ELEC326

Mechatronic Systems

S2 Day 2015

Dept of Engineering

Contents

General Information

Unit convenor and teaching staff
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Credit points
3

Prerequisites
39cp including (ELEC324 and ELEC260 and (MECH201 or MECH202 or MECH203 or MECH204))

Corequisites

Co-badged status

Unit description
This unit is on the theory and practice of designing mechatronic systems using systematic design techniques involving actuators, sensors, hierarchical control with intelligence. It covers designing intelligent machines, which can take decision and activate and can demonstrate particular level of hierarchy of intelligence. Advanced topics in the unit cover pneumatic and hydraulic control in association with programmable controllers, microcontrollers and growing intelligence of mechatronic systems.

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:

1. Demonstrate understanding of mechatronic systems and building blocks of them
2. Demonstrate a systematic design process for creating new mechatronic machines;
3.. Apply pneumatic, and PLCs integrated with pneumatics to control mechatronic systems;

4. Create and modify integrated pneumatic and PLC circuits;
5. Demonstrate understanding of intelligent control / hierarchical control machines.

General Assessment Information

Satisfactory performance in the practicals and on the design project are required to pass the unit.

Design Project:

As the students gradually learn the theories of designing mechatronic machines and components/units required for building mechatronic machines, they will practice their growing knowledge by accomplishing a team based project over the semester. Students in small teams (3-4 students) select a project topic at the beginning of the semester. Groups of students will produce design projects using a systematic method. Detail of a systematic design method is provided in lecture classes over the semester. Detailed guidance on the preparation of the report will be available on iLearn. **Important dates:**

Week 1-2: Team building and project topic selection;

Week 6-7: Mid-semester project progress submission and review (ungraded);

Week 13: Submit final design report.

Due: This report must be submitted on iLearn in Week 13.

Practicals (Worth 30%):

Each student must perform six laboratory experiments during the semester. Each laboratory session duration is at least two hours. Laboratory experiments are designed to develop practical knowledge of the theoretical aspects of the subject matters. They are devoted to physical understanding of pneumatic control systems and applications and PLCs programming applicable for mechatronics machine development.

A written report must be submitted on each experiment performed. The report should be written according to the following standard layout:

- A title page
- Number and name of experiment
- Objective/s (of the experiment)
- Theoretical background
- Equipment and tools used
- Sketch of the experimental set-up and relevant circuit
- Method / procedure
- Result
- Conclusion

Assessment of Practicals will be equally based on

- Individual performance during the laboratory sessions (assessed by tutor), and
- written reports

Due: Report due dates will be indicated on experiment instruction sheets.

Final Exam (50% of total marks):

The final exam will cover topics dealt with in lectures and tutorial classes. The exam duration will be 3 hours, and it will be worth 50% of your final grade.

Assessment Tasks

Name	Weighting	Due
Design Project	20%	Wk 6 & Wk 13
Practical	30%	Wks 4 - 13
Final exam	50%	Exam Timetable

Design Project

Due: **Wk 6 & Wk 13**
Weighting: **20%**

Group based project on Mechatronic System design spread over the 13 weeks of study. Students submit 1 group report worth 20% of final grade

On successful completion you will be able to:

- 1. Demonstrate understanding of mechatronic systems and building blocks of them
- 2. Demonstrate a systematic design process for creating new mechatronic machines;
- 4. Create and modify integrated pneumatic and PLC circuits;
- 5. Demonstrate understanding of intelligent control / hierarchical control machines.

Practical

Due: **Wks 4 - 13**
Weighting: **30%**

Laboratory experiments on pneumatic control used for mechatronic machines. Some of the experiments may involve pneumatics integrating with PLCs. 15% based on individual practical reports, 15% based on the tutors assessment of you individual performance in the prac.

On successful completion you will be able to:

- 2. Demonstrate a systematic design process for creating new mechatronic machines;
- 3.. Apply pneumatic, and PLCs integrated with pneumatics to control mechatronic

systems;

- 4. Create and modify integrated pneumatic and PLC circuits;

Final exam

Due: **Exam Timetable**
Weighting: **50%**

Final examination will cover materials of lecture and practical classes.

On successful completion you will be able to:

- 2. Demonstrate a systematic design process for creating new mechatronic machines;
- 4. Create and modify integrated pneumatic and PLC circuits;
- 5. Demonstrate understanding of intelligent control / hierarchical control machines.

