ENGG*4280
Digital Process Control Design
Winter 2015

UNIVERSITY of GUELPH
School of Engineering

(Revision 0: December, 2014)

1 Instructional Support

1.1 Instructor

Instructor:	Julie Vale, Ph.D., EIT.
Office:	THRN 2345, ext. 54863
Email:	jvale@uoguelph.ca
Office hours:	In lab or by appointment

1.2 Lab Technician

Technician:	Hong Ma
Office:	THRN 1506, ext. 53873
Email:	hongma@uoguelph.ca

1.3 Teaching Assistants

GTA	Email	Office Hours
Mohammad Usman	usmanm@uoguelph.ca	In lab or by appointment

2 Learning Resources

2.1 Course Website

Course material, news, announcements, and grades will be regularly posted to the ENGG*4280 Courselink site. You are responsible for checking the site regularly.

2.2 Required Resources

1. Custom text: *Digital Process Control: Analysis and Design* Prentice Hall, 2014.

2.3 Additional Resources

Lecture Information: Lecture notes will be posted on Courselink after lectures

Project Information: Information for the course projects will be posted within the project section of the Courselink page.

Problem sets: Problem sets will be posted in the 'problem sets' section of courselink. Solutions to selected questions will be posted to the same section in Courselink by the instructor and the GTA. Students are encouraged to post their attempts at solutions to the remaining questions in the discussion forums; GTA and the instructor will monitor these discussions and will provide support to help students arrive at the correct solutions.

Problem sets are not graded.

2.4 Communication and Email Policy

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

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3 ASSESSMENT

3.1 Dates and Distribution

Note that reading week occurs between weeks 6 and 7.

Tests: 40%, allocated based on best of (5%, 10%, 25%) or (0%, 15%, 25%).

Review Test: (5% or 0%)
Second tutorial (Monday January 12)

Term test 1 (10% or 15%)
In class, lecture 12, Friday Feb 13, 2015.

Term test 2 (25%)
In class, lecture 21, Wednesday March 25, 2015.

Process Control mini-project: (10%)
Friday of Week 6 (Feb 13) at 4:30pm

Bonus marks 10% bonus if you submit one week early. Maximum grade is 100%.

Digital Control Project: (50%)

A detailed explanation of the expectations for this project can be found on Courselink under 'Project'

Safety quiz: (Pass/fail)

There is a safety quiz available online in Courselink. This is a pass/fail quiz and does not contribute to your final course grade. You must pass (80% or higher) this quiz before you are allowed to enter the lab. If you do not pass this quiz, you will not be allowed to enter the lab and you will not be allowed to demo or submit any project report.

Proposal: (pass/fail)

Friday of Week 2 (Jan 16) at 4:30pm

This is a pass/fail report and does not contribute to your final course grade. You must pass this proposal before you are allowed to demo or submit any project report.

Modeling report: (5%)

Friday of Week 4 (Jan 30) at 4:30pm

Control report: (5%)

Friday of Week 8 (Mar 6) at 4:30pm

Informal Demo: (pass/fail)

Held during all scheduled lecture, lab, and tutorial slots in week 10. Sign-up sheets will be provided in class for students to select specific days and times.

Demo: (5%)

Held during all scheduled lecture, lab, and tutorial slots in week 12. Sign-up sheets will be provided in class for students to select specific days and times.

Final Report: (35%)

At 4:30pm on day 9 of the exam period (Wed. Apr 15).

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:
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml

Passing grade: In order to pass the course, you must pass both the project (60%) and test (40%) portions. Students must obtain a grade of 50% or higher on the test portion of the course in order for the project portions of the course to count towards the final grade. Similarly, students must obtain a grade of 50% or higher on the project portions of the course in order for the test portions to count towards the final grade. If a student fails both portions of the course, then the grade will be the **lower** of the two.

Missed test: There will be no makeup tests. No extra time will be given to students who arrive late.

Late Submissions: Missed attendance at the demo will yield a grade of zero. Late project reports will be penalized at a rate of 10% per hour.

Group Grading policy - Distribution of Effort: Failure to submit a distribution of effort (DOE - available on Courselink under Grading Sheets) with the final report will result in an incomplete grade for the project components of the course. Details of how these DOEs will be used to adjust individual student's final project grades are provided on courselink. DOE sheets must be submitted in hard copy to drop box 18 by every student.

