

ENGG 3490

Introduction to Mechatronics Systems Design

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Class Hours: Monday/Wednesday/Friday, 11:30am-12:20pm, MACK room 115

Labs: Tuesdays 10:30 am-12:20 pm, THRN Room 2307

Midterm Exam: 7pm - 9pm, Wednesday, Feb. 29th, MACK 121

Final Exam: 7pm - 9pm, (2012/04/16), Room TBA

Outlines: This course covers an introduction to mechatronics systems. Mechatronics, in general, is involved with mechanical, electrical and computer systems. Recently, mechatronics have found a variety of applications in many fields especially in automation and manufacturing industries. In this course, you will learn about mechatronics systems: how are they designed and controlled. We will cover programmable logic controller (PLC), review and modeling of mechatronic systems, sensing and measurement, sensors and applications, actuators and their applications, modeling and control of electric motors (dc and ac), as well as stepper and servo motors. You will also learn about other electromechanical systems such as transformers and their applications. We will introduce some control techniques for mechatronic systems, and finally we briefly review robotics and their recent advances. By the end of the term, you should have a good understanding of design, modeling and control of mechatronic systems. This course contains theory and practical applications of those systems. More importantly, the course has hands-on and practical projects which provide you with great skill sets required to succeed in your career.

This course covers the following topics:

1. Introduction to mechatronic systems: basics
2. Programmable logic controller (PLC)
3. Mechatronic systems: review and modeling
4. Sensing and measurement
5. Sensors and actuators and their applications
6. Transformers and Electric motors
7. Special motors used in mechatronic systems
8. Control of mechatronics systems
9. Introduction to robotics and recent advancements

The breakdown of the marking scheme is:

1. Midterm 10%
2. Assignments 10%
2. Project and presentation 20%
3. Lab 30%
4. Final 30%

Both midterm and final exams have questions and problems. Questions are related to the fundamental understanding of the concepts taught in class. For both exams you are allowed to bring your own **only one-page** aid sheet (double-side) which can **only** have formulas (**No** solved problems, no description, no explanation, no figures, no diagrams, no graphs, no curves, no tables, etc.)

Project:

The project and presentation is about PLC design for which the class will be divided into **two** sections. In each section (which has about 16 students), students will be grouped into four groups (each group has maximum of 4 students).

1. The first section starts their PLC project on Jan. 17th. The final project demonstration is Feb. 14th and final report due is Feb. 17th.
2. The next section starts their PLC project on Feb. 28th. The final project demonstration is March 27th and final report due is March 30th.

Note: Groupings will be done in the lab. The deadlines are firm and cannot be extended. There is no late policy for the demo. Late demonstration is not acceptable. Each group needs to demonstrate their project (whatever they have done by the deadline).

Late policies for the report only:

- 25% deduction if the report is submitted late within 24 hours of the deadline (i.e. within 1 day)
- 50% deduction if the report is submitted late within 48 hours of the deadline (i.e. within 2 days)
- reports are not accepted beyond that (i.e. grade of 0)

Labs:

There are four labs (lab 0 is introduction) throughout the term which you are supposed to complete with a group of 3-4 people. Lab reports are due in the lab sessions and the TA will go over the deadlines as they occur. Reports are usually due the week the next lab starts (i.e. the lab 1 report is due the week the lab 2 starts).

Please check <http://www.soe.uoguelph.ca/webfiles/el2307/engg3490/engg3490.html> for details on the labs.

Late policies:

- 25% deduction if the report is submitted late within 24 hours of the deadline (i.e. within 1 day)
- 50% deduction if the report is submitted late within 48 hours of the deadline (i.e. within 2 days)
- reports are not accepted beyond that (i.e. grade of 0)

Note: Grouping for the labs is also done in the lab. For remarking the labs and projects, please discuss with the TA in the lab.

Assignments:

Assignments are given throughout the semester. Some of the assignments require using Matlab/Simulink for simulations.

Late policies:

- 50% deduction (within 1 day after the deadline)
- reports are not accepted after 24 hours of their deadline

References:

There is no single textbook in general for Mechatronics course simply because Mechatronics is multidisciplinary. The followings books are great sources:

1. "Applied Mechatronics", A. Smaili, F Mrad, Oxford University Press, 2008.
(bookstore)
2. "Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering", W. Bolton, 4th edition, Prentice Hall, 2008.

3. “Programmable Logic Controllers”, Frank D. Petruzella, 3/E, McGrawHill, 2011.
4. “Programmable Logic Controller”, J. R. Hackworth, F. D. Hackworth, Jr., 4th edition, Prentice Hall, 2004.
5. “Mechatronics”, Dan S. Neculescu, Prentice Hall, 2002.
6. Introduction to Mechatronics and Measurement Systems, D. Alciator and M. Histan, 4th edition.
7. “Principles of Robot Motion”, H. Choset, K. M. Lynch, S. Hutchinson, G. Kantor, W. Burgard, L. E. Kavraki and S. Thrun, MIT Press, Boston, 2005
8. “Principles and Applications of Electrical Engineering”, by G. Rizzoni, McGraw-Hill, 5th edition, 2007.
9. “Electric Machinery Fundamental”, by S. J. Chapman, McGraw-Hill, 5th edition, 2011.

Note: Students are responsible to frequently check the course website and the contents that might be modified (or revised) throughout the term.

University Policy on Academic Misconduct:

Academic misconduct, such as plagiarism, is a serious offence at the University of Guelph. Please consult the Undergraduate Calendar 2011-2012 and School of Engineering programs guide, for offences, penalties and procedures relating to academic misconduct.

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml>

Disclaimer:

The instructor reserves the right to change any or all of the above in the event of appropriate circumstances, subject to the University of Guelph Academic Regulations.