ENEX13003 *Design of Mechatronics Elements*
Term 2 - 2023

Profile information current as at 14/12/2025 12:30 pm

General Information

Overview
This unit will introduce you to the basics of mechatronics and machine design, including the design process, engineering mechanics and materials, failure prevention, and characteristics of the principal elements. You will develop an understanding of standard drawings in the communication and definition of parts and assemblies in accordance with Australian Standards. In this unit, you will also learn and apply Autodesk Inventor software or equivalent for drafting and design activities.

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, ENEG11008: Materials for Engineers, and ENEM12009: Structural Mechanics
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 - 2023

- Mackay
- Online

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: 30%
3. **Written Assessment**
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 Student Unit and Teaching Evaluation & personal communications

Feedback
Students praised that the unit contents were very practical and closely related to their potential job requirements.

Recommendation
The unit coordinator should further endeavour to identify practical skills and knowledge required from the industry and include these identified aspects in the unit for continued improvements.

Feedback from Student Unit and Teaching Evaluation

Feedback
Students liked the resourceful content and hands-on tutorial activities for nourishing skills in 3D modeling and simulations.

Recommendation
More case studies will be introduced in the lectures and more hands-on step-by-step tutorial activities will be provided to enhance students' learning experience.

Feedback from Student Unit and Teaching Evaluation & personal communications

Feedback
Students who did not take ENEM12009 felt disadvantaged.

Recommendation
ENEM12009 should be added as a prerequisite unit.

Feedback from Student Unit and Teaching Evaluation & personal communications

Feedback
Some of the students pointed out that some of the assessment tasks and expectations were not clear.

Recommendation
Assessment items should be reviewed and revised to clarify tasks and expectations. Furthermore, each assessment item should have a marking rubric.

Unit Learning Outcomes

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

1. Interpret technical drawings to ensure effective communication and minimum manufacturing error
2. Use common Computer-Aided Design (CAD) software to create a range of engineering components and their production drawings complying with Australian Standards
3. Apply analytical and numerical approaches to perform load, stress, and deflection analysis under static and variable loadings
4. Identify suitable machine and mechatronics elements from manufacturers' catalogues
5. Develop reporting skills to present design concepts effectively and professionally using suitable engineering terminology, symbols, and diagrams that conform to Australian Standards.

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

2.4 Application of systematic approaches to the conduct and management of engineering projects. (LO: 3I 5I)

3.3 Creative, innovative and pro-active demeanour. (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: 1A)

1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline. (LO: 1A 3A 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 2I 3I 4A)

1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline. (LO: 1A 2A 3I 4A)

1.6 Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline. (LO: 1I 2A 3I 4A 5I)

2.1 Application of established engineering methods to complex engineering problem solving. (LO: 3A 4A 5A)

2.2 Fluent application of engineering techniques, tools and resources. (LO: 2A 4I 5I)

2.3 Application of systematic engineering synthesis and design processes. (LO: 1I 2I 3A 4A 5I)

3.2 Effective oral and written communication in professional and lay domains. (LO: 5A)

3.4 Professional use and management of information. (LO: 5A)

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

— 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
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

There are no required textbooks.

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

Jay Sul Unit Coordinator
j.sul@cqu.edu.au

Schedule

Week 1 - 10 Jul 2023

Module/Topic	Chapter	Events and Submissions/Topic
Overview of Engineering drawings - Recap of Engineering design and ENEM12009: Structural mechanics - Introduction to AS1100: Technical Drawings, Part 101: General Principles	Lecture notes AS1100, Part 101	

Week 2 - 17 Jul 2023

Module/Topic	Chapter	Events and Submissions/Topic
Details in engineering drawing - Introduction to AS1100: Technical Drawings, Part 201: Mechanical engineering drawing - Recap of Materials in Machine Design	Lecture notes AS1100, Part 201	

Week 3 - 24 Jul 2023

Module/Topic	Chapter	Events and Submissions/Topic
Geometric dimension and tolerancing & Failure under cyclic loading - Case studies - Recap of failure theories	Lecture notes	

Week 4 - 31 Jul 2023

Module/Topic	Chapter	Events and Submissions/Topic
Basics and design of shafts & Limits and fits - Shaft layout - Critical locations - Other shaft components	Lecture notes Chapter 7, Shigley	

