



MTRN4066

Advanced Mechatronic Engineering

Session 1, In person-scheduled-weekday, North Ryde 2023

School of Engineering

Contents

<u>General Information</u>	2
<u>Learning Outcomes</u>	2
<u>General Assessment Information</u>	3
<u>Assessment Tasks</u>	4
<u>Delivery and Resources</u>	8
<u>Policies and Procedures</u>	9
<u>Changes from Previous Offering</u>	10
<u>Engineers Australia Competency Mapping</u>	11

Disclaimer

Macquarie University has taken all reasonable measures to ensure the information in this publication is accurate and up-to-date. However, the information may change or become out-dated as a result of change in University policies, procedures or rules. The University reserves the right to make changes to any information in this publication without notice. Users of this publication are advised to check the website version of this publication [or the relevant faculty or department] before acting on any information in this publication.

General Information

Unit convenor and teaching staff

Unit Convenor and Lecturer

David Inglis

david.inglis@mq.edu.au

Contact via email or office phone (02 9850 9150)

3 Management Drive, Rm 160

Tuesdays 4-5pm, Thursdays 8-9am (no appointment needed)

Credit points

10

Prerequisites

(MTRN3026 or ELEC326) and (ELEC3024 or ELEC324)

Corequisites

Co-badged status

Unit description

This unit integrates prior learning in a specialist area of engineering with problem solving, emerging technology and aspects of engineering application, technical reporting and self-management to prepare students to work at a professional capacity. The unit aims to address the application of fundamental principles and methods at an advanced level in the context of standards and practices, modelling, analysis, design and practical implementation. The unit also develops skills in the critical evaluation of information, software and sources of error, and experimental methods. Learning will be achieved using case studies, laboratories, presentations, group work and/or traditional lecture format. The specific topics will focus on current advances in the area such as microcontrollers, motors and drive systems, control systems, sensors and actuators and electro-mechanical interfacing.

Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at <https://www.mq.edu.au/study/calendar-of-dates>

Learning Outcomes

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

ULO1: Design, numerically-model, implement, and test a digital motion control system for a non-linear problem

ULO2: Demonstrate, problem solving, initiative, time management, and record keeping, skills in the completion of a significant project

ULO3: Research and evaluate, through advanced knowledge, the modelling and use of modern drive technology

ULO4: Proficiently articulate and critique advanced mechatronic principles, including convolutional neural networks, machine vision, and 3D printing

General Assessment Information

Grading and passing requirement for unit

In order to pass this unit a student must obtain a mark of 50 or more for the unit (i.e. obtain a passing grade P/ CR/ D/ HD), and meet two hurdle requirements (below).

Hurdle Requirements

1) The final examination is a hurdle because it is the only invigilated individual assessment in the unit. A grade of 50% or more in the final exam is a condition of passing this unit. If you are given a second opportunity to sit the final examination as a result of failing to meet the minimum mark required, you will be offered that chance during the supplementary examination period and will be notified of the exact day and time after the publication of final results for the unit. The second attempt at a hurdle assessment is graded as pass/fail. The maximum grade for a second attempt is the hurdle threshold grade of 50%.

2) Completion of homework problems is a hurdle requirement. Students must submit reasonable responses to all questions. If submissions are incomplete, students will be notified and given 1 week to re-submit.

Supplementary Exam: If you receive special consideration for the final exam (or are given a second attempt), a supplementary exam will be scheduled by the faculty during a supplementary exam period. This is typically 3 to 4 weeks after the normal exam period. By making a special consideration application for the final exam you are declaring yourself available for a resit during the supplementary examination period and will not be eligible for a second special consideration approval based on pre-existing commitments. Please ensure you are familiar with the policy prior to submitting an application. Approved applicants will receive an individual notification one week prior to the exam with the exact date and time of their supplementary examination.

Late submissions and Resubmissions

Online quizzes, in-class activities, or scheduled tests and exam must be undertaken at the time indicated in the unit guide. All other assessments must be submitted by 5:00 pm on their due date. Should either of these assessments be missed due to illness or misadventure, students should apply for Special Consideration.

Assessments not submitted by the due date will receive a mark in accordance with the late submission policy as follows: A 12-hour grace period will be given after which the following deductions will be applied to the awarded assessment mark: 12 to 24 hours late = 10% deduction; for each day thereafter, an additional 10% per day or part thereof will be applied until

five days beyond the due date. After this time, a mark of zero (0) will be given. For example, an assessment worth 20% is due 5 pm on 1 January. Student A submits the assessment at 1 pm, 3 January. The assessment received a mark of 15/20. A 20% deduction is then applied to the mark of 15, resulting in the loss of three (3) marks. Student A is then awarded a final mark of 12/20.

Resubmissions of work are not allowed.

Special Consideration

The [Special Consideration Policy](#) aims to support students who have been impacted by short-term circumstances or events that are serious, unavoidable and significantly disruptive, and which may affect their performance in assessment. If you experience circumstances or events that affect your ability to complete the assessments in this unit on time, please inform the convenor and submit a Special Consideration request through ask.mq.edu.au.

