ENGINEERING
McMaster-Mohawk
Bachelor of Technology
Partnership

McMaster University

Course Outline

1. COURSE INFORMATION

Session Offered	Fall 2021
Course Name	Chemical Engineering I: Mass Balances
Course Code	PROCTECH 2CE3
Date(s) and Time(s) of lectures	Lecture: Wednesday 14:30 – 16:20 Friday 8:30 – 9:20 Labs: Monday 8:30-10:50 or 12:00-14:20 or 15:00-17:20 or 18:00-20:20 or Friday 15:00-17:20 or Friday 18:00-20:20
Program Name	Automation Engineering Technology
Calendar Description	Steady-State mass balances with possible recycle and reactions. Gas laws. Phase rule. Vapour-liquid equilibrium basics.

Instructors		
	C01: Kostas Apostolou	C01: Kostas Apostolou Office Hours & Location: TBD
	L01: Greg Matzke	L01: Greg Matzke Office Hours & Location: TBD
	L02 – L06: Pouria Baghaei	L02 – L06: Pouria Baghaei Office Hours & Location: TBD

2. COURSE SPECIFICS

Course Description	Survey of Units and dimensions. Design and interpretation of flowcharts and degree of freedom analysis. Mass balance calculations on single and multi-unit processes with possible recycle, bypass, and chemical reactions. Constitutive equations for ideal and non-ideal gasses and gas mixtures. Compressibility charts. Introduction to vapour pressure. Vapour-liquid phase equilibrium for single-component.

Instruction Type

Code	Type	Hours per term
C	Classroom instruction	38
L	Laboratory, workshop or fieldwork	30
T	Tutorial	
DE	Distance education	
	Total Hours	68

Resources

ISBN	Textbook Title & Edition	Author & Publisher
978-0-470-61629-1	Elementary Principles of Chemical Processes, 4th edition	R. Felder, R. Rousseau, L. Bullard, John Wiley and Sons

Other Supplies	Source
N/A	

Prerequisite(s)	ENGTECH 1CH3, 1MC3, 1PH3 and registration in level II or above of Automation Engineering Technology
Corequisite(s)	*N/A*
Antirequisite(s)	*N/A*
Course Specific Policies	**Exams:**

	Absence from a test without an approved MSAF will result in a grade of zero for the test. If an approved MSAF is submitted, the weight of the missed test will be added to the final exam's weight. In case of multiple missed tests with approved MSAFs, the opportunity to write missed test(s) at an alternate date may be offered, at the discretion of the instructor. **Quizzes:** Most quizzes will be on-line asynchronous. There might be a limited number of announced synchronous (during class time) ones. Absence from any quiz without an approved MSAF will result to a grade of zero for that quiz. A submitted MSAF for an asynchronous quiz will be accommodated by extending the submission window for that quiz. A submitted MSAF for a synchronous quiz will be accommodated either by distributing the weight of the quiz to the remaining quiz components (which might mean that a student will miss any opportunity to "drop" the worst quiz from his/her grade) or by providing the opportunity to take an equivalent asynchronous quiz. **Lab Sessions:** Labs must complete in the section/time students are registered at. **Absence from a lab without an approved MSAF form will result in a grade of zero for the lab.** Students may have to complete a pre-lab quiz prior to attending certain labs. Details for number of labs and lab reports will be outlined during the first week of labs.
Departmental Policies	Students must maintain a GPA of 3.5/12 to continue in the program. In order to achieve the required learning objectives, on average, B.Tech. students can expect to do at least 3 hours of "out-of-class" work for every scheduled hour in class. "Out-of-class" work includes reading, research, assignments and preparation for tests and examinations. Where group work is indicated in the course outline, such collaborative work is mandatory. The use of cell phones, iPods, laptops and other personal electronic devices are prohibited from the classroom during the class time, unless the instructor makes an explicit exception. Announcements made in class or placed on Avenue are considered to have been communicated to all students including those individuals that are not in class. Instructor has the right to submit work to software to identify plagiarism.

