# MTRN4066

## Advanced Mechatronic Engineering

Session 1, Special circumstances, North Ryde 2021

*School of Engineering*

## Contents





**Notice**

As part of Phase 3 of our return to campus plan, most units will now run tutorials, seminars and other small group activities on campus, and most will keep an online version available to those students unable to return or those who choose to continue their studies online.

To check the availability of face-to-face activities for your unit, please go to timetable viewer. To check detailed information on unit assessments visit your unit's iLearn space or consult your unit convenor.

# General Information

Unit convenor and teaching staff
Lecturer and Unit Convenor
David Inglis
david.inglis@mq.edu.au
Contact via x9144
9WW 321
Tuesday 4-5pm, Thursday 8-9am

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, MEMs, nanotechnologies, 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, MEMS, microfluidics, and manufacturing processes including 3D printing and microfabrication

**ULO4:** Apply deep learning to proficiently articulate and critique advanced mechatronic principles, including convolutional neural networks

# 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).

If you receive special consideration for the final exam, a supplementary exam will be scheduled by the faculty during a supplementary exam period, typically about 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.

**Hurdle Requirements**

The final examination is a hurdle requirement. A grade of 50% or more in the final examination 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.

Completion of homework problems is a hurdle requirement. Students must submit reasonable responses to all questions. If submissions do not meet the hurdle requirement, students will be notified and given 1 week to re-submit.

**Late submissions and Resubmissions**

Unauthorized late submissions will attract a penalty of 10/100 marks per day. Extenuating circumstances will be considered upon lodgement of an application for special consideration or communication with the unit convenor.

Resubmissions of work are not allowed.

# Assessment Tasks

| Name | Weighting | Hurdle | Due |
|---|---|---|---|
| Final Exam | 35% | Yes | Formal Exam period |
| Report 1 | 10% | No | Week 3 |
| Report 2 | 11% | No | Week 6 |
| Homework/problem sets | 0% | Yes | Weeks 4, 7, 10, 13 |
| Report 3 | 11% | No | Week 9 |
| Project Demonstration | 11% | No | Week 12 |
| Report - Final | 11% | No | Week 12 |
| Log Book | 11% | No | Week 12 |

## Final Exam

Assessment Type [1]: Examination
Indicative Time on Task [2]: 11 hours
Due: **Formal 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, MEMS, microfluidics, and manufacturing processes including 3D printing and microfabrication
- Apply deep learning to proficiently articulate and critique advanced mechatronic principles, including convolutional neural networks

## 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

## 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

## Homework/problem sets

Assessment Type [1]: Problem set
Indicative Time on Task [2]: 10 hours
Due: **Weeks 4, 7, 10, 13**

Weighting: **0%**
**This is a hurdle assessment task (see assessment policy for more information on hurdle assessment tasks)**

4 problem sets will be assigned based on lecture content. Each assessment is graded as pass/ fail. To pass, students must make 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, MEMS, microfluidics, and manufacturing processes including 3D printing and microfabrication
- Apply deep learning to proficiently articulate and critique advanced mechatronic principles, including convolutional neural networks

## 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

## 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
- Apply deep learning to proficiently articulate and critique advanced mechatronic principles, including convolutional neural networks

---

[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

**Delivery:** Attendance in lectures is strongly recommended. Audio or video recordings of the lecture may not be available. Practical classes start in week 1.

**Textbook Resources**: Selected topics from:

A. Smaili and F. Mrad, “Mechatronics, Integrated Technologies for Intelligent Machines”, Oxford University Press, 2008.

Nanua Singh, “Systems Approach to Computer-integrated Design and Manufacturing”

Serope Kalpakjian, “Manufacturing Engineering and Technology”

Additional recommended readings will be assigned and provided in iLearn.

**Technology and Software:** We will make use of MATLAB for modelling and Arduino/Teensy for embedded system programming. Students will also use python for image processing. If you do not have access to your own computer you must attend the face to face SGTA. We strongly recommend students bring their own devices with admin privileges.

# Unit Schedule

Note that practical classes start in week 1.

# Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (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
- Grade Appeal Policy
- Complaint Management 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). 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) 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

# Student Support

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

## Learning Skills

Learning Skills (mq.edu.au/learningskills) provides academic writing resources and study strategies to help you improve your marks and take control of your study.

- Getting help with your assignment
- Workshops
- StudyWise
- 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

Students with a disability are encouraged to contact the Disability Service who can provide appropriate help with any issues that arise during their studies.

## Student Enquiries

For all student enquiries, visit Student Connect at ask.mq.edu.au

If you are a Global MBA student contact globalmba.support@mq.edu.au

## 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

This year we are adding content on image processing using Open CV and dropping content on manufacturing.