ENGINEERING
McMaster-Mohawk
Bachelor of Technology
Partnership

McMaster University

Course Outline

1. COURSE INFORMATION

Session Offered	Fall 2021	
Course Name	Chemical Engineering III: Unit and Process Design	
Course Code	PROCTECH 3CE3	
Date(s) and Time(s) of lectures	Lecture: Wednesday 12:30 – 13:20 Friday 12:30 – 14:20 Labs: Monday 9-11 or 11-13, or 13-15, or 16-18	
Program Name	Automation Engineering Technology	
Calendar Description	This course covers simulation and analysis of integrated process units within a chemical process plant. Key topics covered are: process flow diagrams and simulation models, process analysis using simulation model, rudimentary process optimization and plant simulation.	
Instructor(s)	Kostas Apostolou Lecture Ali Mohsenipour Labs	E-Mail: apostol@mcmaster.ca Office Hours & Location: TBD E-Mail: mohsea2@mcmaster.ca Office Hours & Location: TBD

2. COURSE SPECIFICS

Course Description

Reaction kinetic fundamentals and reactor design. Heat Transfer: one dimensional conduction and convection. Heat exchanger calculations. Fluid flow: laminar and turbulent flow; Bernoulli's equation; pressure drop through pipes; pump curves and requirements. Introduction to process simulation software; construction and interpretation of process flow diagrams. Process optimization through simulation.

Instruction Type

Code	Type	Hours per term
C	Classroom instruction	37
L	Laboratory, workshop or fieldwork	24
T	Tutorial	
DE	Distance education	
	Total Hours	61

Resources

ISBN	Textbook Title & Edition	Author & Publisher
ISBN:		

Other Supplies	Source
	978-0133887518, H. Scott Fogler, Elements of Chemical Reaction Engineering, Prentice Hall; 5th edition 978-0470501962, Theodore L. Bergman, Adrienne S. Lavine, David P. DeWitt and Frank P. Incropera, Introduction to Heat Transfer, Wiley; 6th edition

		978-1-1181-1613-5, Bruce R. Munson, Donald F. Young, Theodore H. Okiishi, Wade W. Huebsch, Fundamentals of Fluid Mechanics, Wiley, 7th edition.
Prerequisite(s)	ENGTECH 2MA3 , PROCTECH 2EC3, 3CT3 and registration in Level IV 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 with a limited number of announced in-class synchronous 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 on-line quiz will be accommodated by extending the submission window for that quiz. A submitted MSAF for an in-class 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 on-line 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.** Details for number of labs and lab reports will be outlined during first week of labs. All lab reports are due one week from the day of performing the corresponding experiment, unless otherwise noted. Reports submitted late without an acceptable explanation or prior permission will be penalized by 10% per calendar day.	
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	Reaction kinetics: Rate of reaction, rate laws, Arrhenius equation	Fogler
Week 2	Reaction kinetics: Reaction mechanisms, catalysis	Fogler
Week 3	Chemical Reactor Design: Batch, CSTR balance equations	Fogler
Week 4	Chemical Reactor Design: Examples	Fogler
Week 5	Heat Transfer: One dimensional conduction ***Test 1***	Incropera
Midterm Recess		
Week 6	Heat Transfer: One dimensional conduction & introduction to convection	Incropera
Week 7	Heat Transfer: Convection & Heat Exchangers fundamentals	Incropera
Week 8	Heat Transfer: Heat Exchanger equations and design	Incropera
Week 9	Fluid flow: Introduction: laminar vs turbulent flow. Bernoulli's Equation	Munson
Week 10	Fluid flow: Application of Bernoulli's equation ***Test 2***	Munson
Week 11	Fluid flow: Pressure drop in pipes	Munson
Week 12	Fluid flow: Pump characteristics and curves	Munson
Week 13	*Review*	
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 to UniSim Design – Heat Exchanger	
Lab 2	Reactions – CSTR	
Lab 3	Reactions – CSTR Case Studies	
Lab 4	Reaction – PFR	
Lab 5	Demethanization	
Lab 6	Biodiesel production	
Lab 7	Steam Power Plant	
Lab 8	PID Control	
Lab 9	PID Control #2	
Lab 10	Lab Test 2	
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%
Term Tests (Oct. 8 & Nov. 19)	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. Combine mass and energy balances to calculate required flowrates and energy inputs in chemical reactors.
2. Integrate mass balances with reaction rate fundamentals for predicting the extent of reactions in CSTR, PFR, and Batch reactors.
3. Perform one-dimensional conduction and convection calculations.
4. Apply heat transfer calculations to the analysis and design of heat exchangers
5. Use the Bernoulli equation and augment it for calculations in pipes
6. Demonstrate the importance and use of pump curves
7. Execute process analysis using Unisim Design
8. Monitor the transient behavior of industrial processes through process simulation software and critique on the interplay of the control aspects of those processes.

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.

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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.