MTRN4066

Advanced Mechatronic Engineering

Session 1, In person-scheduled-weekday, North Ryde 2022

School of Engineering

Contents

General Information

Unit convenor and teaching staff
Unit Convenor and Lecturer
David Inglis
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9WW-321
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, 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

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.

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 requirments (below).

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.

Hurdle Requirements

The final examination is a hurdle requirement. 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.

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

Online quizzes, in-class activities, or scheduled tests and exam must be undertaken at the time indicated in the unit guide. Should these activities be missed due to illness or misadventure, students may apply for Special Consideration.

All other assessments must be submitted by 5:00 pm on their due date.

Should 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.

Assessment Tasks

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

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

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:

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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
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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

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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

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

Final Exam

Assessment Type [1]: Examination
Indicative Time on Task [2]: 11 hours
Due: **Examination 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
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[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.

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
- 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). 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

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 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

Adding section on industrial machine drawings and electrotechnology

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	

Changes since First Published

Date	Description
02/ 02/ 2022	This updated version of the unit guide now includes the Faculty policy on late submissions and a mapping ot learning outcomes and EA Stage 1 competencies.