ELEC260

Introduction to Mechatronics

S1 Day 2016

Dept of Engineering

Contents

General Information

Unit convenor and teaching staff
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Credit points
3

Prerequisites
COMP115(P) and (ENGG150(P) or ENGG170(P) or ELEC170(P)) and (PHYS140(P) or PHYS106(P)) and (MATH132(P) or MATH135(P))

Corequisites

Co-badged status

Unit description
This unit introduces the basic components of mechatronic systems including sensors, actuators, mechanical elements, decision-making components and the human-machine interface. It then covers the underlying principles and limitations of common types of sensor (electrical, optical, mechanical, etc) and commonly used actuators (electrical, mechanical, pneumatic, etc). Electrical circuits for sensing and actuator systems are described, including signal conditioning techniques, and the limitations and advantages of different approaches highlighted.

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:

- Demonstrate theoretical and practical use of a variety of sensors and actuators, including an understanding of interface electronics.
- Demonstrate use and theoretical understanding of a simple but modern microcontroller
- Demonstrate use and theoretical understanding of electromechanics and small DC motors.
- Demonstrate creativity and initiative in building small open ended mechatronic systems.

Demonstrate a qualitative understanding of system response, including 2nd order

systems.

General Assessment Information

In order to pass the Unit students must demonstrate evidence of achievement in the learning outcomes.

Assessment Tasks

Name	Weighting	Due
Final Exam	45%	Exam period
Practical Exam	15%	13
Online Quizes	12%	Weeks 2-13
Labs/Practicals	25%	Weeks 2-12
Homework Problem Set	3%	Week 6

Final Exam

Due: **Exam period**
Weighting: **45%**

You will be permitted to bring one, double sided sheet of hand written notes and a calculator. No other formulas will be given during the exam. Relevant data sheets for components may be provided.

On successful completion you will be able to:

- • Demonstrate theoretical and practical use of a variety of sensors and actuators, including an understanding of interface electronics.
- • Demonstrate use and theoretical understanding of electromechanics and small DC motors.
- Demonstrate a qualitative understanding of system response, including 2nd order systems.

Practical Exam

Due: **13**
Weighting: **15%**

In week 13 you will be given an individual and invigilated practical test. Specific instructions will be given, but it will be on one of the following topics: 1) Control the intensity of an LED using a turnpot, 2) Control the speed of a DC motor using a turnpot, 3) Button control of multiple LEDs,

4) Display analog voltage using serial port, 5) I^2C sensor, 6) Hobby Servo Control.

The test is Pass or Fail. A Pass is given full marks and a Fail is given no marks.

On successful completion you will be able to:

- • Demonstrate theoretical and practical use of a variety of sensors and actuators, including an understanding of interface electronics.
- • Demonstrate use and theoretical understanding of a simple but modern microcontroller
- • Demonstrate use and theoretical understanding of electromechanics and small DC motors.

Online Quizes

Due: **Weeks 2-13**
Weighting: **12%**

From weeks 2 to 5 and 7 to 13 there will be online quizzes. The quizzes can be taken outside of class and can be attempted multiple times.

On successful completion you will be able to:

- • Demonstrate theoretical and practical use of a variety of sensors and actuators, including an understanding of interface electronics.
- • Demonstrate use and theoretical understanding of a simple but modern microcontroller
- • Demonstrate use and theoretical understanding of electromechanics and small DC motors.
- Demonstrate a qualitative understanding of system response, including 2nd order systems.

Labs/Practicals

Due: **Weeks 2-12**
Weighting: **25%**

Practicals will be completed in pairs, and largely assessed in class.

The tutors need time to set up for the following prac. It is therefore important that all grades for pracs be awarded early enough to allow students to disassemble, put components away and tidy up before departing. To encourage this, a **2 mark per minute reduction** will be applied to every grade awarded after **2.5 hours** from the start of the lab. Also, if the tutors need to disassemble your project, or put your components away, a **5, 10 ,or 20 mark reduction** will be applied depending on the degree of assistance needed from tutors.

On successful completion you will be able to:

- • Demonstrate theoretical and practical use of a variety of sensors and actuators, including an understanding of interface electronics.
- • Demonstrate use and theoretical understanding of a simple but modern microcontroller
- • Demonstrate use and theoretical understanding of electromechanics and small DC motors.
- • Demonstrate creativity and initiative in building small open ended mechatronic systems.

Homework Problem Set

Due: **Week 6**
Weighting: **3%**

In addition to a typical set of problems, this homework set will require you to deal with a real data set from a sensor.

On successful completion you will be able to:

- • Demonstrate theoretical and practical use of a variety of sensors and actuators, including an understanding of interface electronics.

Delivery and Resources

Textbook

Introduction to Mechatronics and Measurement Systems by Alciatore and Histand. (3rd or 4th Edition is suitable)

Equipment

It is strongly recommended that you purchase a hobby electronics controller such as an Arduino, and some components. A typical kit costs around $100.

Textbook homepage: http://mechatronics.colostate.edu/

Technology and Software: We will make use of Labview, and NI myDAQ, and Arduino in the practical sessions. You will also be expected to analyse data using matlab, MS Excel or some other program of your choice.

Late Submissions: Unless agreed to in advance of due dates, late submissions will not be allowed.

Extensions: Extensions may be granted if a valid case for disruption to studies exits. See policies and procedures below.

Unit Schedule

A unit schedule will be available on iLearn.

Learning and Teaching Activities

Practicals

Students will work in pairs in formative assessments. Students will be required to periodically change partners and roles with the group.