Assessment Tasks

Name	Weighting	Hurdle	Due
Homework/problem sets	0%	Yes	Weeks 4, 8, 11, and 13
Report 3	11%	No	Week 9
Report 2	11%	No	Week 6
Project Demonstration	11%	No	Week 12
Report - Final	11%	No	Week 12
Log Book	11%	No	Week 12
Final Exam	35%	Yes	Exam Period
Report 1	10%	No	Week 3

Homework/problem sets

Assessment Type ¹: Problem set

Indicative Time on Task ²: 10 hours

Due: **Weeks 4, 8, 11, and 13**

Weighting: **0%**

This is a hurdle assessment task (see [assessment policy](#) for more information on hurdle assessment tasks)

Development of knowledge and skills requires repeated practice. Four problem sets will be assigned based on lecture content. Each assessment is graded as pass/fail. To pass this hurdle assessment, you must demonstrate that practice by making a reasonable attempt to answer each question.

On successful completion you will be able to:

- Demonstrate, problem solving, initiative, time management, and record keeping, skills in the completion of a significant project
- Research and evaluate, through advanced knowledge, the modelling and use of modern drive technology
- Proficiently articulate and critique advanced mechatronic principles, including convolutional neural networks, machine vision, and 3D printing

Report 3

Assessment Type ¹: Report

Indicative Time on Task ²: 10 hours

Due: **Week 9**

Weighting: **11%**

Stage 3 of the Report should build on stage 2 and respond to feedback. It should now include performance predictions based on numerical solutions to the equations of motion. It is expected that you will update your control approach to achieve good performance.

On successful completion you will be able to:

- Design, numerically-model, implement, and test a digital motion control system for a non-linear problem
- Demonstrate, problem solving, initiative, time management, and record keeping, skills in the completion of a significant project

Report 2

Assessment Type ¹: Project

Indicative Time on Task ²: 10 hours

Due: **Week 6**

Weighting: **11%**

Stage 2 of project report should build on the stage 1. You should respond to all feedback and now include a full derivation of the mathematical model of the closed loop system and conclude with well presented equation of motion as a differential equation.

On successful completion you will be able to:

- Design, numerically-model, implement, and test a digital motion control system for a non-linear problem
- Demonstrate, problem solving, initiative, time management, and record keeping, skills in the completion of a significant project

Project Demonstration

Assessment Type ¹: Demonstration

Indicative Time on Task ²: 10 hours

Due: **Week 12**

Weighting: **11%**

Demonstrate your system performance at the same time that you submit your report. Grade criteria posted to iLearn

On successful completion you will be able to:

- Design, numerically-model, implement, and test a digital motion control system for a non-linear problem
- Demonstrate, problem solving, initiative, time management, and record keeping, skills in the completion of a significant project

Report - Final

Assessment Type ¹: Report

Indicative Time on Task ²: 10 hours

Due: **Week 12**

Weighting: **11%**

Build on your previous report by responding to feedback. The report should now present a complete picture of the system included model prediction compared against measured results.

On successful completion you will be able to:

- Design, numerically-model, implement, and test a digital motion control system for a non-linear problem
- Demonstrate, problem solving, initiative, time management, and record keeping, skills in

the completion of a significant project

Log Book

Assessment Type ¹: Lab book

Indicative Time on Task ²: 10 hours

Due: **Week 12**

Weighting: **11%**

Assessment of record keeping in Log book

On successful completion you will be able to:

- Design, numerically-model, implement, and test a digital motion control system for a non-linear problem
- Demonstrate, problem solving, initiative, time management, and record keeping, skills in the completion of a significant project
- Proficiently articulate and critique advanced mechatronic principles, including convolutional neural networks, machine vision, and 3D printing

Final Exam

Assessment Type ¹: Examination

Indicative Time on Task ²: 11 hours

Due: **Exam Period**

Weighting: **35%**

This is a hurdle assessment task (see [assessment policy](#) for more information on hurdle assessment tasks)

Invigilated Final Exam

On successful completion you will be able to:

- Design, numerically-model, implement, and test a digital motion control system for a non-linear problem
- Demonstrate, problem solving, initiative, time management, and record keeping, skills in the completion of a significant project
- Research and evaluate, through advanced knowledge, the modelling and use of modern drive technology

- Proficiently articulate and critique advanced mechatronic principles, including convolutional neural networks, machine vision, and 3D printing

Report 1

Assessment Type ¹: Report

Indicative Time on Task ²: 10 hours

Due: **Week 3**

Weighting: **10%**

Stage 1 of project report. Include relevant system parameters need to model system and a circuit diagram for the electrical system.

