



ENEX13003 *Design of Mechatronics Elements*

Term 2 - 2019

Profile information current as at 20/04/2024 08:36 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.

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 - 2019

- Mackay
- Mixed Mode

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. **Practical and Written Assessment**

Weighting: 20%

3. **Practical and Written Assessment**

Weighting: 20%

4. **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 'Have your say' feedback

Feedback

The use of Autodesk Inventor was considered useful.

Recommendation

The labs in this unit require 3D modeling and simulation software to be used to implement some of the learning concepts. The same software will be used in the future offerings.

Feedback from 'Have your say' feedback

Feedback

The TAFE hands-on activities and residential school were interesting to students.

Recommendation

These hands-on activities give the students an opportunity to implement basic tools to measure, cut, and join materials. These activities will be continued in further offerings.

Feedback from 'Have your say' feedback

Feedback

Guidelines on lab reports need to be improved.

Recommendation

The guidelines on what is expected while attempting lab questions will be improved and discussed with the students.

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

Learning outcomes are linked to Engineers Australia Stage 1 Competencies and also discipline capabilities. You can find the mapping for this on the [Engineering Undergraduate Course website](#).

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

Assessment Tasks	Learning Outcomes						
	1	2	3	4	5	6	7
1 - Written Assessment - 20%	•	•				•	
2 - Practical and Written Assessment - 20%		•	•	•	•	•	•
3 - Practical and Written Assessment - 20%		•	•	•	•	•	•
4 - Examination - 40%	•	•				•	

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 - Practical and Written Assessment - 20%	•	•	•			•		•		
3 - Practical and Written Assessment - 20%	•	•	•		•	•	•	•		
4 - Examination - 40%	•	•	•					•		

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

Books:

All books are available from the CQUni Bookshop here: <http://bookshop.cqu.edu.au>

Software:

Autodesk Inventor (or any 3D modelling software)

(We will use the software for 3D solid modelling of some selected machine elements or systems. Please check if the software is available free of charge for students – only for personal use - at the following site. You may need to create an account using cqu mail)

http://www.autodesk.com/education/free-software/inventor-professional?_ga=1.113196420.1238353875.1479429906

Alternatively it is available for use in Mackay Ooralea computer lab (24/G.46).

Misc IT Resources:

- > Computer with windows
- > Internet with access to Moodle unit website
- > CQ University Student Email
- > Software access as per the description above

[View textbooks at the CQUniversity Bookshop](#)

IT Resources

You will need access to the following IT resources:

- CQUniversity Student Email
- Internet
- Unit Website (Moodle)
- Software access as per the description under software section

Referencing Style

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

For further information, see the Assessment Tasks.

Teaching Contacts

Umer Izhar Unit Coordinator

u.izhar@cqu.edu.au

Schedule

Week 1 - 15 Jul 2019

Module/Topic	Chapter	Events and Submissions/Topic
Load and Stress Analysis	Chap 3: Text Book	Example Problems (Stress, Strain, Mohr Circle) Discussion on unit requirements

Week 2 - 22 Jul 2019

Module/Topic	Chapter	Events and Submissions/Topic
Deflection and Stiffness	Chap 4: Text Book	Example problems (Beam deflection, Singularity functions)

Week 3 - 29 Jul 2019

Module/Topic	Chapter	Events and Submissions/Topic
Failures Resulting from Static Loading	Chap 5: Text Book	Example problems (Stress Concentration, Failure Theories)

Week 4 - 05 Aug 2019

Module/Topic	Chapter	Events and Submissions/Topic
Failure due to Static and Variable Loading	Chap 5 & 6: Text Book	Example Problems (Strain Energy, Castigliano's Theorem) Review and Discuss Assessment 1

Week 5 - 12 Aug 2019

Module/Topic	Chapter	Events and Submissions/Topic
Failure due to Variable Loading	Chap 6: Text Book	Example Problems (Fatigue, Failure, Endurance) Computer Lab Session (3D Modeling and Simulation)

Written Assessment Due: Week 5
Friday (16 Aug 2019) 11:55 pm AEST

Vacation Week - 19 Aug 2019

Module/Topic	Chapter	Events and Submissions/Topic
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Week 6 - 26 Aug 2019

Module/Topic	Chapter	Events and Submissions/Topic
Screws and Fasteners	Chap 8: Text Book	Example Problems

Week 7 - 02 Sep 2019

Module/Topic	Chapter	Events and Submissions/Topic
Cams	Slides / Lecture Material	Example Problems (SVAJ Diagrams, Cam Design) Computer Lab Session (Threads, Animations)

Week 8 - 09 Sep 2019

Module/Topic	Chapter	Events and Submissions/Topic
Gear Analysis	Chap 13-15 (selected topics): Text Book	Example Problems (Gear parameters, Meshing, Transmissions)

Week 9 - 16 Sep 2019

Module/Topic	Chapter	Events and Submissions/Topic
Mechanical Springs	Chap 10: Text Book	Example Problems (Stresses, Compression, Stability.) Computer Lab Session (springs, gears)

Week 10 - 23 Sep 2019

Module/Topic	Chapter	Events and Submissions/Topic
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Power Transmission: Case study