3. SUB TOPIC(S)		
Week 1	Units, Process variables: Units, unit conversions, significant figures, pressure, temperature and composition	Chapters 2,3
Week 2	Material Balances: General balance equation, Flow charts drawing, Degree of freedom analysis	Section 4.1, 4.2
Week 3	Material Balances: Balances on single and multi-unit processes	Section 4.3, 4.4
Week 4	Material Balances:	Section 4.3, 4.4

	Balances on single and multi-unit processes	
Week 5	Material Balances: Recycle & bypass	Section 4.5
Midterm Recess		
Week 6	**Midterm1** Material Balances: Reaction stoichiometry, extent of reaction	Section 4.6
Week 7	Material Balances: Material balances with reactions	Section 4.7,4.8
Week 8	Gasses: Constitutive equations for ideal gases and mixtures	Section 5.1,5.2
Week 9	Gasses: Constitutive equations for non-ideal gases and mixtures	Section 5.3,5.4
Week 10	Phase equilibrium: Single Component Phase diagrams Vapour Pressure, Gibbs Phase law	Section 6.1 Section 6.2
Week 11	**Midterm 2** Phase equilibrium: Vapour Pressure	Section 6.2
Week 12	Phase equilibrium: Gas/Liquid systems with one condensable component	Section 6.3
Week 13	Review - Overflow	
Classes end: Wednesday, December 8th, 2021 Final Examination Period: Thursday, December 9 to Wednesday, December 22 All examinations MUST be written during the scheduled examination period.		
List of experiments		
Lab 1	Intro - Basic Excel tools	
Lab 2	Two-Component System: Phase diagram for two-component solid-liquid mixture	
Lab 3	Absorption: Determination of flooding conditions in a gas-liquid absorption column	
Lab 4	Membrane Filtration: Measurement of permeate flow rate and evaluation of membrane type	
Lab 5	Residence Time in a CSTR: Following transient concentration profile in a CSTR reactor	
Lab 6	Adsorption Measuring active carbon's effectiveness in removing contaminants from a solution	
Lab 7	Vapour Pressure: Measurement of methanol's vapour pressure dependence on temperature	
Lab 8	Evaporation: Concentration of methylene blue solution by evaporation	
Lab 9	Plate-and-frame heat exchanger: Heat transfer measurement and characteristics	

Lab 10	Distillation: Operation of a pilot-scale distillation column at total reflux
Lab 11	Fluid flow: Measurement of pressure drops through pipe components
Lab 12	Make-up labs

Note that this structure represents a plan and is subject to adjustment term by term.
The instructor and the University reserve the right to modify elements of the course during the term. The University may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes.

4. ASSESSMENT OF LEARNING *including dates*	Weight
Quizzes	10%
Mid-term test (Oct. 20 & Nov. 24)	35%
Labs	25%
Final examination (tests cumulative knowledge)	30%
TOTAL	**100%**

Percentage grades will be converted to letter grades and grade points per the University calendar.

5. LEARNING OUTCOMES

1. Construct flowcharts for simple processes and interpret complex flowcharts.
2. Deconstruct complex flowcharts and perform Degree of Freedom Analysis.
3. Execute mass balance calculations on a plethora of processes with possible reactions.
4. Use constitutive equations for ideal and non-ideal gasses and mixtures.
5. Carry-out dew point, bubble point, saturation calculation for single and multi-component mixtures.
6. Identify industrial instrumentation equipment.
7. Critique on the validity of theoretical predictions on different experimental settings.

6. COURSE OUTLINE – APPROVED ADVISORY STATEMENTS

ANTI-DISCRIMINATION

The Faculty of Engineering is concerned with ensuring an environment that is free of all discrimination. If there is a problem, individuals are reminded that they should contact the Department Chair, the Sexual Harassment Officer or the Human Rights Consultant, as soon as possible.
http://www.mcmaster.ca/policy/General/HR/Discrimination_Harassment_Sexual_Harassment-Prevention&Response.pdf

ACADEMIC INTEGRITY

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity. It is your responsibility to understand what constitutes academic dishonesty.

