



ENEX13003 *Design of Mechatronics Elements*

Term 2 - 2021

Profile information current as at 27/09/2024 10:12 am

All details in this unit profile for ENEX13003 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

This unit will introduce you to the fundamentals of mechatronics element design. You will learn the design principles and rules of fundamental mechanical elements, fundamental electromechanical elements, simple power transmission elements, and complex mechatronics systems. You will also learn solid modelling and selection of electromechanical sensors and actuators. 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 3*

Credit Points: 6

Student Contribution Band: 8

Fraction of Full-Time Student Load: 0.125

Pre-requisites or Co-requisites

Prerequisites: ENEG11005 Fundamentals of Professional Engineering and ENEM12010 Engineering Dynamics

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
- Mixed Mode
- Rockhampton

Attendance Requirements

All on-campus students are expected to attend scheduled classes – in some units, these classes are identified as a mandatory (pass/fail) component and attendance is compulsory. International students, on a student visa, must maintain a full time study load and meet both attendance and academic progress requirements in each study period (satisfactory attendance for International students is defined as maintaining at least an 80% attendance record).

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. **Electronic Focused Interactive Learning (eFIL)**

Weighting: 30%

3. **Take Home Exam**

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 Students' teaching comments

Feedback

Students appreciated the bi-weekly follow-up sessions so that they could clarify questions as progressing.

Recommendation

The Unit Coordinator will make an effort to keep the level of interactions high.

Feedback from Student Unit and Teaching Evaluation

Feedback

Students felt lacking in interactions with lectures and tutorials delivered in recordings.

Recommendation

The lectures and tutorials will be delivered live in Term 2, 2021 to enhance students' engagement and interactions.

Feedback from Student Unit and Teaching Evaluation

Feedback

Students found assessment feedback was helpful and provided in a timely manner so that they were able to consolidate their understanding.

Recommendation

The Unit Coordinator will strive to provide the best possible feedback on students' assessment items for a better student learning experience.

Feedback from Self reflection

Feedback

Students could easily get lost for some of the design processes due to their tediousness.

Recommendation

The Unit Coordinator will make an effort to develop more intuitive ways for students to learn the design process of machine elements.

Unit Learning Outcomes

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

1. Explain design principles and rules of fundamental mechatronics elements
2. Apply stress analysis and fatigue analysis theories, and failure modes to design simple mechatronics elements
3. Analyse the design requirements and select most suitable components from manufacturers' catalogues
4. Analyse static and dynamic loading conditions of mechatronics elements using industry standard software
5. Design simple electromechanical power transmission units and model them using industry standard solid modelling software
6. Solve real-life problems and communicate professionally using mechatronics engineering terminology, symbols, and diagrams that conform to Australian and international standards
7. Work individually, and collaboratively in teams, communicate professionally in presenting your solutions.

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 2.2 Fluent application of engineering techniques, tools and resources. (LO: 4I 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: 1A) 1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline. (LO: 1A 2A 4A) 1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline. (LO: 1A 2I 3A 4A 5A) 1.4 Discernment of knowledge development and research directions within the engineering discipline. (LO: 1A 3I 5A 6A) 1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline. (LO: 1A 2A 3I 4A 5I 6A) 1.6 Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline. (LO: 1I 2I 3I 4A 5I 6A) 2.1 Application of established engineering methods to complex engineering problem solving. (LO: 2A 3A 4A 5A 6A) 2.3 Application of systematic engineering synthesis and design processes. (LO: 1I 2I 3I 4I 5I 6A) 2.4 Application of systematic approaches to the conduct and management of engineering projects. (LO: 3I 5I 6A) 3.2 Effective oral and written communication in professional and lay domains. (LO: 5A 6A 7A) 3.3 Creative, innovative and pro-active demeanour. (LO: 5I 6A) 3.4 Professional use and management of information. (LO: 5A 6A 7A) 3.5 Orderly management of self, and professional conduct. (LO: 7A) 3.6 Effective team membership and team leadership. (LO: 7A)

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	6	7
1 - Written Assessment - 20%	•	•				•	

