

Western University
Faculty of Engineering
Department of Chemical and Biochemical Engineering

CBE 9112 - Industrial Applications of Chemical Engineering Principles

COURSE OUTLINE 2021-2022

DESCRIPTION

This graduate level course is a comprehensive review of fundamentals of chemical engineering principles as well as unit operations, which are tailored to large scale applications considering different raw materials and processes. Basics of chemical process development considering safety and environmental protection are covered. New technologies and their applications in chemical industry are presented. The course also covers design of different units exclusive to chemical engineering processes. Modeling and simulation of major units such as distillation and absorption towers, dryers, etc., using soft wares such as VMGSim and Aspen Hysis as well as their optimization are reviewed. Safety considerations and their impact on design calculations are presented in detail. Case studies are reviewed to enhance the students understanding of vision to chemical engineering.

ENROLLMENT RESTRICTIONS

Enrollment in this course is restricted to graduate students in the department of Chemical and Biochemical Engineering

INSTRUCTOR CONTACT INFORMATION

Course instructor: Dr. S. Barghi, (TEB 447)

Email address: sbarghi2@uwo.ca

Office: TEB 447

Office hours: To be announced

COURSE FORMAT

The course is delivered face to face, although it may be delivered online or in hybrid format depending on circumstances.

TOPICS

Topic #	Description	Learning Activities	Tentative timeline
1. Course overview	Introduction to Topic	<ul style="list-style-type: none"> Lectures 	Week 1
2. Materials delivery in chemical industry	Lesson 1: Background	<ul style="list-style-type: none"> Lectures Additional reading material 	Week 1 -2
	Lesson 2: Design consideration and equations	<ul style="list-style-type: none"> Lectures Tutorial session 	Weeks 1-2
	Lesson 3: Design consideration and equations, multiphase flow, and supercritical flow calculations	<ul style="list-style-type: none"> Lectures Practice problems set Tutorial session Assignment 	Week 3
3. Thermal energy considerations in chemical industry	Introduction Heat exchangers, different types applications	<ul style="list-style-type: none"> Lectures Tutorial session 	Week 4
	Design considerations in Reactors (Exo. and Endothermic reaction, Thermal energy recycling Pinch technology	<ul style="list-style-type: none"> Lectures Tutorial session Problem solving Assignment 	Week 5
	Detailed design, selection of equipment and instrumentation	<ul style="list-style-type: none"> Lectures Tutorial session Problem solving 	Week 6
4. Simulation and modeling	Introduction, review of available soft wares, basic definitions	<ul style="list-style-type: none"> Lectures Tutorial session Problem solving Assignment 	Week 7
5. Mass transfer and unit operations	Introduction, review of principles and applications, Distillation, batch and continuous Simulation	<ul style="list-style-type: none"> Lectures Tutorial session Problem solving 	Week 8-9
	Absorption towers, design calculations, Simulation	<ul style="list-style-type: none"> Lectures Tutorial session Problem solving 	Week-10
6. Special topics	Review of complementary information on design of	<ul style="list-style-type: none"> Lectures Tutorial session 	Week 11

	other units such as dryers, extraction on drying, Simulation	<ul style="list-style-type: none"> • Problem solving • 	
Special topics and general review of the whole course	Continue of week 11, Simulation	<ul style="list-style-type: none"> • Lectures • Tutorial session • 	Week 12

SPECIFIC LEARNING OUTCOMES

Degree Level Expectation	Weight	Assessment Tools	Outcomes
Depth and breadth of knowledge	30%	<ul style="list-style-type: none"> • Assignments • Examinations 	<ul style="list-style-type: none"> • Understanding of advanced concepts and theories • Awareness of important current problems in the field of study • Understanding of computational and/or empirical methodologies to solve related problems
Research & scholarship	5%	<ul style="list-style-type: none"> • Quizzes on open ended problems 	<ul style="list-style-type: none"> • Ability to conduct critical evaluation of current advancements in the field of specialization
Application of knowledge	40%	<ul style="list-style-type: none"> • Assignments • Examinations • Quizzes 	<ul style="list-style-type: none"> • Ability to apply knowledge in a rational way to analyze an industrial problem • Ability to use coherent approach to design a particular engineering system using existing design tools
Professional capacity / autonomy	5%	<ul style="list-style-type: none"> • Project 	<ul style="list-style-type: none"> • Awareness of academic integrity • Ability to implement established procedures and practices in the coursework • Defends own ideas and conclusions • Integrates reflection into his/her learning process
Communication skills	10%	<ul style="list-style-type: none"> • Project 	<ul style="list-style-type: none"> • Ability to communicate (oral and/or written) ideas, issues, results and conclusions clearly and effectively
Awareness of limits of knowledge	10%	<ul style="list-style-type: none"> • Project 	<ul style="list-style-type: none"> • Awareness of the need of assumptions in complex scientific analyses and their consequences • Understanding of the difference between theoretical and empirical approaches • Ability to acknowledge analytical limitation due to complexity of practical problems