Bonus mark cap: There are bonus marks available in this course; however, no assessment grade can be greater than 100%.

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4 AIMS, OBJECTIVES & GRADUATE ATTRIBUTES

4.1 Calendar Description

Design, analysis synthesis and simulation of process control and automation systems. Automation hardware, process compensation techniques and P.I.D. controllers, design and dynamics of final control elements, computer control and the microprocessor.
Prerequisite(s): ENGG*3410

4.2 Course Aims

This course has three main components: it explores the fundamentals of using computers and other discrete time tools to control real, continuous time, systems and it takes a deeper look at process control. The main goals of this course are to (1) teach students how to mathematically analyze and control 'hybrid systems' using a number of different methods, (2) to investigate some of the specifics of process control, and (3) to teach students to write a well structured formal report.

4.3 Learning Objectives

At the successful completion of this course, a student will be able to:

1. analyze a hybrid control system using a combination of Laplace transforms and z-transforms.
2. design a digital controller that achieves given specifications for a continuous time plant via both direct and emulation design techniques.
3. analyze and design a digital controller in the context of process control.
4. implement a digital controller using Matlab in a laboratory setting.
5. compare and contrast different controllers in the context of performance, robustness, and stability.
6. write a clear and comprehensive engineering report.

4.4 Graduate Attributes

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

Graduate Attribute	Learning Objectives	Assessment
1. Knowledge Base	1	Tests
3. Investigation	4	Project
4. Design	2-5	Project, Exam
6. Communication	6	Project report
11. Environment, Society, Business, & Project Management	3,4	Project

4.5 Relationships with other Courses & Labs

Previous Courses:

ENGG*3410: Everything

Follow-on Courses:

ENGG*4030: Foundations of digital and process control

ENGG*4090: Foundations of digital and process control

ENGG*4430: Foundations of discrete time systems and digital control

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5 Teaching and Learning Activities

5.1 Timetable

Lectures:			
Wednesday		8:30-9:50	GRHM 2310
Friday		8:30-9:50	GRHM 2310
Tutorials:			
Monday		11:30 - 12:30	MACK 223
Laboratory:			
Wednesday	Sec 01	15:30 - 17:30	RICH 2504
Wednesday	Sec 02	11:30 - 13:30	RICH 2504

There is no tutorial in week 1.

5.2 Lecture Schedule

Lectures in this course address material that students require in order to be able to do the project. Topics are fluid and are driven, at least in part, by student's project related needs. The following is a list of topics that will be covered in this course. The depth of coverage (and therefore the number of lectures devoted to those topics) will depend on student feedback.

Review of ENGG*3410 concepts

Discrete time mathematics

Effect of a sample and hold operation

Discrete time systems - stability, behaviour, control specifications

Introduction to hybrid systems

Emulation Control

Direct Control

How to write a formal report

The last three lectures will be used as an open forum for students to bring project related questions and concerns to the group. No new content will be introduced during these weeks. These lectures will be held in the lab.

5.3 Project Schedule

The instructor will be in the lab during all scheduled lab times starting in week 2. There are two types of instructor related lab activities:

Group meetings: Groups will have a pre-set time to meet with me for 15 minutes; this schedule will be determined on the second day of class. We can use that time to discuss the project, group dynamics/issues, or any other course related questions that you may have. Consider these meetings to be similar to progress reports that you would give your boss if you were working on a large project in industry.

Open hours: I will have 30 min, bookable time slots available for meetings with groups or individuals. Consider this time to be similar to an office hour. Bookings must be made (on the lab door) by 8am on the day of the lab. I will not be present in the lab during any unbooked times.

Week	**Lab activity**	**Items due**
1	TA demo of equipment	Safety quiz
2	group meetings	Proposal/project plan
3	open hours	
4	group meetings	Modeling Report
5	open hours	Mini project report - early submission 10% bonus
6	group meetings	Mini-project report
Reading week!!		
7	open hours	
8	group meetings	Control Report
9	open hours	
10	Informal Demos	Informal Demos
11	open hours	
12	Formal Demos	Formal Demos
Exam period		Final report

5.4 Other Important Dates

Monday, January 5 2015: First day of class

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

Friday, March 6 2015: drop date - 40th class

Friday, April 3 2015: last day of class

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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.

A lab safety quiz is available on Courselink. You will not be allowed to enter the lab until you have successfully completed this quiz.

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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 offences 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