ENEM20001 *Advanced Modelling, Simulation and Control of Dynamic Systems*
Term 2 - 2020

Profile information current as at 30/04/2024 04:17 am

General Information

Overview

This project-based learning unit examines the behaviour of mechanical systems. You will apply knowledge of engineering science and mathematics to model, simulate and analyse mechanical systems and consider the nature of engineering assumptions and the effects of uncertainty on analysis and modelling. You will apply control and vibration theory, design and analyse linear and non-linear mathematical models and use simulation software to predict the behaviour of mechanical systems. You will be expected to apply the modelling and analysis of mechanical systems to industrial problems and contexts. You will have opportunities to work individually and in teams to complete projects and to develop interpersonal and technical communication skills. You will prepare professional documentation of problem solutions and project reports.

Details

Career Level: *Postgraduate*
Unit Level: *Level 8*
Credit Points: *12*
Student Contribution Band: *8*
Fraction of Full-Time Student Load: *0.25*

Pre-requisites or Co-requisites

There are no requisites for this unit.
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

- Melbourne
- Perth
- 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).

Residential Schools

This unit has a Compulsory Residential School for distance mode students and the details are:
Click here to see your Residential School Timetable.

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 12-credit Postgraduate unit at CQUniversity requires an overall time commitment of an average of 25 hours of study per week, making a total of 300 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. **Project (applied)**
Weighting: 25%
2. **Project (applied)**
Weighting: 20%
3. **Laboratory/Practical**
Weighting: 25%
4. **Portfolio**
Weighting: 30%

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

In my opinion, there should be a laboratory session on MATLAB and SIMULINK because it is very hard to work on the project whilst learning the software at the same time.

Recommendation

Help files on learning MATLAB and SIMULINK should be added to the Moodle site.

Feedback from Student Email

Feedback

Experimental laboratory sessions should be demonstrated in person, not via videos.

Recommendation

Videos were used due to unprecedented pandemic issues. Once the situation becomes normal, face to face experimental laboratory sessions will resume.

Unit Learning Outcomes

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

1. Design mathematical models that analyse and evaluate complex mechanical systems
2. Explain and apply control theory and control system approaches to complex mechanical systems
3. Apply engineering assumptions in building mathematical models of complex mechanical systems
4. Relate theory to the operation and maintenance of mechanical systems in the industrial context
5. Identify and evaluate engineering uncertainty and the limitations of mathematical models
6. Work collaboratively in a team to produce high quality outputs
7. Create professional documentation including the use of mechanical systems terminology, equations, symbols and diagrams.

The learning outcomes are linked to Engineers Australia Stage 1 Competency Standard and Australian Qualification Framework (AQF) 9 Level.

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 - Project (applied) - 25%	•					•	
2 - Project (applied) - 20%		•				•	
3 - Laboratory/Practical - 25%				•			
4 - Portfolio - 30%			•		•		•

Alignment of Graduate Attributes to Learning Outcomes

Graduate Attributes	Learning Outcomes						
	1	2	3	4	5	6	7
1 - Knowledge	○	○	○	○			○
2 - Communication		○				○	○
3 - Cognitive, technical and creative skills	○		○		○		
4 - Research		○					
5 - Self-management						○	
6 - Ethical and Professional Responsibility							
7 - Leadership							
8 - 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
1 - Project (applied) - 25%	○		○	○				
2 - Project (applied) - 20%	○		○	○				
3 - Laboratory/Practical - 25%	○	○				○		
4 - Portfolio - 30%		○	○		○			

Textbooks and Resources

Textbooks

ENEM20001

Supplementary

Mechanical Vibrations in SI Units
Edition: 6th edn (2017)
Authors: Rao, Singiresu
Pearson
Harlow , Essex , USA
ISBN: 9781292178608
Binding: Paperback
ENEM20001

Supplementary

Modeling And Analysis Of Dynamic Systems
Edition: 3rd edn (2001)
Authors: Close, Frederick & Newell

