

CBE 4497 - 4498: Chemical and Biochemical Process Plant Design
Course Outline (2023 - 2024)

Course Description

A design is prepared for a full-scale chemical, biochemical, and/or green process. This involves the detailed design of all major components, an estimate of the environmental footprint, and an economic analysis. Problem formulation, innovative solutions and professional decision making are emphasized.

Prerequisites: CBE 2220A/B, CBE 2224A/B, GPE 3315A/B, CBE 3322A/B, CBE 3323A/B, CBE 3324A/B, and CBE 3318A/B, CBE 3319 A/B.

Unless you have the requisites for this course or written special permission from your Dean 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.

Corequisite(s): n/a

Antirequisite(s): CEE 4441, ECE 4416, MME 4499, SE 4450, ES 4499, MSE 4499, ECE 4415.

Contact Hours: 2 lecture hours, 3 tutorial hours, 1.0 course

Instructors:

- Dominic Pjontek (course coordinator), Ph.D., P.Eng., TEB 377, email: dpjontek@uwo.ca, t.: 519-661-2143
- Mita Ray, Ph.D., P.Eng., TEB 443, email: mbhowmic@uwo.ca
- Katherine Albion, Ph.D., P.Eng., email: kalbion@sarnialambtonresearchpark.ca
- Cedric Briens, Ph.D., P.Eng., email: cbriens@uwo.ca
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Teaching Assistants:

- Jingyuan Guan, email: jguan58@uwo.ca
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Recommended Textbooks:

- Turton et al., " Analysis, Synthesis and Design of Chemical Processes", Prentice Hall, 2008.
- G. Towler and R. Sinnott "Chemical Engineering Design", Elsevier, Inc. 2008.

Additional Textbooks:

- Perry, R.H. and Green, D.W., "Perry's Chemical Engineers Handbook", 8th edition, McGraw-Hill Inc., 2008.

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 teaches students to synthesize and analyze chemical, biochemical, and/or green processes and equipment through creative problem solving and teamwork by applying basic chemical engineering principles and economics learned in previous courses. The general objectives for the student are to:

- Apply engineering judgement to propose reasonable solutions for open-ended design problems.
- Identify design problems and apply decision making to evaluate design alternatives.
- Consider safety, environmental, and economic issues, as well as their impact on design decisions.
- Develop technical communication skills to present and defend decisions in both written and oral formats.
- Recognize the need for life-long learning to keep with the state-of-the-art for design, modifications and improvements in chemical processes.

These objectives are accomplished within the course framework, attempting to simulate a real world industrial environment to the extent possible. During the tutorials, groups of up to five students are given guidance and coaching (interactive learning) to assist in progressing the design project. Each group of project engineers is assigned to a specific section Teaching Assistant and Professor.

Specific Learning Objectives

The course develops professional skills while applying prior engineering knowledge to an industrial design project.

Team Work and Time Management

- Working in a team and becoming familiar with team dynamics to make use of colleagues' strengths.
- Divide a project into tasks and sub-tasks with deadlines and milestones to schedule and allocate resources.

Information Collection, Analysis and Synthesis

- Gather the required information from sources such as literature, industry, equipment suppliers, etc.
- Analyse occasionally conflicting information and determine an appropriate solution.

Critical Thinking (applied to the design process)

- Recognize and compare alternative solutions for a given design problem based on selected criteria.
- Ensure and verify calculations prior to making a recommendation.

Engineering Judgment and Communication

- Identify appropriate approximations in design calculations based on sound reasoning and documentation.
- Apply practical considerations to reduce downtime, improve safety and operability of designed systems.
- Discuss and defend designs both orally and in written format as per acceptable standards.

Engineering Safety and Environmental Considerations

- Incorporate engineering safety and risk analysis in the final process and equipment designs.
- Identify and minimize environmental risks.
- Consider and improve process sustainability based on green principles.

