ENEM12009 *Structural Mechanics*
Term 1 - 2023

Profile information current as at 07/05/2024 07:00 am

General Information

Overview

In this unit, you will study the behaviour of solid bodies under different loadings by applying basic stress analysis principles and the introductory knowledge of engineering materials. You will gain in-depth understanding of the concepts of continuum stress, strain and deflection; analyse the response of mechanical components to axial, transverse, torsional, bending and buckling loads in the linear elastic regime. You will apply the theory of generalised Hooke's law to design pressure vessels and similar thin walled structures. You will perform calculations concerned with the mechanical properties of materials and conceptually design different mechanical components and structures based on strength, stiffness and stability. You will acquire the skills and knowledge required to develop analytical techniques that are used to solve a wide range of linear stress/strain problems in engineering practice.

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

Pre-requisites: (MATH11160 Technology Mathematics or MATH11218 Applied Mathematics) AND (ENEG11006 Engineering Statics or ENEM12007 Statics & Dynamics) AND (ENEG11008 Materials for Engineers or ENEG12005 Material 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 1 - 2023

- 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. **Written Assessment**
Weighting: 20%
2. **Written Assessment**
Weighting: 20%
3. **Written Assessment**
Weighting: 20%
4. **Written Assessment**
Weighting: Pass/Fail
5. **Examination**
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 Student evaluation

Feedback
The unit delivery and student learning was good

Recommendation
This good practice will be continued.

Feedback from Student grades

Feedback
A high number of students had to sit Supplementary Examinations

Recommendation
Additional resources and guidance will be provided to assist students with their exam preparations.

Unit Learning Outcomes

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

1. Analyse the elastic behaviour of engineering structures and components and determine stresses, principal stresses, strains and deflections and the effects of impact loads
2. Analyse stress and strain using theoretical methods
3. Explain theories of failure and apply failure analysis to structures and components
4. Describe the nature of engineering assumptions and explain both the approaches used to deal with uncertainty and limitations of the validity of results
5. Prepare professional, technical project documentation showing the evaluation of uncertainties and results obtained
6. Communicate, work and learn independently and collaboratively and communicate in a professional manner.

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 1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline. (LO: 1N 3N 4N) 1.6 Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline. (LO: 1N 3N 4N) 3.5 Orderly management of self, and professional conduct. (LO: 1N 3N 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 2N 3I 4I 5N 6N) 1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline. (LO: 1N 3I 4I 5N) 1.4 Discernment of knowledge development and research directions within the engineering discipline. (LO: 1N 3I 4I) 2.2 Fluent application of engineering techniques, tools and resources. (LO: 1I 2N 3I 4I 5I) 2.3 Application of systematic engineering synthesis and design processes. (LO: 1I 2N 3I 4I)

Advanced 1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline. (LO: 1I 2N 3A 4I 5N) 2.1 Application of established engineering methods to complex engineering problem-solving. (LO: 1I 2N 3A 4I)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 informationhttps://moodle.cqu.edu.au/course/view.php?id=1511

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 - Written Assessment - 20%	•	•				
2 - Written Assessment - 20%			•	•		
3 - Written Assessment - 20%			•		•	•
4 - Written Assessment - 0%				•	•	•
5 - Examination - 40%	•	•				

Alignment of Graduate Attributes to Learning Outcomes

Graduate Attributes	Learning Outcomes					
	1	2	3	4	5	6
1 - Communication	•	•	•	•	•	•
2 - Problem Solving	•	•	•	•		•
3 - Critical Thinking	•	•	•	•		
4 - Information Literacy				•	•	•
5 - Team Work						
6 - Information Technology Competence					•	•
7 - Cross Cultural Competence						
8 - Ethical practice						
9 - Social Innovation						
10 - Aboriginal and Torres Strait Islander Cultures						

Textbooks and Resources

Textbooks

ENEM12009

Prescribed

Mechanics of Materials
Edition: 7th SI (2015)
Authors: Beer and Johnston
McGraw-Hill
New York , NY , USA
ISBN: 978-9-814-59524-7
Binding: Hardcover

Additional Textbook Information
Copies 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)

Referencing Style

All submissions for this unit must use the referencing style: Harvard (author-date)
For further information, see the Assessment Tasks.

