ELEC326

Mechatronic Systems

S2 Day 2016

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. Apply pneumatic, and PLCs integrated with pneumatics to control mechatronic systems;
3. Demonstrate understanding of modelling of mechatronic systems and kinematics of robotic system
4. Demonstrate understanding of AC motor drives and controller
5. Demonstrate understanding of embedded systems for intelligent mechatronic systems and IoT based Future mechatronic systems.

General Assessment Information

General Assessment Information

Notifications

The attenadance to lectures and laboratory classes will be noted.

Formal notification of assessment tasks, grading rubrics and due dates will be posted on iLearn. Although all reasonable measures to ensure the information is accurate, The University reserves the right to make changes without notice. Each student is responsible for checking iLearn for changes and updates.

Late submissions or absences from laboratories will not be accepted without prior arrangement made at least one week before the submission date. Extenuating circumstances will be considered upon lodgement of a formal notice of disruption of studies.

The grading will be as per the university guidelines.

Assessment Tasks

Name	Weighting	Due
Mid-semester Test	10%	Week 7
Final Examination	50%	Formal Examination time
Mini-Project and presentation	10%	Week 14
Practical Experiments #1	10%	Week 5
Practical Experiments #2	10%	Week 9

Name	Weighting	Due
Practical Experiment #3	10%	Week 13

Mid-semester Test

Due: **Week 7**
Weighting: **10%**

A written test of 1 hour will be conducted on the 7th week.

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

On successful completion you will be able to:

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

Final Examination

Due: **Formal Examination time**
Weighting: **50%**

3 hour Final examination.

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

On successful completion you will be able to:

- 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
- 4. Demonstrate understanding of AC motor drives and controller
- 5. Demonstrate understanding of embedded systems for intelligent mechatronic systems and IoT based Future mechatronic systems.

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 self-management.

On successful completion you will be able to:

- 5. Demonstrate understanding of embedded systems for intelligent mechatronic systems and IoT based Future mechatronic systems.

Practical Experiments #1

Due: **Week 5**
Weighting: **10%**

Practical Experiments:

The students will be working in groups.

#1: Pneumatic Circuit design (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.

On successful completion you will be able to:

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

Practical Experiments #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 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.

On successful completion you will be able to:

- 3. 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.

On successful completion you will be able to:

- 4. Demonstrate understanding of AC motor drives and controller

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

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

- 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
- 4. Demonstrate understanding of AC motor drives and controller
- 5. Demonstrate understanding of embedded systems for intelligent mechatronic systems and IoT based Future mechatronic systems.

Assessment tasks

- Mid-semester Test
- Final Examination
- Mini-Project and presentation
- Practical Experiments #1
- Practical Experiments #2
- Practical Experiment #3

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 pneumatic, and PLCs integrated with pneumatics to control mechatronic systems;
- 3. Demonstrate understanding of modelling of mechatronic systems and kinematics of robotic system
- 4. Demonstrate understanding of AC motor drives and controller
- 5. Demonstrate understanding of embedded systems for intelligent mechatronic systems and IoT based Future mechatronic systems.

Assessment tasks

- Mini-Project and presentation

- Practical Experiments #2
- Practical Experiment #3

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

Assessment tasks

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- Final Examination
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- Practical Experiments #1
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- Practical Experiment #3

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 pneumatic, and PLCs integrated with pneumatics to control mechatronic

systems;
- 3. Demonstrate understanding of modelling of mechatronic systems and kinematics of robotic system
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Assessment tasks

- Mid-semester Test
- Final Examination
- Mini-Project and presentation
- Practical Experiments #1
- Practical Experiments #2
- Practical Experiment #3

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 pneumatic, and PLCs integrated with pneumatics to control mechatronic systems;
- 3. Demonstrate understanding of modelling of mechatronic systems and kinematics of robotic system
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Assessment tasks

- Final Examination
- Mini-Project and presentation
- Practical Experiments #1
- Practical Experiments #2

- Practical Experiment #3

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 pneumatic, and PLCs integrated with pneumatics to control mechatronic systems;
- 3. Demonstrate understanding of modelling of mechatronic systems and kinematics of robotic system
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Assessment tasks

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- Final Examination
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- Practical Experiments #2
- Practical Experiment #3

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
- 4. Demonstrate understanding of AC motor drives and controller

Assessment tasks

- Mid-semester Test
- Final Examination
- Mini-Project and presentation
- Practical Experiments #1

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

- 1. Demonstrate understanding of mechatronic systems and building blocks of them
- 5. Demonstrate understanding of embedded systems for intelligent mechatronic systems and IoT based Future mechatronic systems.

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 outcomes

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