Week 5 - 07 Aug 2023

Module/Topic	Chapter	Events and Submissions/Topic
Basics and design of rolling-contact bearings and gears - Bearing types and life - Selection of ball bearings - Types of gears - Terminology - Force analysis - Efficiency of gear trains	Lecture notes, Chapters 11 & 13, Shigley	**Interpretation of technical drawings and construction of 3D models** Due: Week 5 Monday (7 Aug 2023) 11:59 pm AEST

Vacation Week - 14 Aug 2023

Module/Topic	Chapter	Events and Submissions/Topic

Week 6 - 21 Aug 2023

Module/Topic	Chapter	Events and Submissions/Topic
Assembly drawing and assembly in Autodesk Inventor - Necessary information - List of the parts needed - Showing how to assemble the parts	Lecture notes	

Week 7 - 28 Aug 2023

Module/Topic	Chapter	Events and Submissions/Topic
Design of cams and Dynamic simulations in Autodesk Inventor - Terminology in cams - Fundamental law of cam design - Practical design considerations	Lecture notes	

Week 8 - 04 Sep 2023

Module/Topic	Chapter	Events and Submissions/Topic
Design of mechanical springs - Stresses in Helical springs - Deflection in Helical springs - Modelling of mechanical springs	Lecture notes Chapter 10, Shigley	

Week 9 - 11 Sep 2023

Module/Topic	Chapter	Events and Submissions/Topic
Mechanical seal for underwater applications - Static vs dynamic seals - Ingress Protection rating	Lecture note	**Design of a mechanism for rotating-reciprocating motion** Due: Week 9 Monday (11 Sept 2023) 11:59 pm AEST

Week 10 - 18 Sep 2023

Module/Topic	Chapter	Events and Submissions/Topic
Practical basics of FEA and FEA in Inventor - Finite element solution process - Types of finite elements - Boundary conditions	Lecture notes Chapter 19, Shigley	

Week 11 - 25 Sep 2023

Module/Topic	Chapter	Events and Submissions/Topic
Selection of electrical motors and batteries - Performance curves of DC motors and rated parameters - Consideration of start-up torque - Types of batteries	Lecture notes	

Week 12 - 02 Oct 2023

Module/Topic	Chapter	Events and Submissions/Topic
Future of technical drawings and sustainability in design - Model-based definition that integrates CAD/CAM/CAI into a digital workflow - Sustainable design embracing social, economic, and environmental impacts	Lecture notes	

Review/Exam Week - 09 Oct 2023

Module/Topic	Chapter	Events and Submissions/Topic
		Design and analysis of a cordless underwater cleaning mechanism Due: Review/Exam Week Monday (9 Oct 2023) 11:59 pm AEST

Exam Week - 16 Oct 2023

Module/Topic	Chapter	Events and Submissions/Topic

Assessment Tasks

1 Interpretation of technical drawings and construction of 3D models

Assessment Type
Written Assessment

Task Description
Task 1: Create an engineering drawing template in A1 and A4 sizes in accordance with AS1100 using Autodesk Inventor Professional (DWG)
Task 2: Create a 3D model in Autodesk Inventor for the technical drawings attached separately.
Task 3: Create a technical drawing of the object given.
Task 4: Design a shaft under the given loading and layout conditions.

Assessment Due Date
Week 5 Monday (7 Aug 2023) 11:59 pm AEST

Students to submit their report to the link provided in the unit's Moodle site.

Return Date to Students
Week 7 Monday (28 Aug 2023)

Students can access feedback through Turnitin Feedback Studio using the same link for submission.

Weighting
20%

Minimum mark or grade
50%

Assessment Criteria
Your work will be assessed against the following items:
1. Demonstration of a good understanding of AS1100.101 and .201 by using correct techniques in technical drawings
2. Understanding underlying theories to design and select the most suitable machine elements
3. Application of correct dimensioning and tolerances in technical drawings

Referencing Style

- Harvard (author-date)

Submission
Online

Submission Instructions
Students are required to submit a report together with drawing files using the link provided in the unit's Moodle site.