Teaching Contacts

Nirmal Mandal Unit Coordinator
n.mandal@cqu.edu.au

Schedule

Week 1 - 06 Mar 2023

Module/Topic	Chapter	Events and Submissions/Topic
Lecture - Elastic behaviour - stress, strain and displacement, concept of stresses: axial, bending and torsional stress components, Stress on an oblique plane, design criteria. Tutorial - Four tutorial problems will be supplied during the tutorial.	Chapter 1, Beer	

Week 2 - 13 Mar 2023

Module/Topic	Chapter	Events and Submissions/Topic

Lecture –Mechanical Properties of Materials, stress – strain diagram, Deformation, Hooke's Law (axial force). Tutorial- Four tutorial problems will be supplied during the session.	Chapter 2, Beer	

Week 3 - 20 Mar 2023

Module/Topic	Chapter	Events and Submissions/Topic
Lecture-: Stress –strain, Poisson's ratio – Generalised Hooke's Law, elastic-plastic deformation, residual stress. Tutorial- Four tutorial problems will be supplied during the tutorial.	Chapter 2, Beer	

Week 4 - 27 Mar 2023

Module/Topic	Chapter	Events and Submissions/Topic
Lecture- Torsional stress: Torsion formula, angle of twist, design of transmission shaft. Tutorial- Four tutorial problems will be supplied during the tutorial.	Chapter 3, Beer	**Assignment 1** Due: Week 4 Friday (31 Mar 2023) 11:45 pm AEST

Week 5 - 03 Apr 2023

Module/Topic	Chapter	Events and Submissions/Topic
Lecture- Stresses in bending loadings, analysis of bending stresses in beams. Tutorial- Four tutorial problems will be supplied during the tutorial	Chapter 4, Beer	

Vacation Week - 10 Apr 2023

Module/Topic	Chapter	Events and Submissions/Topic
Teaching free week	N/A	

Week 6 - 17 Apr 2023

Module/Topic	Chapter	Events and Submissions/Topic
Lecture – Design of beams for bending: shear force and bending moment diagrams. Tutorial- Four tutorial problems will be supplied during the tutorial.	Chapters 5 and 6, Beer	

Week 7 - 24 Apr 2023

Module/Topic	Chapter	Events and Submissions/Topic
Lecture- Transformations of stresses and strains: principal stresses, combined loadings. Tutorial- Four tutorial problems will be supplied during the tutorial.	Chapters 7 and 8, Beer	

Week 8 - 01 May 2023

Module/Topic	Chapter	Events and Submissions/Topic
Lecture- Deflections of beams, measurement methods and analysis Tutorial- a few problems will be given during the tutorial	Chapter 9, Beer	**Assignment 2** Due: Week 8 Friday (5 May 2023) 11:45 pm AEST

Week 9 - 08 May 2023

Module/Topic	Chapter	Events and Submissions/Topic
Lecture- Linear elastic buckling Tutorial- a few problems will be given during the tutorial	Chapter 10, Beer	

Week 10 - 15 May 2023

Module/Topic	Chapter	Events and Submissions/Topic
Lecture Failure theories of structural elements, Energy method Tutorial - a few problems will be given during the tutorial	Chapters 7 and 11, Beer	

Week 11 - 22 May 2023

Module/Topic	Chapter	Events and Submissions/Topic
Lecture- Fatigue and Fatigue life Tutorial- a few problems will be given during the tutorial	Lecturer notes	**Assignment 3** Due: Week 11 Friday (26 May 2023) 11:45 pm AEST

Week 12 - 29 May 2023

Module/Topic	Chapter	Events and Submissions/Topic
Lecture: Discussion on FEA and Review of unit Tutorial: Review tutorial problems	All Chapters	**Workbook** Due: Week 12 Friday (2 June 2023) 11:45 pm AEST

Review/Exam Week - 05 Jun 2023

Module/Topic	Chapter	Events and Submissions/Topic

Exam Week - 12 Jun 2023

Module/Topic	Chapter	Events and Submissions/Topic

Assessment Tasks

1 Assignment 1

Assessment Type
Written Assessment

Task Description
This assignment assesses contents from week 1 to week 4 of this unit. The assignment questions will be available in the Moodle site at the beginning of Week 1

Assessment Due Date
Week 4 Friday (31 Mar 2023) 11:45 pm AEST
Compulsory submission

Return Date to Students
Week 6 Friday (21 Apr 2023)
After two working weeks of submission date

Weighting
20%

Minimum mark or grade
50%

Assessment Criteria
It will be graded based on presentation, correct process and result, appropriate explanation, neat diagram, correct units, interpretation of results and analysis etc.

