CBE 3319: Introduction to Plant Design and Safety
Course Outline (Winter 2026)

Description
This course introduces the analysis and design of chemical processes, specifically considering safety and economic aspects. Chemical process design and safety considerations will be covered from both theoretical and practical perspectives. The course will also provide a review and analysis of major accidents in chemical industry and preventive measures.

Prerequisites: ES 1050, CBE 2220A/B, CBE 2221A/B, and CBE 2224A/B.

Unless you have the requisites for this course or written special permission to enrol in it, you will 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 if you are dropped from a course for failing to have the necessary prerequisites.

Antirequisite(s): the former GPE 3382A/B.

Contact Hours: 2 lecture hours, 2 tutorial hours, 0.5 course.

Instructor: Dominic Pjontek, Ph.D., P.Eng.

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Teaching Assistants:

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Recommended Textbooks:

- Turton et al., "Analysis, Synthesis and Design of Chemical Processes", Prentice Hall.
- G. Towler and R. Sinnott “Chemical Engineering Design”, Elsevier, Inc.
    - Please note: Students are not required to purchase specific editions of the textbooks. Required concepts will be presented via the lectures. Nonetheless, the textbooks can provide additional information on concepts presented during the course.

Course Notes: The notes will be provided by the instructor through the OWL website.

Units: The International System of Units (SI) will be used in this course.

Primary Learning Outcomes

This course introduces students to the synthesis and analysis of chemical processes, including design heuristics, process diagrams, costing methods, and safety analysis. The primary learning outcomes for the students are:

i. Designing chemical processes based on process heuristics, including the preparation of process diagrams that conform to industry standards.

ii. Estimating the capital and operating expenditures for a full-scale chemical production facility, followed by an evaluation of the plant profitability.

iii. Learning process health and safety regulations to then perform risk assessments and hazards analysis.

These objectives are accomplished within the course framework, including open-ended design projects. During the tutorials, students are given guidance to progress in their projects by applying concepts taught in the lectures.

Specific Learning Objectives

- Process diagrams: block flow diagrams (BFD), process flow diagrams (PFD), piping and instrumentation diagrams (P&ID), process topology, stream information, equipment information, control strategy.
- Process heuristics: operating temperatures and pressures, kinetic data and reactor selection, separation procedures, heating and cooling, material transportation.
- Economic analysis: capital costs, purchased and bare module costs, grass roots estimate, manufacturing costs, cash flow diagrams, profitability analysis.
- Process safety: hazard versus risk, legislation, toxicity, fires and explosions, pressure relief systems, inherently safe design, case studies of past accidents in the chemical industry.
- Hazard analysis: what-if, checklist, layers-of-protection (LOPA), hazards and operability study (HAZOP).

Methods of Evaluation

The final course mark will be determined as follows

• Participation and peer evaluation	10%
• Project 1 (Process Design)	25%
• Project 2 (Economics)	25%
• Project 3 (Safety)	25%
• Quizzes	15%

All quizzes will be closed book. Only non-programmable calculators will be permitted. Each quiz will be 1 hour in length, taking place shortly after the submission of each project.

Notes:

1) If you are unable to write the quiz for medical or compassionate reasons, you must provide the appropriate documentation. Failure to provide adequate documentation will result in a mark of 0.

2) Reports will be submitted electronically on the course OWL site. The penalty for late submission of a report is 10 percentage points per day.

CEAB Attributes Monitored

Graduate Attribute	Indicator	Assessment tool	Assessment Level
Design	DE1: Demonstrate ability to frame a complex, open-ended design problem in engineering terms	Project 1	D: Developing
Professionalism	PR2: Recognizes role of protection of public	Project 3	D: Developing
Economics and Project Management	EPM1: Demonstrate ability to incorporate economics into engineering projects	Project 2	D: Developing

Use of Electronic Devices

Only non-programmable calculators will be permitted during tests and examinations. All other electronic devices are not permitted.

Use of Generative Artificial Intelligence (AI)

Any use of generative AI in the completion of coursework should be cited appropriately, including the identification of any tools that were used, how the tools were employed, and how the AI-generated content was integrated into the submitted coursework.

Academic Offences

Scholastic offences are taken seriously, and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:
https://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf

All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (http://www.turnitin.com).

Computer-marked multiple-choice tests and/or exams may be subject to submission for similarity review by software that will check for unusual coincidences in answer patterns that may indicate cheating

Support Services

The Web sites for Registrarial Services (http://www.registrar.uwo.ca), and the same for affiliated university colleges when appropriate, and any appropriate Student Support Services (including the services provided by the USC listed here: http://westernusc.ca/services/) and the Student Development Services, should be provided for easy access.

Gender-Based and Sexual Violence

Western is committed to reducing incidents of gender-based and sexual violence (GBSV) and providing compassionate support to anyone who is going through or has gone through these traumatic events. If you are experiencing or have experienced GBSV (either recently or in the past), you will find information about support services for survivors, including emergency contacts at the following website:
https://www.uwo.ca/health/student_support/survivor_support/gethelp.html

To connect with a case manager or set up an appointment, please contact support@uwo.ca.

Students who are in emotional/mental distress should refer to Mental Health@Western http://www.uwo.ca/uwocom/mentalhealth/ for a complete list of options about how to obtain help.

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, except for 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 in all lectures, tutorials and laboratories 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 final examination in the course.

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 question regarding an accommodation.

Notices

Students are responsible for regularly checking their Western email and notices posted on the OWL website.

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 = 50 %
Engineering Design = 50 %