John Wiley and Sons
Southern Gate , Chicester , UK
ISBN: 9780471394426
Binding: Paperback
ENEM20001

Supplementary

Theory of Vibrations with Applications
Edition: 5th edn (Pearson New International Version) (2014)
Authors: Thomson, W & Dahleh, M
Pearson
Harlow , Essex , UK
ISBN: 9781292042718
Binding: Paperback

Additional Textbook Information
It is not mandatory to purchase the unit textbooks, but it is highly recommended you have access to a mechanical vibrations reference (Thomson or Rao as per the Textbooks section). If funds are limited do purchase the Rao ebook. The ebook Rao is available from the CQU library, however access is not guaranteed. Hard copies of the Textbook have been requested to be available from the CQUni Bookshop here: http://bookshop.cqu.edu.au (and search on the Unit code) to see availability. Close is an interesting read but does not get used much in the unit, but as the ebook version is less expensive that may help justify the purchase. The ebook versions provide lower cost options, and can be also purchased from the Publisher's Australian websites, but note there is no ebook option for Thomson. A list of available online textbooks from the CQU library is available on the moodle site, these can be used in lieu of the supplementary textbooks.
Recommended chapter readings and tutorial questions are referred to from Thomson (2014) and Close (2001) during the unit. Any tutorial questions sourced from the textbooks are provided to students so they can use alternative textbooks/resources as theory references. Any edition of the textbooks are suitable.
In this unit you are required to use Matlab and Simulink software. This software is installed in the CQU computer rooms. For DIST students, or if on-campus students wish to work at home you will need to purchase 'Matlab and Simulink Student Suite' available from: https://au.mathworks.com/store/link/products/student/new. Also if you plan on completing the unit 'ENEM20002 Fluid Power Engineering and Control' consider purchasing the other toolboxes 'Simscape' and 'Simscape fluids' at the same time as discounts apply for additional toolbox purchases. While not used anywhere in CQU units 'Simscape Multibody' and 'Simscape Driveline' are interesting additions for mechanical students. Concerning COVID19 restrictions and software , if the university campuses have to close then other arrangements may be made concerning software availability. Do check with the Unit co-ordinator or Head of School for more up to date information closer to the start of the term.

View textbooks at the CQUniversity Bookshop

IT Resources

You will need access to the following IT resources:

- CQUniversity Student Email
- Internet
- Unit Website (Moodle)
- 3.5mm Headphones to be used in the Computer Labs

Referencing Style

All submissions for this unit must use the referencing style: Harvard (author-date)
For further information, see the Assessment Tasks.

Teaching Contacts

Neamul Khandoker Unit Coordinator
n.khandoker@cqu.edu.au

Schedule

Week 1 - 13 Jul 2020

Module/Topic	Chapter	Events and Submissions/Topic
Review of Mechanical Vibrations Project #1 - Mechanical Vibration Modelling	Close: Ch: 1, 2, 3, 4, 8, 9, 14 ; Thomas: Ch: 1, 2, 3, 4	Computer Lab: Introduction to Matlab and Simulink Tutorial: Free Vibration

Week 2 - 20 Jul 2020

Module/Topic	Chapter	Events and Submissions/Topic
Analysis of Vibratory Systems – Mathematical Theories and Modelling Approaches	As above	Computer Lab: 1 DOF modelling in Matlab and Simulink Tutorial: Damped Vibration Experimental Laboratory 1: Whirling of Shafts* *Estimated timing, see Moodle for the timing of experimental laboratories for your campus.

Week 3 - 27 Jul 2020

Module/Topic	Chapter	Events and Submissions/Topic
Forced Vibration and Support Motion Vibration Modelling	Close: Ch: 2, 3, 4, 7, 8, 9, 14, Thomas: Ch: 1, 2, 3, 4	Computer Lab: Forced Vibration and Non-linear Modelling Tutorial: Forced Vibration

Week 4 - 03 Aug 2020

Module/Topic	Chapter	Events and Submissions/Topic
Two Degrees of Freedom Modelling	as above	Computer Lab: 2DOF modelling in Matlab and Simulink Tutorial: Forced Vibration Experimental Laboratory 2: Torsional Vibration* *Estimated timing, see Moodle for the timing of experimental laboratories for your campus.

