



ELEC326

Mechatronic Systems

S2 Day 2017

Dept of Engineering

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General Information

Unit convenor and teaching staff

Lecturer

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Thursday 10:00AM to 12:00PM

Tutor

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Credit points

3

Prerequisites

ELEC324 and ELEC260

Corequisites

Co-badged status

Unit description

This unit builds on the instrumentation foundation of ELEC260 and the system control concepts of ELEC324. It introduces a number of mechatronic specific topics including AC electric motors and drives, pneumatics, application specific integrated circuits, and advanced control. It requires the application of design and modelling procedures developed in prerequisites, and through medium-scale projects, prepares students to undertake advanced projects.

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. Apply pneumatics, and PLCs integrated with pneumatics, to control of mechatronic systems

3. Demonstrate understanding of AC motor drives and controller
4. Demonstrate understanding of modelling of mechatronic systems and kinematics of robotic system

Assessment Tasks

Name	Weighting	Hurdle	Due
<u>Mini Test #1</u>	5%	No	Week #3
<u>Practical Experiment#1</u>	10%	No	Week #5
<u>Mid Term Test</u>	10%	No	Week#7
<u>Practical Experiment #2</u>	10%	No	Week #9
<u>Mini Test #2</u>	5%	No	Week 10
<u>Practical Experiment #3</u>	10%	No	Week #13
<u>Mini Project and Presentation</u>	10%	No	Week #14
<u>Final Examination</u>	40%	No	Exam time

Mini Test #1

Due: **Week #3**

Weighting: **5%**

This Test will be conducted on the learning of Week 1 and 2. This will help the students to learn the topic in a better way. The Test will be for a duration of 30 minutes and is worth of 5%.

This assessment task related to the Learning outcome #1.

On successful completion you will be able to:

- 1. Demonstrate understanding of mechatronic systems and building blocks of them
- 2. Apply pneumatics, and PLCs integrated with pneumatics, to control of mechatronic systems

Practical Experiment#1

Due: **Week #5**

Weighting: **10%**

#1: Pneumatic Circuit design and PLC (the students will do experiments on 2nd and 3rd week on making different pneumatic circuits for pneumatic control. They will learn PLC on the 4th week and use them in the laboratory. The students will be asked for making a circuit to implement a

specific job using pneumatic components and PLC on the 5th week which will be assessed against 10% of full grade.

Grading will take into consideration the level of discovery as evidenced by insight presented in the report in terms of critical evaluation of the laboratory activity and technical justification of procedure and design. The assignments problems will be set to develop learning outcomes during the lecture block associated with the laboratory. Grading will take into consideration the level of understanding demonstrated as evidenced by the approach taken to present each solution. Grading will also take into consideration of the level of participation as evidenced by attendance and demeanour in the classes. High marks will be awarded for initiative, approach to self-learning and self-management. Students are expected to participate in the learning activities with a developing level of independence as well as team work.

This Assessment Task relates to the following Learning Outcomes: • 2. Apply pneumatic, and PLCs integrated with pneumatics to control mechatronic systems;

On successful completion you will be able to:

- 1. Demonstrate understanding of mechatronic systems and building blocks of them
- 2. Apply pneumatics, and PLCs integrated with pneumatics, to control of mechatronic systems

Mid Term Test

Due: **Week#7**

Weighting: **10%**

Mid semester Test will be held on week#7. The Test will be for a duration of 45 minutes and will be at the start of the lecture.

This Assessment Task relates to the following Learning Outcomes:

1. Demonstrate understanding of mechatronic systems and building blocks of them
2. Apply pneumatic, and PLCs integrated with pneumatics to control mechatronic systems;
3. Demonstrate understanding of AC motor drives and controller

On successful completion you will be able to:

- 1. Demonstrate understanding of mechatronic systems and building blocks of them
- 2. Apply pneumatics, and PLCs integrated with pneumatics, to control of mechatronic systems
- 3. Demonstrate understanding of AC motor drives and controller

Practical Experiment #2

Due: **Week #9**

Weighting: **10%**

#2: AC Motor drive: The students will learn on Schneider motor drive on the week 6, 7 and 8. They will be asked to implement some drive activities on the 9th week. This activity is worth of 10%. Grading will take into consideration the level of discovery as evidenced by insight presented in the report in terms of critical evaluation of the laboratory activity and technical justification of procedure and design. The assignments problems will be set to develop learning outcomes during the lecture block associated with the laboratory. Grading will take into consideration the level of understanding demonstrated as evidenced by the approach taken to present each solution. Grading will also take into consideration of the level of participation as evidenced by attendance and demeanour in the classes. High marks will be awarded for initiative, approach to selflearning and self-management. Students are expected to participate in the learning activities with a developing level of independence as well as team work.