Delivery and Resources

Teaching and learning materials will be available on the course iLearn website organised on weekly basis. **Unit homepage:** https://ilearn.mq.edu.au/login/MQ/

Note: Please see the detailed delivery schedule in the Unit schedule section.

Literature used are as follows:

Text Books: (Not adopted)

References (Any edition of the followings may be adequate. Students may achieve some access electronically):

1. D. Shetty, R. A. Kolk - Mechatronics system design, PWS Publishing, Boston, 1997.
2. D. Bradely, et el. – Mechatronics and the design of intelligent machines and systems. Stanely Thornes Ltd., UK, 2000.
3. ROHNER Peter – Industrial Hydraulic Control. JW & Sons. 1989.
4. K. T.Ulrich, S. D. Eppinger Product design and development. McGraw Hill ,NY, 1995.
5. IEEE Transactions on Robotics and Automation (selected articles from different numbers).

Unit Schedule

Detailed unit schedule will be available through iLearn.

Learning and Teaching Activities

Practicals

Students will practice material taught in lecture, and prepare individual reports on their work. Details for each practical session will be available through iLearn.

Design Project

Students will work in groups on a semester long design project. They will be expected to apply and document engineering methods to the design of mechatronic system.

Lecture

Weekly lectures will introduce new material and techniques that students will be expected to use in practicals and apply in the final exam.

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

Assessment Policy http://mq.edu.au/policy/docs/assessment/policy.html

Grading Policy http://mq.edu.au/policy/docs/grading/policy.html

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

Grievance Management Policy http://mq.edu.au/policy/docs/grievance_management/policy.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://informatics.mq.edu.au/help/.

When using the University's IT, you must adhere to the Acceptable Use 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

- 1. Demonstrate understanding of mechatronic systems and building blocks of them
- 2. Demonstrate a systematic design process for creating new mechatronic machines;
- 4. Create and modify integrated pneumatic and PLC circuits;
- 5. Demonstrate understanding of intelligent control / hierarchical control machines.

Assessment tasks

- Design Project
- Practical
- Final exam

Learning and teaching activities

- Students will work in groups on a semester long design project. They will be expected to apply and document engineering methods to the design of mechatronic system.

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

- 1. Demonstrate understanding of mechatronic systems and building blocks of them

Learning and teaching activities

- Students will work in groups on a semester long design project. They will be expected to apply and document engineering methods to the design of mechatronic system.

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:

Learning outcomes

- 1. Demonstrate understanding of mechatronic systems and building blocks of them
- 4. Create and modify integrated pneumatic and PLC circuits;
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Assessment tasks

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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

- 1. Demonstrate understanding of mechatronic systems and building blocks of them
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Assessment tasks

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Learning and teaching activities

- Students will practice material taught in lecture, and prepare individual reports on their work. Details for each practical session will be available through iLearn.
- Students will work in groups on a semester long design project. They will be expected to apply and document engineering methods to the design of mechatronic system.
- Weekly lectures will introduce new material and techniques that students will be expected to use in practicals and apply in the final exam.

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:

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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 outcomes

- 1. Demonstrate understanding of mechatronic systems and building blocks of them
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expected to use in practicals and apply in the final exam.

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:

Learning outcomes

- 1. Demonstrate understanding of mechatronic systems and building blocks of them
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Assessment tasks

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Engaged and Ethical Local and Global citizens

As local citizens our graduates will be aware of indigenous perspectives and of the nation's historical context. They will be engaged with the challenges of contemporary society and with knowledge and ideas. We want our graduates to have respect for diversity, to be open-minded, sensitive to others and inclusive, and to be open to other cultures and perspectives: they should have a level of cultural literacy. Our graduates should be aware of disadvantage and social justice, and be willing to participate to help create a wiser and better society.

This graduate capability is supported by:

Learning outcome

- 2. Demonstrate a systematic design process for creating new mechatronic machines;

Assessment tasks

- Design Project
- Practical

Socially and Environmentally Active and Responsible

We want our graduates to be aware of and have respect for self and others; to be able to work with others as a leader and a team player; to have a sense of connectedness with others and country; and to have a sense of mutual obligation. Our graduates should be informed and active participants in moving society towards sustainability.

This graduate capability is supported by:

Learning outcome

- 2. Demonstrate a systematic design process for creating new mechatronic machines;

Changes from Previous Offering

This is the first offering of this unit in its current form. Content may be upgraded during the course.