Week 5 - 10 Aug 2020

Module/Topic	Chapter	Events and Submissions/Topic
Multiple Degrees of Freedom Modelling	Close: Ch: 2, 3, 4, 7, 8, 9, 14 , Thomas: Ch: 4, 5, 6, 8.	Computer Lab: Multiple DOF modelling in Matlab and Simulink Tutorial: Mode Shapes

Vacation Week - 17 Aug 2020

Module/Topic	Chapter	Events and Submissions/Topic

Week 6 - 24 Aug 2020

Module/Topic	Chapter	Events and Submissions/Topic

Control System Theory Project #2 - Application of Mechanical Control	Close: Ch: 5, 7, 8, 9, 14, 15 , Thomas: Ch: 4, 5, 6, 8	Computer Lab: PID Controller Tutorial: Control Block Diagrams Experimental Laboratory 3: Mass Balance* *Estimated timing, see Moodle for the timing of experimental laboratories for your campus. **Project 1: Mechanical Vibration Modelling** Due: Week 6 Friday (28 Aug 2020) 11:45 pm AEST
Week 7 - 31 Aug 2020		
Module/Topic	**Chapter**	**Events and Submissions/Topic**
Control System Stability	As above	Computer Lab: Analysis of Controllers Tutorial: Control Stability Calculations
Week 8 - 07 Sep 2020		
Module/Topic	**Chapter**	**Events and Submissions/Topic**
Noise and Delay in Control Systems	As above	Computer Lab: Combination of Control, Vibration Modelling and Kinematics Tutorial: Noise and Delay in Control Calculations Experimental Laboratory 4: Free Vibration* *Estimated timing, see Moodle for the timing of experimental laboratories for your campus.
Week 9 - 14 Sep 2020		
Module/Topic	**Chapter**	**Events and Submissions/Topic**
Real Data Modelling and System Commissioning	As above	Computer Lab: Help on Project #2 Tutorial: Help on Project #2
Week 10 - 21 Sep 2020		
Module/Topic	**Chapter**	**Events and Submissions/Topic**
Finalising Project 2		Computer Lab: Help on finalising Project #2 Tutorial: Help on finalising Project #2 Experimental Laboratory 5: Forced Vibration* *Estimated timing, see Moodle for the timing of experimental laboratories for your campus. **Project 2: Application of Mechanical Control** Due: Week 10 Friday (25 Sept 2020) 11:45 pm AEST **Laboratory Reports** Due: Week 10 Friday (25 Sept 2020) 11:45 pm AEST
Week 11 - 28 Sep 2020		
Module/Topic	**Chapter**	**Events and Submissions/Topic**
Theory Review and Portfolio Finalisation		Computer Lab: Collating the Portfolio Tutorial: Portfolio and Demonstration Questions Clarification
Week 12 - 05 Oct 2020		
Module/Topic	**Chapter**	**Events and Submissions/Topic**

Portfolio Finalisation		Computer Lab: Portfolio Finalisation Tutorial: Portfolio Finalisation **Portfolio of Individual Work** Due: Week 12 Friday (9 Oct 2020) 11:45 pm AEST

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

The delivery of this unit will be online only due to COVID-19 social distancing policy.

Assessment Tasks

1 Project 1: Mechanical Vibration Modelling

Assessment Type
Project (applied)

Task Description
Project 1 is a team project consisting of 4 to 6 students. The project includes the mechanical vibration modelling and analysis of a mechanical system from a simple single degree of freedom through to multiple degrees of freedom analysis. Three types of modelling and analysis will be used, including mechanical vibration theory, Matlab and Simulink software packages. The project instructions will provide details on the core elements required from modelling through to analysis, discussion and conclusions. The full details of the project is on the Moodle site (available 2 weeks prior to the term). The team project contributes to the units final grade and also provides learning and evidence required for the Individual portfolio submission. To pass the unit, involvement in the team project needs to be demonstrated.

