

Chemical Engineering 3P4, Term 2, 2014

Process Control

Instructor

Kevin Dunn, kevin.dunn@mcmaster.ca (BSB, room B105)

Teaching assistants

- Kuilin Chen, chemac.3p4@gmail.com (JHE 132)
- Zamry Jamaludin, chemac.3p4@gmail.com (JHE 369)
- Mudassir Rashid, chemac.3p4@gmail.com (JHE 370B)

Class time and location

- Lecture times: T13, Room 127, on Monday, Wednesday and Friday morning, 08:30 to 09:20 (*sorry - I don't get to pick these times!*)
- Tutorial times: JHE A101 (Monday, 11:30 to 13:20 *or* Friday from 14:30 to 16:20)

Disclaimer

This outline **may be modified**, as circumstances change.

1 About the course

Official description

Transient behaviour of chemical processes. Theory and practice of automatic control. Introduction to computer process control.

Prerequisites

CHEM ENG 2004 (fluid mechanics), CHEM ENG 3A04 (heat transfer), CHEM ENG 3E04 (process models), CHEM ENG 3K04 (reactor design), and your math prerequisites, MATH 2Z03 and 2ZZ3.

Course materials

The course website will be permanently available at: <http://learnche.mcmaster.ca/3P4>

Course materials, tutorials, assignments, solutions, *etc* will be available from the website.

Course announcements will only be posted to the main page of the website - students are expected to check the website at least 3 times per week. Please note that this is not an Avenue course website. You may also choose to receive all course notifications from the Twitter feed at [@3P4control](https://twitter.com/3P4control).

Also visit <http://pc-education.mcmaster.ca>, which contains additional learning resources with solutions.

Required textbook

The official course textbook is available from The Campus Store

Thomas E. Marlin, Process Control: Designing Processes and Control Systems for Dynamic Performance, McGraw-Hill, second edition. bookstore should have copies in stock by the start of the course.

Other references you may consider are listed on the course website and are generally available in Thode Library.

What you must be able to demonstrate by the end of the course

This course emphasizes three issues that are highly relevant for all engineers.

1. *dynamic behaviour*, because no process operates at steady state

2. *process operation*, because existing equipment must be operated safely to yield high profit, and
3. *automatic control*, because engineers implement operating decisions through computer technology.

This requires knowledge of dynamic behaviour of processes (process modelling, solution of dynamic equations, characterization of dynamic behaviour); control systems; stability and techniques for assessing it; performance criteria and how they are affected by controller parameters.

This course will bring together multiple aspects from other Chemical Engineering courses: fluid flow, heat transfer, reactor design, and the ability to solve these process models. **Every single prerequisite will be fully used.** Your 3E4 and math courses will be used to solve the equations we derive.

Be prepared to go back to these course notes during assignments, and when preparing for class, especially if you are not comfortable with the prerequisite material.

2 Grading

To assess your understanding of the course materials, the grading for the course will be:

Component	Fraction	Notes
Assignments	10%	Expect around 6 assignments; can be completed individually, or in groups of 2 (no exceptions).
Tutorials	8%	Expect a tutorial every week of term.
Midterm 1	12.5%	Written midterm exam 1
Midterm 2	12.5%	Written midterm exam 2
Quests	9%	Short tests that you complete online
Final exam	48%	A written exam, lasting 3 hours.

Very important note: Achieving a grade of below 50% in the final exam will automatically imply failure in the course, with a grade of F, no matter what your other grades for the midterms, tutorials and assignments are.

Policies regarding grading

- We encourage you to complete the assignments in groups of no more than 2 members.
- You, and your group, will receive the greatest benefit if you each do **all** the questions yourselves. Arrange to meet and review your solutions, discussing various approaches.
- Assemble a **single submission** for the group – the TAs will not grade loose sheets handed in after the first submission. All group submissions must clearly show the names of the group members.
- You are defeating the purpose of the group-based assignment if you simply divide the assignment into sections, one for each group member. This is definitely not recommended, because you are losing out on the learning opportunity of seeing your mistakes and the group member's mistakes, and learning from them.
- No sharing of any work may be done between groups for assignments. This includes handwritten documents and electronic files of any type. Reusing solutions from previous years will be considered plagiarism. Please ensure that you have read the University's academic integrity policy (part of which is reproduced below).
- This is a large class of over 120 students, so late hand-ins interfere with the TAs' ability to efficiently grade your assignments. Late assignments will be penalized by deducting 30% per day for every late day. A grade of zero will be given for submissions handed in after the solutions are posted (usually within 2 days of assignment hand-in).
- Emergencies and such arise, so each person has 2 "late day" credits for assignments. So you can hand in one assignment 2 days late, or 2 assignments each one day late, without penalty. Late day credits cannot be used for midterms, only for assignments.
- Grading of assignments and tests will include contributions for clarity and organization of presentation.
- No make-ups will be given for assignments, tutorials or Quests.

