ENGG*4480 Advanced Mechatronics Systems Design
Winter 2015

UNIVERSITY of GUELPH
School of Engineering

(Revision 1: Jan. 5, 2015)

---

1 INSTRUCTIONAL SUPPORT

1.1 Instructor

Instructor:	Medhat Moussa, Ph.D., P.Eng.
Office:	THRN 1339, ext. 52435
Email:	mmoussa@uoguelph.ca
Office hours:	after lecture or by appointment

1.2 Lab Technician

Technician:	Nate Groendyk
Office:	THRN 2308, ext. 53873
Email:	groendyk@uoguelph.ca

Technician:	Ken Graham and David Wright
Office:	THRN 1021 and 1019, ext. 53924 and 56706
Email:	dwrigh02@uoguelph.ca

2 LEARNING RESOURCES

2.1 Course Website

Course material, news, announcements, and grades will be regularly posted to the ENGG*4480 Courselink site. You are responsible for checking the site regularly.

2.2 Resources

Mechatronics is a multi-disciplinary field and since this is a project based course, there is no single textbook that will be used in this course. However, you may find the following resources helpful

General Mechatronics Reference W. Bolton, *Mechatronics*, 5th Edition, Pearson, 2012.

Mechanical Design N. Sclater, N P. Chironis, *Mechanisms and Mechanical Devices Source Book*, 4th Edition, McGraw Hill, 2007.

Project E. Grimo, *Nut Tree Ontario, A practical Guide*, The Society of Ontario Nut Growers, 2011.

Reports David Beer, A Guide to Writing as an Engineer, 3rd Edition, John Wiley, 2009.

Tools Arduino

1. Introduction, http://www.makeuseof.com/tag/arduino-technology-explained/

2. Arduino website, http://arduino.cc/

Raspberry Pi

1. Introduction, http://www.makeuseof.com/tag/great-things-small-package-your-unofficial-raspberry-pi-manual/

2. Raspberry Pi website, http://www.raspberrypi.org/

Lecture notes: Lecture notes covering various additional topics will be posted on courselink.

2.3 Communication and Email Policy

Please use lectures to ask questions about the course. Major announcements will be posted to the course website. As per university regulations, all students are required to check their mail.uoguelph.ca e-mail account regularly: e-mail is the official route of communication between the University and its students.

3 ASSESSMENT

Successful completion of ENGG 4480 requires satisfactory performance in mandatory group components. Group components consist of group meetings with instructor, group oral presentations, and completing the design project. Regular instructor appointments with the groups will be scheduled once the group makeup

has been decided. Students are required to work in groups of 3-4 students. The breakdown of the marks (percentage) for ENGG 4480 is as follows, with detail on how the grade is determined for each component:

3.1 Dates and Distribution

Project: 70%
Students must complete a term long project that includes two design phases: Preliminary design and detailed design. The 70% is split between both phases. The first phase counts for 35% while the second phase counts for 35%. Each report and related specified deliverables will be marked according to a design rubric (Project Report Grading Form). Since both projects are group efforts, a signed Group Participation Evaluation Form must be included with each report. This form distributes the marks among group members according to effort. If this form is not included in the report, the group submission will not be graded. In the event of disagreement among group members on distribution of effort, the instructor will act as arbitrator.

- Preliminary design report: Due Friday Feb. 13, 2015 @23:59 on courselink
- Final design report: Due Thursday April 2, 2015 @23:59 on courselink

Weekly professor-in-the-loop group meetings: 10%
Groups are required to attend a weekly meeting with instructor. The meetings are expected to be regular group meetings but with the presence of the instructor who will silently observe the meeting and then provide feedback to the group on their progress. The meeting format, assessment tool, and time will be provided on courselink and discussed during lecture once groups are formed. It is mandatory that all group members attend these meetings.

Design reviews: 15%
There will be two design reviews in this course where each group will present their design to other groups for peer evaluation and review. Presentation format, peer review rubric, and time will be provided on courselink and discussed during lecture.

Two page paper: 5%
Students are required at the end of the term to write a two page paper that describes their project. You will have to submit two versions of the paper. The first will be reviewed by the instructor and feedback provided to you. The second will be the final version submitted for evaluation.

The instructor may change any of the above as course needs dictate, subject to University of Guelph academic regulations.

3.2 Course Grading Policies

Missed Assessments: If you are unable to meet an in-course requirement due to medical, psychological, or compassionate reasons, please email the course instructor. See the undergraduate calendar for information on regulations and procedures for Academic Consideration:
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Accommodation of Religious Obligations: If you are unable to meet an in-course requirement due to religious obligations, please email the course instructor within two weeks of the start of the semester to make alternate arrangements. See the undergraduate calendar for information on regulations and

procedures for Academic Consideration of Religious Obligations:

Passing grade: The passing grade in this course is 50%

Late Project Reports: Late submissions of project reports will be subject to the following penalty policy.

- 1% will be deducted for every hour after submission deadline up to 24 hours late,

- 2% will be deducted for every hour after 24 hours from submission deadline up to 48 hours late,

- No reports will be accepted after 48 hours of the submission deadline date.