Assessment Due Date
Week 6 Friday (28 Aug 2020) 11:45 pm AEST

Return Date to Students
Week 8 Friday (11 Sept 2020)
Reports will be returned two weeks after submission.

Weighting
25%

Minimum mark or grade
25%

Assessment Criteria
While this is a team report, each member of the team may receive varying grades. In the final report, the team will be asked to specify each members percentage contribution in the project. This percentage contribution will be used to determine the grade each student will receive. To help with team management the percent contribution should be discussed at the beginning of the project and at the end of the project. Each team member should reference their own contributions in the team report by use of the Harvard author-date system i.e. (McClanachan 2018).

The team report will be graded on the main elements of modelling through to analysis, discussion and conclusions. The report should also be professionally presented, clearly show and explain the development of modelling equations, models including any assumptions or limitations of the analysis. To maximise time spent on the unit's core aim it is recommended that diagrams are hand-drawn and any mathematical equations or working be handwritten and scanned into the document. The report should be written and contain enough detail such that an engineer could understand, check and if necessary repeat the work described. A detailed marking criteria specific to the project elements is available on the Moodle site (available two weeks prior to the start of the term).

Referencing Style

- Harvard (author-date)

Submission
Online Group

Submission Instructions
Each team shall submit one report as a pdf document, plus the submission of a zip file containing all the associated Simulink, Matlab and Excel files.

Learning Outcomes Assessed

- Design mathematical models that analyse and evaluate complex mechanical systems
- Work collaboratively in a team to produce high quality outputs

Graduate Attributes

- Knowledge
- Cognitive, technical and creative skills
- Research

2 Project 2: Application of Mechanical Control

Assessment Type
Project (applied)

Task Description
Project 2 is a team project consisting of 4 to 6 students. The project applies mechanical control and control theory analysis to a mechanical system. Control is applied to a simple single degree of freedom model through to multiple degrees of freedom model. Three types of modelling and analysis will be used, including the use of control theory, Matlab and Simulink software packages. The project instructions will provide details on the core elements required from the application of control through to analysis, discussion and conclusions. The full details of the project are on the Moodle site (available 2 weeks prior to the term). The team project contributes to the units final grade and also provides learning and evidence required for the Individual portfolio submission. To pass the unit, involvement in the team project needs to be demonstrated.

Assessment Due Date
Week 10 Friday (25 Sept 2020) 11:45 pm AEST

Return Date to Students
Week 12 Friday (9 Oct 2020)
Reports will be returned two weeks after submission.

Weighting
20%

Minimum mark or grade
25%

Assessment Criteria
While this is a team report, each member of the team may receive varying grades. In the final report, the team will be asked to specify each members percentage contribution in the project. This percentage contribution will be used to determine the grade each student will receive. To help with team management the percent contribution should be discussed at the beginning of the project and at the end of the project. Each team member should reference their own contributions in the team report by use of the Harvard author-date system i.e. (McClanachan 2018).

The team report will be graded on the main elements of the application of control through to analysis, discussion and conclusions. The report should also be professionally presented, clearly show and explain the development of the control system, equations, models including any assumptions or limitations of the control system and analysis. To maximise time spent on the unit's core aim it is recommended that diagrams are hand-drawn and any mathematical equations or working be handwritten and scanned into the document. The report should be written and contain enough detail such that an engineer could understand, check and if necessary repeat the work described. A detailed marking criteria specific to the project elements is available on the Moodle site (available two weeks prior to the start of the term).

Referencing Style

- Harvard (author-date)

Submission
Online Group

Submission Instructions
Each team shall submit one report as a pdf document, plus the submission of a zip file containing all the associated Simulink, Matlab and Excel files.

