The University of Western Ontario
Faculty of Engineering

DEPARTMENT OF CHEMICAL AND BIOCHEMICAL ENGINEERING

CBE 3310 - Process Dynamics and Control
Course Outline 2025 - 2026

Description
The course covers the dynamic behaviour, modelling, and control of chemical/biochemical processes. The principles of feedback, feedforward and cascade control of the commonly encountered systems such as level, flow, temperature, and pressure control loops are described. The theory of linear control systems is introduced followed by the description of hardware components to implement various types of controllers. Dynamic simulations of chemical processes will make use of the MATLAB/SIMULINK programming environments. The control of an actual process using LabView and National Instrument-data acquisition (NI-DAQ) systems will be implemented in the undergraduate lab.

Prerequisites
Applied Mathematics 2411 or 2415, CBE 2291A/B.

Unless you have either the requisites for this course or written special permission from your dean to enrol in it, you may be removed from this course, and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

Co-requisites None

Anti-requisite
The former CBE 4410A/B

Contact Hours
3 lecture hours, 1 computer laboratory (tutorial), and 1 experimental lab hour, 0.5 course.

Instructor
Dr. S. Rohani (TEB 457) Telephone: 519- 661-2111 ext: 84116 email: srohani@uwo.ca

Teaching Assistants (TAs)
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Lab Technician
Erin Johnson (SEB 1081) 519-661-2111 ext. 88457, email: epeter22@uwo.ca

Undergraduate Administrative Assistant
Brandy Hunter (TEB 477) Telephone: 519- 661-2111 ext. 82131, email: brandy.hunter@uwo.ca

Recommended Text
S. Rohani, Coulson and Richardson Chemical Engineering, Vol 3B: Process Control, Fourth Edition, IChem E, Elsevier, 2017. Extensive Course Notes will be provided on the OWL.

Reference Texts
Seborg, D.E.; Edgar, T.F.; Mellichamp, D.A.; Doyle, F.I. "Process Dynamics and Control", 3rd Edition, Wiley, 2011.
Marlin, T.E. "Process Control", (2nd Edition), McGraw Hill, 2000).
Smith, A. B. & Corripio, C.A. "Principles and Practice of Automatic Process Control", John Wiley, 2005.

Course Notes
Course notes and problem sets will be available for download from the course website.

Lab Notes
Lab notes will be available for download from the course website.

Laboratory
Students are expected to attend 1 tutorial/problem solving hour every week in a designated computer laboratory. The experimental laboratory component of the course consists of both Computer labs/Tutorials using MATLAB and SIMULINK, as well as experimental implementation of a feedback control system using LabView and NI-DAQ (National Instrument-Data Acquisition) system. The Computer Lab is held every week; however, the experimental lab must be arranged through the TAs and the Laboratory Technician (see above).

Units
Both SI and English units will be used.

Learning Outcomes
- Students will be able to develop dynamic models of chemical processes based on material and energy balances.
- Students will become proficient in solving differential equations using Laplace Transform
    - Note: this learning objective aligns with and is selected for the assessment of the Graduate Attribute Knowledge Base (**KB2 and KB3, LEVEL: Developing**): Demonstrate competence in engineering fundamentals and specialized engineering knowledge appropriate to engineering discipline.
- Students will be able to set up simple feedback control loops using PID controllers.
- Students will be able to analyze the stability of the feedback systems in Laplace domain.
- Students will be able to tune PID-controllers
    - Note: this learning objective aligns with and is selected for the assessment of the Graduate Attribute Design (**DE1 and DE2, LEVEL: Developing**): Demonstrate ability to frame a complex, open-ended process control design problem.
- Students will be able to analyze cascade and feedforward controllers
    - Note: this learning objective aligns with and is selected for the assessment of the Graduate Attribute Design (**DE1 and DE2, LEVEL: Developing**): Demonstrate ability to frame a

complex, open-ended process control design problem.

- Students will use MATLAB/SIMULINK to implement various types of controllers
  - Note: this learning objective aligns with and is selected for the assessment of the Graduate Attribute Engineering Tools (**ET1 and ET2, LEVEL: Developing**): Demonstrate ability to identify and select appropriate engineering tool(s) and resources.
- Students will run feedback control experiments using LabView
  - Note: this learning objective aligns with and is selected for the assessment of the Graduate Attribute Engineering Tools (**ET1 and ET2, LEVEL: Developing**): Demonstrate ability to identify and select appropriate engineering tool(s) and resources.