- Tutorials are generally graded as pass/fail, provided a reasonable attempt has been made to attempt the work.
- Weekly tests (Quests): These tests may be answered from any device with internet access. These tests are *completed individually*. There will be multiple choice, short answer and long answer questions on the tests, with questions randomly generated per student. Many questions will be automatically graded and the results returned to you after completion of the test window. Some questions will require you to upload electronic files and images.

The testing window is a period of time (approximately a 30-hour window). Once you start the test on your device you will only have an hour to complete it. The intention is that you study the material taught in class the week prior and then take the test. Questions will occasionally be from work covered several weeks prior to the test. Solutions will be revealed at the end of the window.

The reason for using short, frequent tests is that there is ample evidence in the learning literature that the [testing effect](#) and that [spaced repetition](#) improve your retention and understanding of the material. This is true in this course where the structure has been carefully planned to be cumulative. Click on the links for some basic background reading.

The other advantage of smaller tests are that they they lower the stakes and reduce the pressure on you, for example if you are having a bad week, it will only affect a small test of around 1%, as opposed to a midterm or final exam which has much greater stakes.

- Any paper-based materials (textbooks, notes, *etc*) are allowed during tests and exams.
- Any calculator may be used during the tests and exams.
- The *midterms are optional* and there are no make-up for either of them. If you choose not to write the midterms, or cannot write it due to illness or other reasons, then the usual approach will be followed: the contribution from the midterms will be added to the final examination weighting. Please note however, the course grading is structured in a way to minimize your risk and spread out your learning pace.
- All assignments will be graded, and the mean of **all** assignments used to calculate the assignment grade. You should expect $N \approx 6$, and the assignments will be more frequent at the start of the course, slowing down at the end.
- The final percentage grades will be converted to letter grades using the Registrar's recommended procedure.
- Adjustment to the final grades may be done at the discretion of the instructor.
- The final exam will be cumulative, based on the entire semester's material.

3 Important notes

Class participation:

Please bring a calculator to every class. A cell phone, laptop, tablet computer, or some sort of device to connect to the internet in the class rooms, while not mandatory, will help you for tutorials and answering questions during class.

Course software

Programs such as MATLAB, Python, Excel, or whatever software best suits your needs, may be used to answer assignment questions.

Out-of-class access and email

Office hours are by email appointment with the TAs and instructor. Please check the [instructor's online calendar](#), <http://learnche.mcmaster.ca/contact-info> if you would like to make an appointment.

The TAs for this course can be contacted by email - please see their common email address above. Try to send email from your McMaster account - email from personal accounts are sometimes discarded by spam filters. Your instructor filters his email, so emails from @mcmaster.ca addresses receive higher priority.

4 Academic integrity

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity.

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: “Grade of F assigned for academic dishonesty”), and/or suspension or expulsion from the university.

It is your responsibility to understand what constitutes academic dishonesty. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at <http://www.mcmaster.ca/academicintegrity>

The following illustrates only three forms of academic dishonesty:

1. Plagiarism, e.g. the submission of work that is not one’s own or for which other credit has been obtained.
2. Improper collaboration in group work: this point is particularly important and will be strongly penalized in this course.
3. Copying or using unauthorized aids in tests and examinations.

Consider this course outline to be a first warning; any lack of academic integrity will not be accepted.

5 Accessibility

The instructor aims to make this class accessible to all students. Please forward and optionally discuss any accommodation granted by [Student Accessibility Services](#) with the instructor before the third week of the course. Please raise any other accessibility issues with the instructor as soon as possible, e.g. accessibility of the course website and course materials.

6 Important dates

A list of *tentative* dates is below. Some changes will occur as the course progresses. Please check the course website at least 3 times per week for updates:

Date	Description
06 January 2014	Overview class: review of course content and administrative issues
06 February	Midterm 1
18-24 February	Midterm break
13 March	Midterm 2
10 April	Exams start