ENEX13003 *Design of Mechatronics Elements*
Term 2 - 2020

Profile information current as at 27/09/2024 10:19 am

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 - 2020

- 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. **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 Have your say feedback

Feedback
Labs and relevant explanation were appreciated by students.

Recommendation
Efforts will be made to make labs more interesting and engaging.

Feedback from Have your say feedback

Feedback
Text book was useful in understanding concepts.

Recommendation
This textbook is used throughout the world as a standard text. Same text will be used for future offerings.

Feedback from Have your say feedback

Feedback
Some students found exam a bit difficult.

Recommendation
Exam covers key concepts from the unit and is based on the content discussed in lectures and tutes. More questions will be practiced in tutes to prepare students for the exam.

Feedback from Self reflection

Feedback
Students need to be made aware of the available learning resources.

Recommendation
Information on types and location of learning resources available to the students will be communicated throughout the term.

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
1 - Written Assessment - 20%	•	•				•	
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 copy, they are available at the CQUni Bookshop here: http://bookshop.cqu.edu.au (search on the Unit code). eBooks are available at the publisher's website.

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

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

Schedule

Week 1 - 13 Jul 2020

Module/Topic	Chapter	Events and Submissions/Topic
• Introduction to design of machine elements • Design Standards and Design Codes • Design for Strength & Stiffness - Review of static design methods	Lecture Notes Chapters 1 - 4	Discussion on assessments, unit expectations Tutorial: Introduction to Machine Drawing and CAD modelling

Week 2 - 20 Jul 2020

Module/Topic	Chapter	Events and Submissions/Topic
• Failure Modes and Prevention in Machine Elements • Failure Theories and Design for Static Loading	Lecture Notes Chapter 5	Solved example problems, design case study Tutorial: Problem Solving. Instruction on 2D engineering drawing

Week 3 - 27 Jul 2020

Module/Topic	Chapter	Events and Submissions/Topic

• Design for Variable Loading • Fatigue Life Methods - Stress-life & Strain-life Methods • Linear Elastic Fracture Mechanics (LEFM) Method	Lecture Notes Chapters 6	Solved example problems, design case study Tutorial: Problem Solving. Instruction on 2D engineering drawing

Week 4 - 03 Aug 2020

Module/Topic	Chapter	Events and Submissions/Topic
• Design of Shafts – materials, shaft layout, shaft design for stress deflection considerations, critical speeds, limits and fits • Design of shaft components - keys and keyways	Lecture Notes Chapter 7	Tutorial: Problem Solving. Instruction on 2D engineering drawing

Week 5 - 10 Aug 2020

Module/Topic	Chapter	Events and Submissions/Topic
• Design & Selection of Roller Bearings - Variable loading, Selection of ball, cylinder and tapered roller bearings • Design assessment, lubrication, mounting and enclosure design	Lecture Notes Chapter 11	Solved example problems, Design case study Tutorial: Problem Solving. Instruction on 2D engineering drawing **Problem Solving** Due: Week 5 Friday (14 Aug 2020) 11:59 pm AEST

Vacation Week - 17 Aug 2020

Module/Topic	Chapter	Events and Submissions/Topic

Week 6 - 24 Aug 2020

Module/Topic	Chapter	Events and Submissions/Topic
• Gears – types of gears, Spur gear terminology, Lewis Bending equation • AGMA Stress equations, AGMA Strength equations, dynamic, overload, size, surface condition factors	Lecture Notes Chapter 13	Solved example problems, Design case study Tutorial: Introduction to CAD modelling

Week 7 - 31 Aug 2020

Module/Topic	Chapter	Events and Submissions/Topic
• 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	Lecture Notes Chapter 14	Solved example problems, Design case study Tutorial: CAD exercise

Week 8 - 07 Sep 2020

Module/Topic	Chapter	Events and Submissions/Topic
• Design of Bevel Gears • Design of Worm Gears	Lecture Notes Chapter 15	Solved example problems, Design case study Tutorial: CAD exercise

Week 9 - 14 Sep 2020

Module/Topic	Chapter	Events and Submissions/Topic
• Design of Machine frames & Housings • Design of Non-permanent Joints - Threads, Screws and Fasteners	Lecture Notes Chapter 8	Solved example problems Tutorial: CAD exercise

Week 10 - 21 Sep 2020

Module/Topic	Chapter	Events and Submissions/Topic
• Design of Cams	Lecture Notes	Solved example problems Tutorial: CAD exercise

Week 11 - 28 Sep 2020

Module/Topic	Chapter	Events and Submissions/Topic
• Design of Mechanical Springs	Lecture Notes Chapter 10	Solved example problems, Design case study **CAD Modelling of Machine Elements** Due: Week 11 Monday (28 Sept 2020) 11:59 pm AEST

Week 12 - 05 Oct 2020

Module/Topic	Chapter	Events and Submissions/Topic
• Design and selection of Actuators	Lecture Notes	Solved example problems

Review/Exam Week - 12 Oct 2020

Module/Topic	Chapter	Events and Submissions/Topic

Exam Week - 19 Oct 2020

Module/Topic	Chapter	Events and Submissions/Topic

Term Specific Information

There will be no residential school in T2/2020 owing to COVID-19 social distancing guidelines. This is replaced with take home exercises. Similarly, the final examination is replaced with a take home exam. Please refer to the changes in assessments for this term.

Assessment Tasks

1 Problem Solving

Assessment Type
Written Assessment

Task Description
This assignment will consist of 5 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 5 Friday (14 Aug 2020) 11:59 pm AEST

Return Date to Students
Week 7 Friday (4 Sept 2020)

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. Comment on the final results obtained

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 (28 Sept 2020) 11:59 pm AEST

Return Date to Students
Week 12 Friday (9 Oct 2020)

Weighting
30%

Minimum mark or grade
40%

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
In this task, 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

Its exact due date will be announced during the term.

Return Date to Students

Students to view marks on the day for certification of grades

Weighting
50%

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. Comment 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