ENEX13003 *Design of Mechatronics Elements*
Term 2 - 2019

Profile information current as at 02/05/2024 09:40 pm

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

— 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	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, Catigliano'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 (Fatigure, 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

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

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**

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 mechtatronics 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