Learning Outcomes Assessed

- Explain and apply control theory and control system approaches to complex mechanical systems
- Work collaboratively in a team to produce high quality outputs

Graduate Attributes

- Knowledge
- Cognitive, technical and creative skills
- Research

3 Laboratory Reports

Assessment Type
Laboratory/Practical

Task Description
The experimental laboratories will begin in Week 2. The laboratory classes will be online due to COVID-19 social distancing policy. The schedule of the laboratory classes will be announced in week -1.

The experimental laboratories are compulsory and will aid your understanding in the area of mechanical vibration fundamentals. Attendance at all the laboratories is required to pass the unit. The laboratories topics include:
- Whirling Shafts - (Week 2)
- Torsional Vibration - (Week 2)
- Mass Balancing - (Week 4)
- Free Damped Vibration - (Week 8)
- Forced Damped Vibration - (Week 10)

While the laboratories will be done in groups of 4 to 6 students, **each student is to submit their own individual laboratory reports**. Use the group environment to confirm and check measurements and application of theory and sample calculations however **the presentation of results, discussion and reflections should be your own individual work.**

The laboratory reports will include the measurements, results, calculations, discussion and reflections (the laboratory sheets are available on the Moodle site). Laboratory reports are due one week following the laboratory, please refer to the assessment submission block on the Moodle site for exact the due dates.

Assessment Due Date
Week 10 Friday (25 Sept 2020) 11:45 pm AEST
Laboratory Reports are due one week following the completion of each laboratory.

Return Date to Students
Week 12 Friday (9 Oct 2020)
Laboratory Reports will be returned two weeks after submission.

Weighting
25%

Minimum mark or grade
50%

Assessment Criteria
Each student is to submit their own individual laboratory reports. Students are requested to show the measurements, calculations, results, discussion and required reflections as detailed in the laboratory sheets provided in Moodle. **The laboratory reports should not contain work by any other student.**

Five reports are required, each worth 5% of the unit's final grade.

The reports will be graded on accuracy of measurements, correct application of theoretical calculations, presentation of results, discussion and comparison to theory, further understanding shown in the required reflections and overall presentation. To maximise time spent on the unit's core aim it is recommended that diagrams are hand-drawn and any mathematical equations or working be handwritten and scanned into the document.

As the theory is presented on the laboratory sheets it is not required to repeat or explain the background to the theory. However, the equations used in the calculations should be shown with some sample calculations and any additional

description of your analysis. The remainder of calculations can be submitted in the appendix or calculated with the use of a MS Excel spreadsheet. Any additional files the student has used should be submitted along with the laboratory report pdf file.

Referencing Style

- Harvard (author-date)

Submission
Online

Submission Instructions
Submit the report as a pdf plus the submission of a zip file containing any associated MS Excel files.

Learning Outcomes Assessed

- Relate theory to the operation and maintenance of mechanical systems in the industrial context

Graduate Attributes

- Knowledge
- Communication
- Ethical and Professional Responsibility

4 Portfolio of Individual Work

Assessment Type
Portfolio

Task Description
The Portfolio of Individual Work is a record of your individual journey through this unit. It should include your own work on the projects, tutorial questions, worked examples, demonstration questions and team management contributions. To maximise time spent on the unit's core aim it is recommended that diagrams are hand-drawn and any mathematical equations or working be handwritten and scanned into the document. The portfolio should only contain work which you completed. Any contributions by others should not be included. Descriptions of the parts of the portfolio are listed below:

- Reflective Journal
In the reflective journal section of the portfolio, students will reflect on what they have set out to learn, how they have approached their learning, what they have achieved, where in industry they could apply what was learnt and what they would do differently in future to improve. The journal should also include reflections on management and teamwork skills learnt during the unit.