Assessment Tasks	Learning Outcomes						
	1	2	3	4	5	6	7
2 - Electronic Focused Interactive Learning (eFIL) - 30%			•	•		•	•
3 - Take Home Exam - 50%	•	•			•	•	

Alignment of Graduate Attributes to Learning Outcomes

Graduate Attributes	Learning Outcomes						
	1	2	3	4	5	6	7
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 - Written Assessment - 20%	•	•	•			•		•		
2 - Electronic Focused Interactive Learning (eFIL) - 30%	•	•	•			•		•		
3 - Take Home Exam - 50%	•	•	•					•		

Textbooks and Resources

Textbooks

ENEX13003

Prescribed

Shigley's Mechanical Engineering Design

10th Edition in SI units (2015)

Authors: Richard G. Budynas and J. Keith Nisbett

McGraw Hill

New York , New York , USA

ISBN: 978-981-3151-00-0

Binding: Paperback

Additional Textbook Information

If you prefer to study with a paper text, you can purchase one 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)
- Microsoft Teams

Referencing Style

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

For further information, see the Assessment Tasks.

Teaching Contacts

Jay Sul Unit Coordinator

j.sul@cqu.edu.au

Schedule

Week 1 - 12 Jul 2021

Module/Topic	Chapter	Events and Submissions/Topic
• Introduction to design of machine elements		
• Design Standards and Design Codes	Chapters 1 - 4	
• Design for Strength & Stiffness - Review of static design methods		

Week 2 - 19 Jul 2021

Module/Topic	Chapter	Events and Submissions/Topic
• Failure Modes and Prevention in Machine Elements		
• Failure Theories and Design for Static Loading	Chapter 5	

Week 3 - 26 Jul 2021

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> • Design for Variable Loading • Fatigue Life Methods - Stress-life & Strain-life Methods • Linear Elastic Fracture Mechanics (LEFM) Method 	Chapters 6	
Week 4 - 02 Aug 2021		
Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> • Design of Shafts - materials, shaft layout, shaft design for stress deflection considerations, critical speeds, limits and fits • Design of shaft components - keys and keyways 	Chapter 7	
Week 5 - 09 Aug 2021		
Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> • Design & Selection of Roller Bearings - Variable loading, Selection of ball, cylinder and tapered roller bearings • Design assessment, lubrication, mounting and enclosure design 	Chapter 11	
Vacation Week - 16 Aug 2021		
Module/Topic	Chapter	Events and Submissions/Topic
Week 6 - 23 Aug 2021		
Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> • Gears - types of gears, Spur gear terminology, Lewis Bending equation • AGMA Stress equations, AGMA Strength equations, dynamic, overload, size, surface condition factors 	Chapter 13	
Week 7 - 30 Aug 2021		
Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> • Design of Spur & Helical Gears - Load distribution, hardness ratio, stress cycle life, temperature, reliability factors • Design of gear trains - calculation of reduction ratios, power transmission 	Chapter 14	
Week 8 - 06 Sep 2021		
Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> • Design of Bevel Gears • Design of Worm Gears 	Chapter 15	Problem Solving Due: Week 8 Monday (6 Sept 2021) 9:00 am AEST
Week 9 - 13 Sep 2021		
Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> • Design of Machine frames & Housings • Design of Non-permanent Joints - Threads, Screws and Fasteners 	Chapter 8	Resident school to be held on 13-14 (Monday-Tuesday) September
Week 10 - 20 Sep 2021		
Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> • Design of Cams 	Lecture notes	
Week 11 - 27 Sep 2021		

Module/Topic	Chapter	Events and Submissions/Topic
• Design of Mechanical Springs	Chapter 10	CAD Modelling of Machine Elements Due: Week 11 Monday (27 Sept 2021) 9:00 am AEST
Week 12 - 04 Oct 2021		
Module/Topic	Chapter	Events and Submissions/Topic
• Design and selection of Actuators	Lecture Notes	
Review/Exam Week - 11 Oct 2021		
Module/Topic	Chapter	Events and Submissions/Topic
Exam Week - 18 Oct 2021		
Module/Topic	Chapter	Events and Submissions/Topic
		Take home exam Due: Exam Week Friday (22 Oct 2021) 11:59 pm AEST

Assessment Tasks

1 Problem Solving

Assessment Type

Written Assessment

Task Description

This assignment will consist of several numerical problems which you will solve and submit during the term. Each problem will be related to the syllabus covered in the first 6 weeks. Refer to the Unit Moodle Site for more comprehensive information about this task.