---

4 AIMS, OBJECTIVES & GRADUATE ATTRIBUTES

4.1 Calendar Description

This course is a project course which uses electronics to control real world mechanical systems. The course covers signal conditioning, system calibration, system models, dynamic models, large scale systems, networking, microprocessors, programmable logic controllers, communication systems and fault finding. *Prerequisite(s): ENGG*3490, ENGG*3640, ENGG*4460*

4.2 Course Aims

This course links several of the courses in the Mechatronics stream like ENGG 3490, ENGG 3640, and ENGG 4460 to enable students to design, build, and test a complex mechatronics system that solves a real-world problem. The course also emphasizes lots of soft skills that any engineer must have to be able to successfully complete major design projects including: project management, communication of design ideas through presentations and design reports, and practice writing long technical report as well as short concise summaries and briefs.

4.3 Learning Objectives

At the successful completion of this course, the student will have demonstrated the following knowledge and skills:

1. Understand the trade-offs inherent in mechtronics design space

2. Describe a complex design problem in terms of constraints, assumptions, and design criteria

3. Analyze a complex problem to create a set of feasible technical mechatronics solutions

4. Evaluate various possible mechatronics solutions against constraints and design criteria

5. Apply solid engineering technical knowledge to synthesis of a selected design solution.

6. Create a mechatronics design that optimally achieves design criteria, satisfies all constraints, and can be realized by available resources.

7. Implement, if possible, or simulate the performance of the design, and test it against performance requirements.

8. Communicate the design in writing and in oral presentation.

9. Plan a project specifying various tasks, milestones and tracking process Organize and conduct meetings to discuss the progress of a project and determine upcoming work.

4.4 Graduate Attributes

Successfully completing this course will contribute to the following CEAB Graduate Attributes:

Graduate Attribute	Learning Objectives	Assessment
1. Knowledge Base for Engineering	1	Project
2. Problem Analysis	2, 3	Project
3. Investigation	-	
4. Design	2, 3, 4, 5, 6	Project
5. Use of Engineering Tools	7	Project
6. Communication	8	Project report, design review, short paper
7. Individual and Teamwork	10	Project
8. Professionalism	-	-
9. Impact of Engineering on Society and the Environment	-	-
10. Ethics and Equity	-	-
11. Environment, Society, Business, & Project Management	9	Project, Professor in the loop meetings
12. Life-Long Learning		Project

4.5 Instructor's Role and Responsibility to Students

The instructor's role is to develop and deliver course material in ways that facilitate learning for a variety of students. Using PITL, lectures, and design review, the instructor will help students achieve a high level of design expertise and skill and be able to communicate that in a clear and precise way.

4.6 Students' Learning Responsibilities

Students are expected to take advantage of the learning opportunities provided by tackling a complex design problem. Students, especially those having difficulty with the course content, should also make use of other resources recommended by the instructor. Students who do (or may) fall behind due to illness, work, or extra-curricular activities are advised to keep the instructor informed. This will allow the instructor to recommend extra resources in a timely manner and/or provide consideration if appropriate.

4.7 Relationships with other Courses & Labs

Previous Courses:

ENGG*3490 Introduction to Mechatronic Systems Design:

ENGG*3640 Microcomputer Interfacing: Interfacing computer to external equipment and data acquisition

ENGG*4460 Robotic Systems: Study the modeling and design of complex mechatronics systems (Robots)

---

5 TEACHING AND LEARNING ACTIVITIES

5.1 Timetable

Lectures:

Tuesday, Thursday	8:30AM - 9:50AM	MACS 301

Laboratory:

Tuesday	2:30PM - 5:20PM	RICH 2510 or Machine shop

5.2 Lecture Schedule (Tentative)

Lectures	Lecture Topics	Learning Objectives
1-2	Project and course introduction	1,2
3-4	Case studies, Report format and document processing tools, Introduction to PITL meetings	3, 8
5-10	PITL, Mechatronics design tools, Writing skills	3,4,5,9
11-12	Design review	8
13-21	PITL, Mechatronics design tools	5,6,7,9
23-24	Design reviews	5

5.3 Other Important Dates

Monday, January 5 2015: First day of class

Monday, February 16 - Friday, February 20 2015: Winter Break

Friday, March 6: drop date - 40th class

Thursday, April 2 2015: last day of class

---

6 LAB SAFETY

Safety is critically important to the School and is the responsibility of all members of the School: faculty, staff and students. As a student in a lab course you are responsible for taking all reasonable safety precautions and following the lab safety rules specific to the lab you are working in. In addition, you are responsible for reporting all safety issues to the laboratory supervisor, GTA or faculty responsible.

If the laboratory rules are not followed, consequences will include removing access to the lab. If this results in lab work not being completed, the student will receive a grade of 0.

7 ACADEMIC MISCONDUCT

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community faculty, staff, and students to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offenses from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member.

7.1 Resources

The Academic Misconduct Policy is detailed in the Undergraduate Calendar:
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

A tutorial on Academic Misconduct produced by the Learning Commons can be found at:
http://www.academicintegrity.uoguelph.ca/

Please also review the section on Academic Misconduct in your Engineering Program Guide.

The School of Engineering has adopted a Code of Ethics that can be found at:
http://www.uoguelph.ca/engineering/undergrad-counselling-ethics

8 ACCESSIBILITY

The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability for a short-term disability should contact the Centre for Students with Disabilities as soon as possible

For more information, contact CSD at 519-824-4120 ext. 56208 or email csd@uoguelph.ca or see the website: http://www.uoguelph.ca/csd/

9 RECORDING OF MATERIALS

Presentations which are made in relation to course work-including lectures-cannot be recorded or copied without the permission of the presenter, whether the instructor, classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

10 RESOURCES

The Academic Calendars are the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs:
http://www.uoguelph.ca/registrar/calendars/index.cfm?index