Learning Outcomes Assessed

- Interpret technical drawings to ensure effective communication and minimum manufacturing error
- Apply analytical and numerical approaches to perform load, stress, and deflection analysis under static and variable loadings
- Develop reporting skills to present design concepts effectively and professionally using suitable engineering terminology, symbols, and diagrams that conform to Australian Standards.

2 Design of a mechanism for rotating-reciprocating motion

Assessment Type
Written Assessment

Task Description
Task 1: Design of a gear reduction mechanism
Task 2: Design of a mechanism for rotating-reciprocating motion
Task 3: Dynamic simulation of the design system
Task 4: Creating engineering drawings

Assessment Due Date
Week 9 Monday (11 Sept 2023) 11:59 pm AEST

Students to submit their report to the link provided in the unit's Moodle site.

Return Date to Students
Week 11 Monday (25 Sept 2023)

Students can access feedback through Turnitin Feedback Studio using the same link for submission.

Weighting
30%

Minimum mark or grade
50%

Assessment Criteria
Your work will be assessed against the following items for each task.
- Task 1 (/25%)
Size requirement
Application of relevant analysis for shafts, gears, and location of bearings based on the appropriate failure theories
Consideration of relevant materials for each machine element
- Task 2 (/25%)
Meeting the design requirements from the given input for the required output
Application of relevant analysis for reciprocating elements based on the appropriate failure theories
Consideration of relevant materials for each machine element
- Task 3 (/25%)
Modelling of each element in Autodesk Inventor
Part assembly and subassemblies for the final product in Inventor
Verfication of the mechanism designed using Dynamic Simulation in Inventor
Graphs and/or tables to demonstrate the results
- Task 4 (/25%)
Drawing for each element
Assembly drawing showing how all elements come together
Part list and BOM

Referencing Style

- Harvard (author-date)

Submission
Online

Submission Instructions
Students are required to submit a report together with drawing and modelling files using the link provided in the unit's Moodle site.

Learning Outcomes Assessed

- Interpret technical drawings to ensure effective communication and minimum manufacturing error
- Use common Computer-Aided Design (CAD) software to create a range of engineering components and their production drawings complying with Australian Standards
- Identify suitable machine and mechatronics elements from manufacturers' catalogues
- Develop reporting skills to present design concepts effectively and professionally using suitable engineering terminology, symbols, and diagrams that conform to Australian Standards.

3 Design and analysis of a cordless underwater cleaning mechanism

Assessment Type
Written Assessment

Task Description
Task 1: Design of a required mechanism for underwater cleaning
Task 2: Selection of suitable electric motor and battery
Task 3: Design of an underwater enclosure to meet IP68
Task 4: Numerical analysis of the design
Task 5: Creation of assembly drawings

Assessment Due Date
Review/Exam Week Monday (9 Oct 2023) 11:59 pm AEST

Students to submit their report to the link provided in the unit's Moodle site.

Return Date to Students

Students can access feedback through Turnitin Feedback Studio using the same link for submission.

Weighting
50%

Minimum mark or grade
50%

Assessment Criteria
Your work will be assessed against the following items for each task.
- Task 1 (/20%)
Size and weight requirement
Application of relevant analysis for shafts, gears, and location of bearings based on the appropriate failure theories
Consideration of relevant materials for each machine element
Meeting the design requirements from the given input for the required output
- Task 2 (/15%)
Choice of a suitable electric motor to provide the required input for the mechanism
Choice of a suitable battery for the design system and analysis of the expected operating hours
- Task 3 (/25%)
Selection of suitable O-rings / gaskets
Design of static/dynamic seals
3D modelling of the final design
- Task 4 (/30%)
Dynamic simulation results to verify the mechanism
FEA analysis for its structural integrity and sealing
- Task 5 (/10%)
Assembly drawing showing how all elements come together
Part list and BOM

Referencing Style

- Harvard (author-date)

Submission
Online

Submission Instructions
Students are required to submit a report together with drawing and modelling files using the link provided in the unit's Moodle site.

Learning Outcomes Assessed

- Use common Computer-Aided Design (CAD) software to create a range of engineering components and their production drawings complying with Australian Standards
- Apply analytical and numerical approaches to perform load, stress, and deflection analysis under static and variable loadings
- Identify suitable machine and mechatronics elements from manufacturers' catalogues

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