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: “Grade of F assigned for academic dishonesty”), and/or suspension or expulsion from the university. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at https://secretariat.mcmaster.ca/university-policies-procedures-guidelines/

The following illustrates only three forms of academic dishonesty: The following illustrates only three forms of academic dishonesty:

- plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
- improper collaboration in group work.
- copying or using unauthorized aids in tests and examinations.

AUTHENTICITY / PLAGIARISM DETECTION

Some courses may use a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. For courses using such software, students will be expected to submit their work electronically either directly to Turnitin.com or via an online learning platform (e.g. A2L, etc.) using plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish their work to be submitted through the plagiarism detection software must inform the Instructor before the assignment is due. No penalty will be assigned to a student who does not submit work to the plagiarism detection software. All submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., on-line search, other software, etc.). For more details about McMaster's use of Turnitin.com, please go to www.mcmaster.ca/academicintegrity.

COURSES WITH AN ON-LINE ELEMENT

Some courses may use on-line elements (e.g. e-mail, Avenue to Learn (A2L), LearnLink, web pages, capa, Moodle, ThinkingCap, etc.). Students should be aware that, when they access the electronic components of a course using these elements, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in a course that uses on-line elements will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure please discuss this with the course instructor.

ONLINE PROCTORING

Some courses may use online proctoring software for tests and exams. This software may require students to turn on their video camera, present identification, monitor and record their computer activities, and/or lock/restrict their browser or other applications/software during tests or exams. This software may be required to be installed before the test/exam begins.

COMMUNICATIONS

It is the student's responsibility to:

- Maintain current contact information with the University, including address, phone numbers, and emergency contact information.
- Use the University provided e-mail address or maintain a valid forwarding e-mail address.
- Regularly check the official University communications channels. Official University communications are considered received if sent by postal mail, by fax, or by e-mail to the student's designated primary e-mail account via their @mcmaster.ca alias.
- Accept that forwarded e-mails may be lost and that e-mail is considered received if sent via the student's @mcmaster.ca alias.
- Check the McMaster/Avenue email and course websites on a regular basis during the term.

CONDUCT EXPECTATIONS

As a McMaster student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all of our living, learning and working communities. These expectations are described in the Code of Student Rights & Responsibilities (the "Code"). All students share the responsibility of maintaining a positive environment for the academic and personal growth of all McMaster community members, whether in person or online.

It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviours that interfere with university functions on online platforms (e.g. use of Avenue 2 Learn, WebEx or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students' access to these platforms.

ACADEMIC ACCOMMODATION OF STUDENTS WITH DISABILITIES

Students with disabilities who require academic accommodation must contact Student Accessibility Services (SAS) at 905-525-9140 ext. 28652 or sas@mcmaster.ca to make arrangements with a Program Coordinator. For further information, consult McMaster University's Academic Accommodation of Students with Disabilities policy.

REQUESTS FOR RELIEF FOR MISSED ACADEMIC TERM WORK

McMaster Student Absence Form (MSAF): In the event of an absence for medical or other reasons, students should review and follow the Academic Regulation in the Undergraduate Calendar "Requests for Relief for Missed Academic Term Work".

ACADEMIC ACCOMMODATION FOR RELIGIOUS, INDIGENOUS OR SPIRITUAL OBSERVANCES (RISO)

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the RISO policy. Students should submit their request to their Faculty Office normally within 10 working days of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests. http://www.mcmaster.ca/policy/Students-AcademicStudies/Studentcode.pdf

COPYRIGHT AND RECORDING

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical and artistic work, including lectures by University instructors

The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done by either the instructor for the purpose of authorized distribution, or by a student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the instructor if this is a concern for you.

EXTREME CIRCUMSTANCES

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email.