This Assessment Task relates to the following Learning Outcomes: 3. Demonstrate understanding of AC motor drives and controller

On successful completion you will be able to:

- 1. Demonstrate understanding of mechatronic systems and building blocks of them
- 3. Demonstrate understanding of AC motor drives and controller

Mini Test #2

Due: **Week 10**

Weighting: **5%**

This Test will be conducted on the learning of Week 7, 8 and 9. This will help the students to learn the topic in a better way. The Test will be for a duration of 30 minutes and is worth of 5%.

On successful completion you will be able to:

- 1. Demonstrate understanding of mechatronic systems and building blocks of them
- 3. Demonstrate understanding of AC motor drives and controller
- 4. Demonstrate understanding of modelling of mechatronic systems and kinematics of robotic system

Practical Experiment #3

Due: **Week #13**

Weighting: **10%**

#3: Robotic Arm: The students will learn on robotic arm on the week 10, 11 and 12. They will be asked to implement some activities using the robotic arm on the 13th week. This activity is worth of 10%. Grading will take into consideration the level of discovery as evidenced by insight presented in the report in terms of critical evaluation of the laboratory activity and technical justification of procedure and design. The assignments problems will be set to develop learning outcomes during the lecture block associated with the laboratory. Grading will take into

consideration the level of understanding demonstrated as evidenced by the approach taken to present each solution.

Grading will also take into consideration of the level of participation as evidenced by attendance and demeanour in the classes. High marks will be awarded for initiative, approach to self-learning and self-management. Students are expected to participate in the learning activities with a developing level of independence as well as team work. This Assessment Task relates to the following Learning Outcomes: 4. Demonstrate understanding of modelling of mechatronic systems and kinematics of robotic system

On successful completion you will be able to:

- 1. Demonstrate understanding of mechatronic systems and building blocks of them
- 4. Demonstrate understanding of modelling of mechatronic systems and kinematics of robotic system

Mini Project and Presentation

Due: **Week #14**

Weighting: **10%**

The students will need to choose a Mechatronic topic (basically a very good existing system available in the market) and do self-study. They need to present the system (history, needs, novelty, components, usefulness, market and so on) in front of fellow students and markers. The allocated time for presentation is 10 minutes. The presented materials should be supported by published articles. They are expected to submit the presented materials along with the studied published articles. High marks will be awarded for initiative, approach to self-learning and selfmanagement. This Assessment Task relates to the following Learning Outcomes:

1. Demonstrate understanding of mechatronic systems and building blocks of them
2. Apply pneumatic, and PLCs integrated with pneumatics to control mechatronic systems; 3. Demonstrate understanding of modelling of mechatronic systems and kinematics of robotic system
3. Demonstrate understanding of AC motor drives and controller
4. Demonstrate understanding of modelling of mechatronic systems and kinematics of robotic system

On successful completion you will be able to:

- 1. Demonstrate understanding of mechatronic systems and building blocks of them
- 2. Apply pneumatics, and PLCs integrated with pneumatics, to control of mechatronic systems
- 3. Demonstrate understanding of AC motor drives and controller

- 4. Demonstrate understanding of modelling of mechatronic systems and kinematics of robotic system

Final Examination

Due: **Exam time**

Weighting: **40%**

3 hour Final examination. Grading will take into consideration the level of understanding demonstrated as evidenced by the approach taken to present each solution.

This Assessment Task relates to the following Learning Outcomes: • 1. Demonstrate understanding of mechatronic systems and building blocks of them • 2. Apply pneumatic, and PLCs integrated with pneumatics to control mechatronic systems; 3. Demonstrate understanding of AC motor drives and controller 4. Demonstrate understanding of modelling of mechatronic systems and kinematics of robotic system •

On successful completion you will be able to:

- 1. Demonstrate understanding of mechatronic systems and building blocks of them
- 2. Apply pneumatics, and PLCs integrated with pneumatics, to control of mechatronic systems
- 3. Demonstrate understanding of AC motor drives and controller
- 4. Demonstrate understanding of modelling of mechatronic systems and kinematics of robotic system

Delivery and Resources

Reference materials: 1. Lecture materials to be uploaded at the website during lectures by Subhas. 2. Pneumatic; Basic Level, Peter Croser and Frank Ebel, FSTO, https://www.fer.unizg.hr/_download/repository/PNEUMATIKA_labs_Festo_eng.pdf 3. Robot Modeling and Control, Mark W. Spong, Seth Hutchinson and M. Vidyasagar, Wiley. 4. Mechatronics, Sabri Cetinkunt, Wiley. 5. Mechatronics, Electronic control systems in mechanical and electrical engineering, W. Bolton, Prentice Hall. 6. Control System Engineering, Norman S. Nise, Wiley. 7. Electrical Machines, Drives and Power Systems, Theodore Wildi, Prentice Hall.

