load combinations
- Demonstrate a professional level of communication and leadership.

**Graduate Attributes**

- Knowledge
- Communication
- Cognitive, technical and creative skills
- Research
- Self-management
- Ethical and Professional Responsibility
- Leadership

## 3 Class Test

**Assessment Type**

In-class Test(s)

**Task Description**

End-of-Term assessment will be conducted in the form of a class test during the examination week.

Date: Wednesday, 14th of June 2023 at 09:00 AM AEST

Duration of the Test: 3 hours

This class test will be conducted at the Melbourne and Rockhampton campuses at the same time. All students (including distance mode students) must present on one of these campuses to complete the test. On request (with a valid reason) this test may be arranged at another campus of CQUni. Any such request should be forwarded to the unit coordinator before Friday Week 6 of the term.

**Assessment Due Date**

Exam Week Wednesday (14 June 2023) 12:00 pm AEST

**Return Date to Students**

On the Certification of Grade day

**Weighting**

40%

**Minimum mark or grade**

50%

**Assessment Criteria**

Each question will be assessed based on the following criteria.

- Correct application of mathematics and arithmetic
- The problem clearly identified and explained in the answer
- Correct results/explanation

In addition, the following criteria will be considered:

Evidence of correct procedures

- All necessary steps in the analysis are presented in the correct order
- Clear presentation of mathematical work

Evidence of an understanding of the topic

- Use of correct principles and theories
- Interpretation of results as necessary

Professional presentation

- Appropriate use of diagrams, clear diagrams
- Use of correct terminologies and conventions
- Clear English in the explanation of procedure and interpretation of results

**Submission**

Offline

**Learning Outcomes Assessed**

- Design complex reinforced concrete structural components using appropriate Australian Standards
- Design prestressed concrete structural components using appropriate Australian Standards

**Graduate Attributes**

- Knowledge
- Communication
- Cognitive, technical and creative skills
- Self-management

## 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