ASSESSMENTS

Assessment Type	Material Covered	Tentative Due Date	Weight
Homework Assignments (four)	All topics		15%
Quizzes	Topics 1-3 and topics 4-6		15%
Midterm	Topics 1-4		20%
Final exam			50%

Activities in which collaboration is permitted:

- None

Activities in which students must work alone (collaboration is not permitted):

- All other activities.

REQUIRED TEXTBOOK

None

OPTIONAL COURSE READINGS

K. S. N. Raju, Fluid Mechanics, Heat Transfer, and Mass Transfer, John Wiley and Sons, 2011.
 Jones, D.S.J., "Elements of Chemical Process Engineering", John Wiley and Sons, 1996.
 Coulson and Richardson's Chemical Engineering, 3rd edition Butterworth-Heinemann, 1992.
 Reference to other books and articles will be made at the appropriate time during the course.

CHEATING, PLAGIARISM/ACADEMIC OFFENCES

Academic integrity is an essential component of learning activities. Students must have a clear understanding of the course activities in which they are expected to work alone (and what working alone implies) and the activities in which they can collaborate or seek help; see information above and ask instructor for clarification if needed. Any unauthorized forms of help-seeking or collaboration will be considered an academic offense. University policy states that cheating is an academic offence. If you are caught cheating, there will be no second warning. 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. Academic offences are taken seriously and attended by academic penalties which may include expulsion from the program. Students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence at the following website: https://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_grad.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>).

CONDUCT

Students are expected to follow proper etiquette to maintain an appropriate and respectful academic environment. Any student who, in the opinion of the instructor, is not appropriately participating in course activities and/or is not following the rules and responsibilities associated with the course activities, will be reported to the Associate Dean (Graduate) (after due warning has been given). On the recommendation of the Department concerned, and with the permission of the Associate Dean (Graduate), the student could be debarred from completing the assessment activities in the course as appropriate.

HEALTH/WELLNESS SERVICES

As part of a successful graduate student experience at Western, we encourage students to make their health and wellness a priority. Western provides several health and wellness related services to help you achieve optimum health and engage in healthy living while pursuing your graduate degree. Information regarding health- and wellness-related services available to students may be found at <http://www.health.uwo.ca/>.

Students seeking help regarding mental health concerns are advised to speak to someone they feel comfortable confiding in, such as their faculty supervisor, their program director (graduate chair), or other relevant administrators in their unit. Faculty of Engineering has a Student Wellness Counsellor. To schedule an appointment with the counsellor, contact Kristen Edwards (khunt29@uwo.ca) via confidential email and you will be contacted by our intake office within 48 hours to schedule an appointment.

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.

SICKNESS

Students should immediately consult with the Instructor (for a particular course) or Associate Chair (Graduate) (for a range of courses) if they have problems that could affect their performance. The student should seek advice from the Instructor or Associate Chair (Graduate) regarding how best to deal with the problem. Failure to notify the Instructor or the Associate Chair (Graduate) immediately (or as soon as possible thereafter) will have a negative effect on any appeal. Obtaining appropriate documentation (e.g., a note from the doctor) is valuable when asking for accommodation due to illness.

Students who are not able to meet certain academic responsibilities due to medical, compassionate or other legitimate reason(s), could request for academic consideration. The Graduate Academic Accommodation Policy and Procedure details are available at:

<https://www.eng.uwo.ca/graduate/current-students/academic-support-and-accommodations/index.html>

ACCESSIBLE EDUCATION WESTERN (AEW)

Western is committed to achieving barrier-free accessibility for all its members, including graduate students. As part of this commitment, Western provides a variety of services devoted to promoting,

advocating, and accommodating persons with disabilities in their respective graduate program. Graduate students with disabilities (for example, chronic illnesses, mental health conditions, mobility impairments) are strongly encouraged to register with Accessible Education Western (AEW): http://academicsupport.uwo.ca/accessible_education/index.html

AEW is a confidential service designed to support graduate and undergraduate students through their academic program. With the appropriate documentation, the student will work with both AEW and their graduate programs (normally their Graduate Chair and/or Course instructor) to ensure that appropriate academic accommodations to program requirements are arranged. These accommodations include individual counselling, alternative formatted literature, accessible campus transportation, learning strategy instruction, writing exams and assistive technology instruction.