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_2016.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.a>

[u/policy/docs/complaint_management/procedure.html](http://www.mq.edu.au/policy/docs/complaint_management/procedure.html)

Disruption to Studies Policy (in effect until Dec 4th, 2017): http://www.mq.edu.au/policy/docs/disruption_studies/policy.html

Special Consideration Policy (in effect from Dec 4th, 2017): <https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policies/special-consideration>

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 outcome

- 3. Demonstrate understanding of AC motor drives and controller

Assessment tasks

- Practical Experiment#1
- Practical Experiment #2
- Practical Experiment #3
- Mini Project and Presentation
- Final Examination

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 outcomes

- 1. Demonstrate understanding of mechatronic systems and building blocks of them
- 2. Apply pneumatics, and PLCs integrated with pneumatics, to control of mechatronic systems

Assessment tasks

- Mid Term Test
- Practical Experiment #2
- Final Examination

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
- 2. Apply pneumatics, and PLCs integrated with pneumatics, to control of mechatronic systems
- 3. Demonstrate understanding of AC motor drives and controller
- 4. Demonstrate understanding of modelling of mechatronic systems and kinematics of robotic system

Assessment tasks

- Mini Test #1
- Practical Experiment#1
- Mid Term Test
- Practical Experiment #2
- Mini Test #2
- Practical Experiment #3
- Mini Project and Presentation
- Final Examination

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
- 2. Apply pneumatics, and PLCs integrated with pneumatics, to control of mechatronic systems
- 3. Demonstrate understanding of AC motor drives and controller
- 4. Demonstrate understanding of modelling of mechatronic systems and kinematics of

robotic system

Assessment tasks

- Mini Test #1
- Practical Experiment#1
- Mid Term Test
- Practical Experiment #2
- Mini Test #2
- Practical Experiment #3
- Mini Project and Presentation
- Final Examination

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:

Learning outcomes

1. Demonstrate understanding of mechatronic systems and building blocks of them
2. Apply pneumatics, and PLCs integrated with pneumatics, to control of mechatronic systems
3. Demonstrate understanding of AC motor drives and controller
4. Demonstrate understanding of modelling of mechatronic systems and kinematics of robotic system

Assessment tasks

- Mini Test #1
- Practical Experiment#1
- Mid Term Test
- Practical Experiment #2
- Mini Test #2
- Practical Experiment #3
- Mini Project and Presentation
- Final Examination

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
- 2. Apply pneumatics, and PLCs integrated with pneumatics, to control of mechatronic systems
- 3. Demonstrate understanding of AC motor drives and controller
- 4. Demonstrate understanding of modelling of mechatronic systems and kinematics of robotic system

Assessment tasks

- Mini Test #1
- Practical Experiment#1
- Mid Term Test
- Practical Experiment #2
- Mini Test #2
- Practical Experiment #3
- Mini Project and Presentation
- Final Examination

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
- 2. Apply pneumatics, and PLCs integrated with pneumatics, to control of mechatronic systems

- 3. Demonstrate understanding of AC motor drives and controller

Assessment tasks

- Practical Experiment#1
- Mid Term Test
- Practical Experiment #2
- Practical Experiment #3
- Mini Project and Presentation
- Final Examination

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 outcomes

- 2. Apply pneumatics, and PLCs integrated with pneumatics, to control of mechatronic systems
- 4. Demonstrate understanding of modelling of mechatronic systems and kinematics of robotic system

Assessment tasks

- Mini Project and Presentation
- Final Examination

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

- 4. Demonstrate understanding of modelling of mechatronic systems and kinematics of robotic system

Assessment tasks

- Practical Experiment #3
- Mini Project and Presentation

Changes in response to students' feedback

There are some changes for 2017 compared to 2016.

In 2016, the lectures were of 2 hours. The lectures have been changed to 3 hours in 2017.

One hour in each week will be used for tutorial types of materials.

The lectures of the 7th week has been used for the Mid-term test in 2016 which will be avoided in 2017. Only one hour will be used for the Mid-term test.

Details of changes will be discussed at the briefing on the very first day.

Changes since First Published

Date	Description
24/08/2017	Re-wording and swapping of learning outcome