Assessment Due Date

Week 8 Monday (6 Sept 2021) 9:00 am AEST

Return Date to Students

Week 10 Monday (20 Sept 2021)

Weighting

20%

Minimum mark or grade

50%

Assessment Criteria

The main criteria for assessment are:

1. Development of accurate free body diagrams (FBDs) for the problems
2. Application of relevant theory and design equations to calculate required unknowns
3. Comments on the final results obtained

Refer to the assessment document for more detailed information

Referencing Style

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

Submission

Online

Submission Instructions

Submit your work as a PDF

Graduate Attributes

- Communication
- Problem Solving
- Critical Thinking
- Information Technology Competence
- Ethical practice

Learning Outcomes Assessed

- Explain design principles and rules of fundamental mechatronics elements
- Apply stress analysis and fatigue analysis theories, and failure modes to design simple mechatronics elements
- Solve real-life problems and communicate professionally using mechatronics engineering terminology, symbols, and diagrams that conform to Australian and international standards

2 CAD Modelling of Machine Elements

Assessment Type

Electronic Focused Interactive Learning (eFIL)

Task Description

In this task, you will use a recommended CAD package such as Autodesk Inventor or Solidworks and develop engineering drawings and CAD models following AS1100.101/201.

Assessment Due Date

Week 11 Monday (27 Sept 2021) 9:00 am AEST

Return Date to Students

Review/Exam Week Monday (11 Oct 2021)

Weighting

30%

Minimum mark or grade

50%

Assessment Criteria

The main assessment criteria for this task are:

1. Production of high quality engineering drawings as per AS1100.101/201
2. Procedural demonstration of CAD modelling

Referencing Style

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

Submission

Online

Submission Instructions

PDFs of all drawings.

Graduate Attributes

- Communication
- Problem Solving
- Critical Thinking
- Information Technology Competence
- Ethical practice

Learning Outcomes Assessed

- Analyse the design requirements and select most suitable components from manufacturers' catalogues
- Analyse static and dynamic loading conditions of mechatronics elements using industry standard software
- Solve real-life problems and communicate professionally using mechatronics engineering terminology, symbols, and diagrams that conform to Australian and international standards
- Work individually, and collaboratively in teams, communicate professionally in presenting your solutions.

3 Take home exam

Assessment Type

Take Home Exam

Task Description

This assessment item consists of two components.

1. You will design and fabricate a prototype of a machine element / component using basic workshop tools during the residential school. You will report your activities at the workshop and replicate your fabrication in 3D CAD.
2. You will answer a set of questions that will be set in a typical examination format. Each question shall be a combination of short answers and numerical questions.

Refer to the Unit Moodle site for more detailed information.

Assessment Due Date

Exam Week Friday (22 Oct 2021) 11:59 pm AEST

Its exact due date will be announced during the term.

Return Date to Students

Students to view marks and feedback in 2 weeks of submission

Weighting

50%

Minimum mark or grade

50%

Assessment Criteria

The main criteria for assessment are:

1. Correct models with desired design requirements and required output
2. All dimensions are clearly visible
3. Supporting text with each major step and rationale of the commands you used
4. Structuring and formatting of the document
5. Development of accurate free-body diagrams for the problems
6. Application of relevant theory and design equations to calculate required unknowns
7. Comments on the final results obtained

Referencing Style

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

Submission

Online

Submission Instructions

Submit your work as PDF

Graduate Attributes

- Communication
- Problem Solving
- Critical Thinking
- Ethical practice

Learning Outcomes Assessed

- Explain design principles and rules of fundamental mechatronics elements
- Apply stress analysis and fatigue analysis theories, and failure modes to design simple mechatronics elements
- Design simple electromechanical power transmission units and model them using industry standard solid modelling software
- Solve real-life problems and communicate professionally using mechatronics engineering terminology, symbols, and diagrams that conform to Australian and international standards

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