Chap 18: Text Book

Res School 25th - 27th Sep
Power transmission focused on gear portion of the power transmission assembly

Week 11 - 30 Sep 2019

Module/Topic	Chapter	Events and Submissions/Topic
Electromechanical Actuators	Slides / Lecture Material	Electromagnetic / Electromechanical Actuators (Linear actuators, Relays etc.) Practical and Written Assessment Due: Week 11 Monday (30 Sept 2019) 11:55 pm AEST

Week 12 - 07 Oct 2019

Module/Topic	Chapter	Events and Submissions/Topic
Misc. Topics	Slides / Lecture Material	Topics / Exam Review

Review/Exam Week - 14 Oct 2019

Module/Topic	Chapter	Events and Submissions/Topic
		Practical and Written Assessment Due: Review/Exam Week Monday (14 Oct 2019) 11:55 pm AEST

Exam Week - 21 Oct 2019

Module/Topic	Chapter	Events and Submissions/Topic
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Term Specific Information

This unit deals mainly with one textbook but some topics will be discussed from other resources. Book and software information is given under textbook and resources tab. Further guidelines about the unit in general can be found on Moodle unit website. Students are advised and encouraged to use Q&A forum for queries about assignments, labs, and software etc.

This is a graded unit and you must obtain a minimum of 50% marks including a minimum of 50% marks in the final exam to pass the unit (refer assessment information for passing marks of individual assessments). All assignments, labs, and practicals are mandatory for the students. This unit has residential school requirements so please refer to Moodle website for the schedule.

Assessment Tasks

1 Written Assessment

Assessment Type

Written Assessment

Task Description

This assessment will cover topics from first five weeks of this unit and will consist mainly of numerical problems. The assessment criteria will be provided with the questions well before the submission date and will be strictly followed. The students are not expected to use word editor for this task, instead they can scan a clear and legible handwritten document and submit it as a pdf file.

Assessment Due Date

Week 5 Friday (16 Aug 2019) 11:55 pm AEST

Return Date to Students

Week 6 Friday (30 Aug 2019)

Weighting

20%

Assessment Criteria

1. Correct Answers
2. Correct format of the questions and the submission itself (cover page, page orientation, pg. numbering etc.)
3. All working must be shown to obtain full marks
4. Assignment answers must be neat, tidy, and legible

Referencing Style

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

Submission

Online

Submission Instructions

One pdf file including solutions and any handwritten data.

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

Graduate Attributes

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

2 Practical and Written Assessment

Assessment Type

Practical and Written Assessment

Task Description

This assessment corresponds to mainly computer lab sessions covering various topics from the unit. The lab will mainly require you to use 3D modeling software to design and model a mechatronics component (such as links, shafts, cams, gears, springs etc.). You will use finite element analysis to determine different mechanical attributes of the component. The practical feasibility of the modeled component will be tested using 3D printers (depending on availability). The details of lab exercises will be available from the unit Moodle website at the start of the term.

Assessment Due Date

Week 11 Monday (30 Sept 2019) 11:55 pm AEST

Return Date to Students

Review/Exam Week Monday (14 Oct 2019)

Weighting

20%

Minimum mark or grade

50% of total assessment marks

Assessment Criteria

1. Correct answers including design steps, pictures, and figures
2. Readability and format of the submissions

Referencing Style

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

Submission

Online

Submission Instructions

One zipped file / folder containing pictures, software file and lab report

Learning Outcomes Assessed

- Apply stress analysis and fatigue analysis theories, and failure modes to design simple mechatronics elements
- 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
- 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
- Work individually and collaboratively in teams, communicate professionally in presenting your solutions

Graduate Attributes

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

3 Practical and Written Assessment

Assessment Type

Practical and Written Assessment

Task Description

As a part of this assessment you will design and fabricate a prototype of a machine element / component using basic workshop tools.

The details will be available from the unit Moodle website at the start of the term. This task is related to the residential school workshop activity so it will be a mandatory assessment.

Assessment Due Date

Review/Exam Week Monday (14 Oct 2019) 11:55 pm AEST

Return Date to Students

In 2 weeks of submission

Weighting

20%

Minimum mark or grade

50% of total assessment marks

Assessment Criteria

1. Report including design, pictures, and figures of hands-on fabricated component
2. Component fabrication within tolerances
3. Readability and format of the submissions

Referencing Style

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

Submission

Online

Submission Instructions

One zipped file / folder containing pictures, software file, movie file of animation and lab report

Learning Outcomes Assessed

- Apply stress analysis and fatigue analysis theories, and failure modes to design simple mechatronics elements
- 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
- 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
- Work individually and collaboratively in teams, communicate professionally in presenting your solutions

Graduate Attributes

- Communication
- Problem Solving

- Critical Thinking
- Team Work
- Information Technology Competence
- Cross Cultural Competence
- Ethical practice

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

Open Book.

Materials

Dictionary - non-electronic, concise, direct translation only (dictionary must not contain any notes or comments).

Calculator - all non-communicable calculators, including scientific, programmable and graphics calculators are authorised

Law dictionaries, Business and Law dictionaries (discipline specific dictionaries) are authorised.

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