Specific Learning Objectives:

Evaluation

The final course mark will be determined as follows:

Four 20-min **announced** quizzes (closed book) during Class time or Tutorial time, **NO MAKEUP QUIZZEZ**, three out of four best marks, each worth 5 marks, will contribute to the final mark. The students who miss quizzes LEGITIMATELY, the corresponding marks of the missed quizzes will be added to the FINAL exam weight.

Quiz 1 Friday January 23 at 1:00 pm

Quiz 2 Friday February 13 at 1:00 pm

Quiz 3 Friday March 13 at 1:00 pm

Quiz 4 Friday March 27 at 1:00 pm

-- **15%**

Laboratory		**15%**
Mid-term Examination	A two-hour closed book exam, Feb 26, 4:30 to 6:30 PM	**25%**
Final Examination		**45%**

Notes
1) Students must turn in all laboratory reports, and achieve a passing grade in the laboratory component, to pass this course.
2) Assignments are to be handed in the OWL course site

Academic considerations

In this course, your written assignments have a no-questions-asked 2-day grace period. This means that you can submit any of these assignments up to 2 days past the posted deadline without penalty. As such, requests for academic consideration for assignments will be denied.

Repeating All Components of the Course
In accordance with Senate and Faculty Policy, students who have failed an Engineering course (i.e. <50%) must repeat all components of the course. No special permissions will be granted enabling a student to retain laboratory, assignment or test marks from previous years. Previously completed assignments and laboratories cannot be resubmitted for grading by the student in subsequent years.

Use of English
In accordance with Senate and Faculty Policy, students may be penalized up to 10% of the marks on all assignments, tests, and examinations for the improper use of English. Additionally, poorly written work with the exception of the final examination may be returned without grading. If resubmission of the work is permitted, it may be graded with marks deducted for poor English and/or late submission.

Attendance
Attendance at lectures, tutorials and labs is mandatory. Any student, who, in the opinion of the instructor, is absent too frequently from class or laboratory periods in any course, will be reported to the Dean (after due warning has been given). On the recommendation of the Department concerned, and with the permission of the Dean, the student will be debarred from taking the regular examination in the course.

Cheating
University policy states that cheating is a scholastic offence. The commission of a scholastic offence is attended by academic penalties, which might include expulsion from the program. If you are caught cheating, there will be no second warning (see Scholastic Offence Policy in the Western Academic Calendar).

Plagiarism
Students must write their essays and assignments in their own words. Whenever students take an idea or a passage of text from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. Plagiarism is a major academic offence (see Scholastic Offence Policy in the Western Academic Calendar).

The University of Western Ontario has software for plagiarism checking. Students may be required to submit their work in electronic form for plagiarism checking.

Conduct
Students are expected to arrive at lectures on time, and to conduct themselves during class in a professional and respectful manner that is not disruptive to others.
Sickness and Other Problems
Students should immediately consult with the instructor or Department Chair if they have any problems that could affect their performance in the course. Where appropriate, the problems should be documented. The student should seek advice from the Instructor or Department Chair regarding how best to deal with the problem. Failure to notify the Instructor or Department Chair immediately (or as soon as possible thereafter) will have a negative effect on any appeal.

Please contact the course instructor if you require material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific questions regarding an accommodation.

STATEMENT ON GENDER-BASED AND SEXUAL VIOLENCE
Western is committed to working to end gender-based and sexual violence on campus and in our community and providing compassionate support to anyone who has gone through these traumatic events. If you have experienced gender-based or sexual violence (either recently or in the past), you can connect with a case manager or set up an appointment (support@uwo.ca).

Notices
Students are responsible for regularly checking their Western email and notices posted on Instructors' doors.

Consultation
Students are encouraged to discuss problems with their teaching assistant and/or instructor in tutorial sessions. Office hours will be arranged for the students to see the instructor and teaching assistants. Other individual consultation can be arranged by appointment with the appropriate instructor.

Accreditation (AU) Breakdown
Engineering Science 60%
Engineering Design 40%
June 2024