Referencing Style

- Harvard (author-date)

Submission
Online

Submission Instructions
It is not expected that students will type up calculations. Students should scan hand calculation for online submissions

Learning Outcomes Assessed

- Analyse the elastic behaviour of engineering structures and components and determine stresses, principal stresses, strains and deflections and the effects of impact loads
- Analyse stress and strain using theoretical methods

2 Assignment 2

Assessment Type
Written Assessment

Task Description
This assignment assesses contents from week 5 to week 8 of this unit. The assignment questions will be available on the Moodle site at the beginning of Week 5

Assessment Due Date
Week 8 Friday (5 May 2023) 11:45 pm AEST
Compulsory submission

Return Date to Students
Week 10 Friday (19 May 2023)
After two weeks of submission date

Weighting
20%

Minimum mark or grade
50%

Assessment Criteria
It will be graded based on presentation, correct processes and result, appropriate explanation, neat diagram, correct units, interpretation of results and analysis etc.

Referencing Style

- Harvard (author-date)

Submission
Online

Submission Instructions
It is not expected that students will type up calculations. Students should scan hand calculation for online submissions

Learning Outcomes Assessed

- Explain theories of failure and apply failure analysis to structures and components
- Describe the nature of engineering assumptions and explain both the approaches used to deal with uncertainty and limitations of the validity of results

3 Assignment 3

Assessment Type
Written Assessment

Task Description
This assignment assesses contents from week 9 to week 11 of this unit. The assignment questions will be available on the Moodle site at the beginning of Week 9

Assessment Due Date
Week 11 Friday (26 May 2023) 11:45 pm AEST
Compulsory submission

Return Date to Students
Review/Exam Week Friday (9 June 2023)
After two week of submission sate

Weighting
20%

Minimum mark or grade
50%

Assessment Criteria
It will be graded based on presentation, correct process and result, appropriate explanation, neat diagram, correct units, interpretation of results and analysis etc.

Referencing Style

- Harvard (author-date)

Submission
Online

Submission Instructions
It is not expected that students will type up calculations. Students should scan hand calculation for online submissions

Learning Outcomes Assessed

- Explain theories of failure and apply failure analysis to structures and components
- Prepare professional, technical project documentation showing the evaluation of uncertainties and results obtained
- Communicate, work and learn independently and collaboratively and communicate in a professional manner.

4 Workbook

Assessment Type
Written Assessment

Task Description
This assignment assesses contents from week 1 to week 12 of this unit.
The workbook is graded as a pass/fail based on the satisfactory performance of the criteria. You have to put solutions to problems in tutorials and lectures (if any) given on a weekly basis.

Assessment Due Date
Week 12 Friday (2 June 2023) 11:45 pm AEST
Compulsory submission

Return Date to Students
Exam Week Friday (16 June 2023)
After two weeks of submission date: A general e-mail on workbook assessment will be sent to the students through Moodle

Weighting
Pass/Fail

Minimum mark or grade
Students should obtain a Pass grade

Assessment Criteria
The criteria and associated weightings are given below. The allocations are as follows:
10% Presentation and layout - includes written appearance of the document, quality of arrangement in records, use of title sections, legality, etc.
90% Content - demonstrates the application of knowledge, adequate personal study and application of unit materials.

There should be evidence of application and analysis relating to each unit topic.

Referencing Style

- Harvard (author-date)

Submission
Online

Submission Instructions
It is not expected that students will type up calculations. Students should scan hand calculation for online submissions

Learning Outcomes Assessed

- Describe the nature of engineering assumptions and explain both the approaches used to deal with uncertainty and limitations of the validity of results
- Prepare professional, technical project documentation showing the evaluation of uncertainties and results obtained
- Communicate, work and learn independently and collaboratively and communicate in a professional manner.

Examination

Outline
Complete an invigilated examination.

Date
During the examination period at a CQUniversity examination centre.

Weighting
40%

Length
180 minutes

Minimum mark or grade
50%

Exam Conditions
Closed Book.

Materials
Dictionary - non-electronic, concise, direct translation only (dictionary must not contain any notes or comments).
Calculator - non-programmable, no text retrieval, silent only

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