Progress will depend on many factors including the complexity of the selected process, availability of process information, industrial contacts established by group, etc. Initiative and creativity is required from every student. This course draws on the knowledge, skills and techniques learned in prerequisite and corequisite courses to solve practical engineering problems. It is a finishing course where students need to demonstrate sound design and professional capabilities before they can graduate.

Evaluation

The final course mark will be determined as follows:

- Report 1: Project definition and scope 10%
- Report 2: Process flow plan and description 15%
- Report 3: Individual design 20%
- Report 4: Final Report 25%
- Fall progress oral presentation 10%
- Final oral presentation 15%
- Participation and peer evaluation 5%

Design Reports

Reports will be submitted electronically on the course OWL site. Requirements for content, formatting and deadlines will be provided on the OWL site. The penalty for late submission of a report is 5% points per day.

Oral Presentations

Two oral presentations will be made by each design group, one in each term. Each student must participate in the presentations. Presentation schedule will be distributed in class approximately two weeks before presentations.

Note: If a member of a group is not present in the presentations, the allocated time will be reduced.

Graduate Attribute Assessment for Accreditation by the Canadian Engineering Accreditation Board

Graduate Attribute	Indicator	Assessment tool	Assessment Level
Design	DE1: Demonstrate ability to frame a complex, open-ended design problem in engineering terms DE2: Demonstrate ability to generate a diverse set of candidate engineering design solutions	Report 4: Individual design	A: Applied
Use of Engineering Tools	ET1: Demonstrate ability to evaluate use of engineering tool(s) and resources ET2: Demonstrate ability to apply appropriate engineering tool(s) and resources	Report 6: Final Report	A: Applied
Individual and Teamwork	ITW3: Demonstrate ability to evaluate peer and self performance based on team effectiveness	Online Peer Evaluations	A: Applied
Communication	CS2: Demonstrate ability to articulate ideas in writing using appropriate technical language, and effective graphical tools CS3: Demonstrate the ability to communicate orally using appropriate materials, language, non-verbal communication, and effective graphical tools.	Report 6: Final Report Final Presentations (industry judges)	A: Applied
Economics and Project Management	EPM1: Demonstrate ability to incorporate economics into engineering projects	Report 5: Economics	A: Applied
Life-long learning	LL1: Ability to assess limitations in knowledge and skills	Report 6: Final Report	A: Applied

Contingency plan for an in-person class pivoting to 100% online learning

In the event of a COVID-19 resurgence during the course that necessitates the course delivery moving away from face-to-face interaction, affected course content will be delivered entirely online, either synchronously (i.e., at the times indicated in the timetable) or asynchronously (e.g., posted on OWL for students to view at their convenience). The grading scheme will **not** change. Any remaining assessments will also be conducted online as determined by the course instructor.

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 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 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 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.

Instructions for Students Unable to Write Tests or Examinations or Submit Assignments as Scheduled

If, on medical or compassionate grounds, you are unable to write term tests or final examinations or complete course work by the due date, you should follow the instructions provided by the Faculty of Engineering. You should understand that academic relief will not be granted automatically on request. You must demonstrate to the Undergraduate Services Office that there are compelling medical or compassionate grounds that can be documented before academic relief will be considered. Different regulations apply to term tests, final examinations and late assignments.

For further information, please consult the University's medical illness policy at:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_medical.pdf

The Student Medical Certificate is available at

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf

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.

Religious Accommodation

When a course requirement conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request accommodation for their absence in writing at least two weeks prior to the holiday to the course instructor and/or the Academic Counselling office of their Faculty of Registration. Please consult University's list of recognized religious holidays (updated annually) at:

<https://multiculturalcalendar.com/ecal/index.php?s=c-univwo>

Accommodation Policies

Students with disabilities are encouraged to contact Accessible Education, which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The policy on Academic Accommodation for Students with Disabilities can be found at:

[https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic Accommodation_disabilities.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Accommodation_disabilities.pdf)

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 = 25 %

Engineering Design = 75 %