Course Outline

1. COURSE INFORMATION

Session Offered	Fall 2020
Course Name	Chemical Engineering Concepts
Course Code	BIO TECH 2EC3
Date(s) and Time(s) of lectures	We 11:30AM - 12:20PM; Virtual Th 11:30AM - 1:20PM; Virtual https://zoom.us/j/92474439539
Program Name	Biotechnology
Calendar Description	Material balances: single and multi-unit systems with possible reactions. Energy balance: energy conservation including enthalpy calculations, steam tables, specific heats, phase changes, and reactions. Survey of momentum, heat and mass transfer; basics of chemical process design.
Instructor(s)	Dr. Amin R. Rajabzadeh	E-Mail: rajaba@mcmaster.ca Office Hours & Location: Th 1:30PM - 3:30PM https://zoom.us/j/92474439539
Lab Instructor	Mr. Pouria Baghaei baghaeip@mcmaster.ca	

2. COURSE SPECIFICS

Course Description	Survey of basic engineering process variables and units. Drawing and labeling flowcharts. Balancing mass on single and multi-unit processes without and with reactions. Chemical reaction stoichiometry and its application on material balances. First law of thermodynamics. Mechanical energy balance. Energy balance on open and close systems. Use of thermodynamic tables. Application of energy balances on chemical and biological processes with possible phase change and reaction. Calculation and application of heats of reactions and combustion.

Instruction Type	Code	Type	Hours per term
	C	Classroom instruction	37
	L	Laboratory, workshop or fieldwork	15
	T	Tutorial	
	DE	Distance education	
		Total Hours	52

Resources	ISBN	Textbook Title & Edition	Author & Publisher
	ISBN: 978-1-118-43122-1	Elementary Principles of Chemical Processes	R.M. Felder and R.W. Rousseau, John Wiley and Sons, 4th Edition
	Other Supplies		**Source**

Prerequisite(s)	ENG TECH 1CH3, 1MT3, 1PH3
Corequisite(s)	
Antirequisite(s)	

Course Specific Policies	If you have missed a test, assignment, quiz, or report, you should submit an MSAF form and let your instructor know. The weight of the MESF'ed task will automatically be added to the final exam. Students may have to complete a pre-lab report prior to attending certain labs. Lab reports are due the following lab session.
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	Engineering Calculations Processes and Process Variables	Chapters 2 and 3
Week 2	Material Balances: -Process Classification, Balances on Single Unit Processes	Sections 4.1 -4.2
Week 3	Material Balances: - Flowcharts, Scaling, Balancing, Degree- of- Freedom Analysis	Section 4.3
Week 4	Material Balances: -Multi-Unit Processes	Section 4.4
Week 5	Material Balances: - Chemical Reaction Stoichiometry	Section 4.6
Week 6	Material Balances: - Chemical Reaction Stoichiometry	
Week 7	Material Balances: - Reactive Processes	Section 4.7
Week 8	Material Balances: - Combustion Reactions Energy and Energy Balances: -Thermodynamics, Kinetic and Potential Energy	Section 4.8 Sections 7.1-7.2
Week 9	Energy and Energy Balances: - Energy Balances on Closed and Open Systems, Tables of Thermodynamic Data	Sections 7.3-7.6
Week 10	Energy Balances on Nonreactive Processes:	Sections

	-Elements of Energy Balance Calculations, Changes in Pressure at Constant Temperature, Changes in Temperature	8.1-8.3
Week 11	Energy Balances on Nonreactive Processes : -Phase Change Operations	Sections 8.4a-c
Week 12	Energy Balances on Reactive Processes: -Heats of Reaction, Calculation of Heats of Reaction	Sections 9.1-9.2
Week 13	Energy Balances on Reactive Processes: -Heats of Reaction, Calculation of Heats of Reaction	Sections 9.1-9.2
Week 14	Review	

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Midterm Recess: Monday, October 12 to Sunday, October 18
Classes end: Wednesday, December 9
Final examination period: Thursday, December 10 to Wednesday, December 23
All examinations MUST be written during the scheduled examination period.

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List of experiments

Lab 1	Distillation
Lab 2	Heat Exchanger
Lab 3	Evaporator
Lab 4	Continuously Stirred Tank Reactors (CSTRs)
Lab 5	Neutralization
Lab 6	Membrane Filtration

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
Assignments	25
Quizzes	10
Term Test 1 (Week 6, to be confirmed)	10
Term Test 2 (Week 12, to be confirmed)	10
Labs	20
Final examination (tests cumulative knowledge)	25
TOTAL	100%

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

5.   LEARNING OUTCOMES

1.   Given a process description a) draw and label a flowchart; b) choose a basis of calculation; c) perform the degree-of –freedom analysis; d) write in order, the equations needed to calculate specified process variables; and e) perform the calculations. This applies to both single and multiple unit processes.

2.   For systems involving reactions, must be able to use: molecular species balances, atomic species balances, or extents of reaction to perform the degree-of-freedom analysis and the process material balance calculations.

3.   Given a description of a closed process system: apply the first law of thermodynamics, simplify the energy balance and solve it for specified process variables.

4.	Given a description of an open process system: write the energy balance in terms of enthalpy and shaft work, simplify the energy balance and solve it for specified process variables.
5.	Learn how to use steam tables and other physical property tables (in Appendix B)
6.	Evaluate changes in specific enthalpies and internal energies when this data is not available in tables for all process species. Once these calculations are performed, write energy balances and solve to determine the energy requirements for nonreactive processes.
7.	Write and solve energy balances on a reactive system using either the heat of reaction method (taking reactant and product species as references for enthalpy calculations) or the heat of formation method (taking elemental species as references).

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.