

Western University
Faculty of Engineering
*Department of Chemical and Biochemical
Engineering*

CBE 9173 – Chemical process safety

COURSE OUTLINE 2020-2021

DESCRIPTION

This course provides an in-depth study of process safety, emphasizing on topics which enables engineers to analyze and solve safety related problems in industry, design safety integrated systems, specifically chemical industries. The general objectives are for the students to be able to:

- become familiar with chemical processes safety and associated standards, rules and regulations
- define and analyze potential hazards arising from chemical and biochemical activities in chemical industries
- become familiar with toxic release and various dispersion models for estimation of pollutants concentrations in a chemical plant
- understand the chemistry of fire and explosion in gases/vapors, liquids and solids (dust)
- design to prevent fire and explosion in chemical plants
- understand and design relief systems
- understand and apply risk assessment and management.
- become familiar with HAZOP study method and apply to a chemical process

PREREQUISITES

None

TOPICS

All lectures and learning activities will be carried out online. The synchronous lectures will be recorded and made available to students after the lectures.

Topic #	Description	Learning Activities	Tentative timeline
1	Lesson 1: Detailed review of safety in industry with main focus on chemical industry. Discussion about the evolution of safety and	<ul style="list-style-type: none">• Two synchronous recorded lectures• Additional reading material	Week 1-2

	toxicology and toxicant effects on human body.		
2	<p>Lesson 2: Dispersion models (puff and plume), and effects of wind. Steady state and unsteady state behaviors in dispersion models. Pollutant release mitigation methods.</p> <p>Technical review of one significant disaster in chemical industry related to dispersion.</p>	<ul style="list-style-type: none"> • Three synchronous recorded lectures • Estimation of pollutant concentration at different location around the release in presence of wind • Live tutorial session 	Weeks 3-4
3	Lesson 3: Brief introduction about Fire and explosion in chemical plants. Flammability diagram, detonation and deflagration, dust explosion	<ul style="list-style-type: none"> • Three synchronous recorded lectures • Practice problems set • Live tutorial session 	Week 5-6
4	Lesson 4: Design to prevent fire and explosion and enhance safety in chemical plants including, explosion proof equipment, electrostatic effects as ignition sources and prevention and control methods, ventilation,	<ul style="list-style-type: none"> • Three recorded lectures • Practice problems set • Live tutorial session 	Week 7-9
5	Lesson 5: Relief systems and their design for different units and materials	<ul style="list-style-type: none"> • Two recorded lectures • Practice problems set • Live tutorial session 	Week 10
6	Lesson 6: Risk assessment, layer of protection analysis, HAZOP, safety review/check	<ul style="list-style-type: none"> • Two recorded lectures • Practice problems set • Live tutorial session 	Week 11
7	<p>Lesson 7: review of major disasters in chemical industry and lessons learned.</p> <p>General review of the whole course</p>	<ul style="list-style-type: none"> • One recorded lectures • Live 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 • Project/presentation • Examinations 	<ul style="list-style-type: none"> • Understanding of principles of safety in chemical industry • Applying the principles in chemical plants
Research & scholarship	10%	<ul style="list-style-type: none"> • Reports on mitigation methods and safety 	<ul style="list-style-type: none"> • Ability to conduct critical evaluation of current state of safety engineering • Application of the knowledge for mitigation purposes
Application of knowledge	35%	<ul style="list-style-type: none"> • Assignments • Examinations 	<ul style="list-style-type: none"> • Ability to apply knowledge in a rational way to analyze incidents and safety related issues • Ability to use coherent approach to design a particular engineering system to enhance operation safety
Professional capacity / autonomy	10%	<ul style="list-style-type: none"> • Descriptive questions as short examination 	<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	5%	<ul style="list-style-type: none"> • Reports 	<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"> • Reports 	<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 (5)	Topics 2, 3, 4, 5	Weeks 3, 5, 8, 10, 11	25%
Multiple Choice Quizzes (4)	Topics 2, 3, 4, 5, 6, 7	Weeks 3, 5, 8, 10, 11	15%
In-class (synchronous) problem solving	Topics 2, 3, 4, 5, 6	Weeks 3-7, 10-12	5%

Term tests (1)	Topics 2, 3, 4, 5,		15%
Participation (synchronous)	Attendance in synchronous class activities	Whole semester	5%
Participation (asynchronous)	Post questions in course forums	Whole semester	5%

Activities in which collaboration is permitted:

- None

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

- All activities

CONTACT INFORMATION

Course instructor: Shahzad Barghi

Email address: sbarghi2@uwo.ca

Contact policy:

- Contact instructor via email (above) or through messages in OWL
- Weekly Office hours are held via Zoom
- A general FAQ section on the 'forums' section of OWL will be used for students to pose course-related questions so that all have the same information.

REQUIRED TEXTBOOK

None

OPTIONAL COURSE READINGS

Chemical Process Safety Fundamentals with applications. 2nd Ed., Daniel A. Crowl/Joseph Louvar. Prentice Hall Inc. ISBN: 0-13-018176-5

Modeling, Measuring and Managing Risk, George Ch. Pflug and Werner Romisch, Published by World Scientific Publishing Co. Pte. Ltd., 2007, ISBN: 978-981-270-740-6.

COURSE CONTENT

The lecture notes and online lecture videos are copyrighted to the instructor and legally protected. Do not post these videos and lecture notes on any other website or online forums. The recording of the live/synchronous sessions of the course without the permission from the instructor is prohibited. The illegal posting and sharing of the copyrighted course content could be subjected to legal actions.

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

under “Assessments” 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 (see Western's scholastic discipline regulations for graduate students).

SYNCHRONOUS LEARNING ACTIVITIES

Students are expected to participate in synchronous learning activities as outlined in the course syllabus and/or described by the instructor. If you have issues that will impede your ability to participate in synchronous activities, please discuss with the course instructor at the beginning of the course.

CONDUCT

Students are expected to follow proper etiquette during synchronous and asynchronous activities to maintain an appropriate and respectful academic environment. Any student who, in the opinion of the instructor, is not appropriately participating in the synchronous and asynchronous learning activities and/or is not following the rules and responsibilities associated with the online learning 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

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 (remotely accessible) 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. Campus mental health resources may be found at http://www.health.uwo.ca/mental_health/resources.html
<https://www.uwo.ca/health/psych/index.html>

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.

ACCESSIBILITY

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 Accessible Education at 661-2111 x 82147 or http://academicsupport.uwo.ca/accessible_education/index.html, for any specific question regarding an accommodation.