Online Quizes

Students will complete short quizzes most weeks which review key concepts

Tutorials

The lecturer will attend 1 or 2 (depending on need) tutorials per week. These are optional and are a chance to ask questions, review concepts, talk about projects, and deepen engagement.

Homework

The homework task provides an opportunity to process and manipulate a data set from a sensor

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central. Students should be aware of the following policies in particular with regard to Learning and Teaching:

Academic Honesty Policy http://mq.edu.au/policy/docs/academic_honesty/policy.html

New Assessment Policy in effect from Session 2 2016 http://mq.edu.au/policy/docs/assessment/policy_2016.html. For more information visit http://students.mq.edu.au/events/2016/07/19/new_assessment_policy_in_place_from_session_2/

Assessment Policy prior to Session 2 2016 http://mq.edu.au/policy/docs/assessment/policy.html

Grading Policy prior to Session 2 2016 http://mq.edu.au/policy/docs/grading/policy.html

Grade Appeal Policy http://mq.edu.au/policy/docs/gradeappeal/policy.html

Complaint Management Procedure for Students and Members of the Public http://www.mq.edu.au/policy/docs/complaint_management/procedure.html

Disruption to Studies Policy http://www.mq.edu.au/policy/docs/disruption_studies/policy.html *The Disruption to Studies Policy is effective from March 3 2014 and replaces the Special Consideration Policy.*

In addition, a number of other policies can be found in the Learning and Teaching Category of Policy Central.

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: https://students.mq.edu.au/support/student_conduct/

Results

Results shown in *iLearn*, 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.

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 improve your marks and take control of your study.

- Workshops
- StudyWise
- Academic Integrity Module for Students
- Ask a Learning Adviser

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

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.

Graduate Capabilities

Creative and Innovative

Our graduates will also be capable of creative thinking and of creating knowledge. They will be imaginative and open to experience and capable of innovation at work and in the community. We want them to be engaged in applying their critical, creative thinking.

This graduate capability is supported by:

Learning outcomes

- • Demonstrate use and theoretical understanding of a simple but modern microcontroller
- • Demonstrate creativity and initiative in building small open ended mechatronic systems.

Assessment tasks

- Practical Exam
- Labs/Practicals

Capable of Professional and Personal Judgement and Initiative

We want our graduates to have emotional intelligence and sound interpersonal skills and to demonstrate discernment and common sense in their professional and personal judgement. They will exercise initiative as needed. They will be capable of risk assessment, and be able to handle ambiguity and complexity, enabling them to be adaptable in diverse and changing environments.

This graduate capability is supported by:

Learning outcome

- • Demonstrate creativity and initiative in building small open ended mechatronic systems.

Commitment to Continuous Learning

Our graduates will have enquiring minds and a literate curiosity which will lead them to pursue knowledge for its own sake. They will continue to pursue learning in their careers and as they participate in the world. They will be capable of reflecting on their experiences and relationships with others and the environment, learning from them, and growing - personally, professionally and socially.

This graduate capability is supported by:

Assessment tasks

- Online Quizes
- Labs/Practicals
- Homework Problem Set

Discipline Specific Knowledge and Skills

Our graduates will take with them the intellectual development, depth and breadth of knowledge, scholarly understanding, and specific subject content in their chosen fields to make them competent and confident in their subject or profession. They will be able to demonstrate, where relevant, professional technical competence and meet professional standards. They will be able to articulate the structure of knowledge of their discipline, be able to adapt discipline-specific knowledge to novel situations, and be able to contribute from their discipline to inter-disciplinary solutions to problems.

This graduate capability is supported by:

Learning outcomes

- • Demonstrate theoretical and practical use of a variety of sensors and actuators, including an understanding of interface electronics.
- • Demonstrate use and theoretical understanding of a simple but modern microcontroller
- • Demonstrate use and theoretical understanding of electromechanics and small DC motors.
- Demonstrate a qualitative understanding of system response, including 2nd order systems.

Assessment tasks

- Final Exam
- Practical Exam
- Online Quizes
- Labs/Practicals
- Homework Problem Set

Critical, Analytical and Integrative Thinking

We want our graduates to be capable of reasoning, questioning and analysing, and to integrate and synthesise learning and knowledge from a range of sources and environments; to be able to critique constraints, assumptions and limitations; to be able to think independently and systemically in relation to scholarly activity, in the workplace, and in the world. We want them to have a level of scientific and information technology literacy.

This graduate capability is supported by:

Assessment tasks

- Final Exam
- Labs/Practicals
- Homework Problem Set

Problem Solving and Research Capability

Our graduates should be capable of researching; of analysing, and interpreting and assessing data and information in various forms; of drawing connections across fields of knowledge; and they should be able to relate their knowledge to complex situations at work or in the world, in order to diagnose and solve problems. We want them to have the confidence to take the initiative in doing so, within an awareness of their own limitations.

This graduate capability is supported by:

Learning outcome

- • Demonstrate theoretical and practical use of a variety of sensors and actuators, including an understanding of interface electronics.

Assessment tasks

- Practical Exam
- Labs/Practicals
- Homework Problem Set

Effective Communication

We want to develop in our students the ability to communicate and convey their views in forms effective with different audiences. We want our graduates to take with them the capability to read, listen, question, gather and evaluate information resources in a variety of formats, assess, write clearly, speak effectively, and to use visual communication and communication technologies as appropriate.

This graduate capability is supported by:

Assessment task

- Homework Problem Set

Changes from Previous Offering

This year we will not cover the circuit model for AC motors. We will spend more time on DC motors and machine control.