- Workbook
The workbook section should contain your own work on the team projects. It is suggested to keep an exercise pad to record any handwritten work done on the projects, this work can then be scanned and added into your portfolio. Provide suitable headings to describe the work and include the date. Work by others should not be included. Use the reflective journal to record your input into team discussions and management. The workbook should contain screenshots of software code or models you created with some brief commentary. The workbook should also contain any tutorial questions or worked examples you completed, however, these should not be a direct copy of any solutions provided but should help to show your understanding of the unit's material. Students are encouraged to include their own exploration of the unit content by individually extending tutorial work or correcting parts of the team projects.

- Demonstration Questions
A selection of optional demonstration questions will be made available on the Moodle for students to complete and include in their final portfolio. Completing these questions will assist students to demonstrate their individual ability. A high involvement in the projects will help with the demonstration questions. As suggested earlier to save time it is recommended that diagrams and any mathematical equations or working be handwritten and scanned into the document.
Without any Demonstration Questions or other individual work it will be very difficult to attain a Distinction or High Distinction Level.

- Supporting Matlab, Simulink and Excel Spreadsheet files
In the portfolio submission, include any files you created during the unit. The files should have appropriate file names and be named in your portfolio document. If a file is not entirely your own work you should clearly indicate your contribution in the comments section of the file or elsewhere in the final portfolio document. Compress the files into

a single 'zip' archive and submit the zip file along with the written portfolio document.

Assessment Due Date
Week 12 Friday (9 Oct 2020) 11:45 pm AEST

Return Date to Students

Feedback will be provided after the Certification of Grades date.

Weighting
30%

Minimum mark or grade
50%

Assessment Criteria
The portfolio will be used to assess your: contributions to the team projects, increase in knowledge, effective management of yourself and others, team collaboration, communication and documentation of technical work. Students are expected to nominate a grade that they consider should be awarded. This must be clearly substantiated with evidences of individual work in support of such claims. These claims will be assessed based on the how well the material in the portfolio demonstrates your ability and understanding regarding the unit's material.

The award of grade will depend the student's demonstrated individual achievement of the learning outcomes of the unit, the student's involvement in the team projects and the holistic development of each student. A detailed Portfolio Assessment Criteria Matrix is available on the Moodle unit site which will be inline with CQUniversity's Grades and Results Policy, see extract below:

Grade and description	Range of marks
High Distinction Demonstrates imagination, originality or flair, based on proficiency in all the learning outcomes of the unit; work is interesting or surprisingly exciting, challenging, well-read or scholarly.	Composite mark in the range 84.50% and above (85 – 100% when rounded to the nearest integer).
Distinction Demonstrates awareness and understanding of deeper and less obvious aspects of the unit, such as ability to identify and debate critical issues or problems, ability to solve non-routine problems, ability to adapt and apply ideas to new situations, and ability to invent and evaluate new ideas.	Composite mark in the range of 74.50 – 84.49% (75 – 84% when rounded to the nearest integer).
Credit Demonstrates ability to use and apply fundamental concepts and skills of the unit, going beyond mere replication of content knowledge or skill to show understanding of key ideas, awareness of their relevance, some use of analytical skills, and some originality or insight.	Composite mark in the range of 64.50 – 74.49% (65 – 74% when rounded to the nearest integer).
Pass Demonstrates the learning outcomes of the unit, such as knowledge of fundamental concepts and performance of basic skills; demonstrates sufficient quality of performance to be considered satisfactory or adequate or competent or capable in relation to the learning outcomes of the unit.	Composite mark in the range 49.50 – 64.49% (50 – 64% when rounded to the nearest integer).

Referencing Style

- Harvard (author-date)

Submission
Online

Submission Instructions
Submit the portfolio as a pdf, plus the submission of a zip file containing all the associated Simulink, Matlab and Excel files.

Learning Outcomes Assessed

- Apply engineering assumptions in building mathematical models of complex mechanical systems
- Identify and evaluate engineering uncertainty and the limitations of mathematical models
- Create professional documentation including the use of mechanical systems terminology, equations, symbols and diagrams.

Graduate Attributes

- Communication
- Cognitive, technical and creative skills
- Self-management

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