On successful completion you will be able to:

- Design, numerically-model, implement, and test a digital motion control system for a non-linear problem
- Demonstrate, problem solving, initiative, time management, and record keeping, skills in the completion of a significant project

¹ If you need help with your assignment, please contact:

- the academic teaching staff in your unit for guidance in understanding or completing this type of assessment
- the [Writing Centre](#) for academic skills support.

² Indicative time-on-task is an estimate of the time required for completion of the assessment task and is subject to individual variation

Delivery and Resources

Practicals and on-campus learning activities start in week 1. If you cannot attend on campus from week 1, contact the unit convenor before the start of week 1.

Technology: you are strongly encourage to bring your own laptop. If you cannot provide one, one will be made available to you during SGTAs and practicals. We will use Matlab, Python, and COMSOL in the class and homework activities.

Textbook Resources: Selected topics from: A. Smaili and F. Mrad, “Mechatronics, Integrated Technologies for Intelligent Machines”, Oxford University Press, 2008. Additional recommended readings will be assigned and provided in iLearn.

Contact: Communication from the Unit convenor will be made to your university student email and through iLearn announcements.

Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central \(https://policies.mq.edu.au\)](https://policies.mq.edu.au). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- [Academic Appeals Policy](#)
- [Academic Integrity Policy](#)
- [Academic Progression Policy](#)
- [Assessment Policy](#)
- [Fitness to Practice Procedure](#)
- [Assessment Procedure](#)
- [Complaints Resolution Procedure for Students and Members of the Public](#)
- [Special Consideration Policy](#)

Students seeking more policy resources can visit [Student Policies \(https://students.mq.edu.au/support/study/policies\)](https://students.mq.edu.au/support/study/policies). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

To find other policies relating to Teaching and Learning, visit [Policy Central \(https://policies.mq.edu.au\)](https://policies.mq.edu.au) and use the [search tool](#).

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: <https://students.mq.edu.au/admin/other-resources/student-conduct>

Results

Results published on platform other than [eStudent](#), (eg. iLearn, Coursera etc.) or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in [eStudent](#). For more information visit ask.mq.edu.au or if you are a Global MBA student contact globalmba.support@mq.edu.au

Academic Integrity

At Macquarie, we believe [academic integrity](#) – honesty, respect, trust, responsibility, fairness and courage – is at the core of learning, teaching and research. We recognise that meeting the expectations required to complete your assessments can be challenging. So, we offer you a range of resources and services to help you reach your potential, including free [online writing and maths support](#), [academic skills development](#) and [wellbeing consultations](#).

Student Support

Macquarie University provides a range of support services for students. For details, visit <http://students.mq.edu.au/support/>

The Writing Centre

The [Writing Centre](#) provides resources to develop your English language proficiency, academic writing, and communication skills.

- [Workshops](#)
- [Chat with a WriteWISE peer writing leader](#)
- [Access StudyWISE](#)
- [Upload an assignment to Studiosity](#)
- [Complete the Academic Integrity Module](#)

The Library provides online and face to face support to help you find and use relevant information resources.

- [Subject and Research Guides](#)
- [Ask a Librarian](#)

Student Services and Support

Macquarie University offers a range of [Student Support Services](#) including:

- [IT Support](#)
- [Accessibility and disability support](#) with study
- Mental health [support](#)
- [Safety support](#) to respond to bullying, harassment, sexual harassment and sexual assault
- [Social support including information about finances, tenancy and legal issues](#)
- [Student Advocacy](#) provides independent advice on MQ policies, procedures, and processes

Student Enquiries

Got a question? Ask us via [AskMQ](#), or contact [Service Connect](#).

IT Help

For help with University computer systems and technology, visit http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/.

When using the University's IT, you must adhere to the [Acceptable Use of IT Resources Policy](#). The policy applies to all who connect to the MQ network including students.

Changes from Previous Offering

MEMS content is out due to new unit MTRN4062--MEMS.

Expanded content on BLDCs, new content on modelling using COMSOL

Engineers Australia Competency Mapping

EA Competency Standard		Unit Learning Outcomes
Knowledge and Skill Base	1.1 Comprehensive, theory-based understanding of the underpinning fundamentals applicable to the engineering discipline.	1,3,4
	1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing.	1
	1.3 In-depth understanding of specialist bodies of knowledge	1,3,4
	1.4 Discernment of knowledge development and research directions	
	1.5 Knowledge of engineering design practice	1
	1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice.	
Engineering Application Ability	2.1 Application of established engineering methods to complex problem solving	1
	2.2 Fluent application of engineering techniques, tools and resources.	1,4
	2.3 Application of systematic engineering synthesis and design processes.	
	2.4 Application of systematic approaches to the conduct and management of engineering projects.	
Professional and Personal Attributes	3.1 Ethical conduct and professional accountability.	1,2
	3.2 Effective oral and written communication in professional and lay domains.	2
	3.3 Creative, innovative and pro-active demeanour.	2
	3.4 Professional use and management of information.	2
	3.5 Orderly management of self, and professional conduct.	2
	3.6 Effective team membership and team leadership	