**COURSE OUTLINE OF CHEMICAL ENGINEERING 3K04: WINTER 2026**
**INTRODUCTION TO REACTOR DESIGN**

**Instructor**: Mr. Alexandre D'Souza (JHE-345; email: dsouzaam@mcmaster.ca)

**TAs**:
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**Lectures**: Tu, Th, Fr 8:30-9:20 (C01)

**Tutorials**:
Mo 10:30-12:20 (T02)
Mo 2:30-4:20 (T01)

**Tests**:
Schedule:
January 13, 11:59 PM, deadline for forming groups
January 28, 11:59 PM, in class test question due
January 31/February 3 (tentative), in class test
February 10 11:59 PM, Mid term 1 question due
Mid Term Test 1: (tentative) February 12, 6:30-8:30 - Location TBD
March 10 11:59 PM, Mid term 2 question due
Mid Term Test 2: (tentative) March 12, 6:30-8:30 – Location TBD

Notes: The test and the exam will be open book and open course notes/solutions/handwritten/digital notes. You will also be allowed the use of your devices during tests/exams **as long as they are in airplane mode** (offline). At the end of your tests/exams you are to upload your tests/exams to the appropriate submission dropbox on Avenue.

**Examination**: Final examination, 2.5 hours.

**Calculators**: Any calculator may be used in the tests and final exam.

**Grading**:

| | |
|---|---|
| Graded Tutorials | 12 % (best 10 X 1.2%) |
| ICTQ | 1 % |
| In Class Test (ICT) | 2 % |
| Mid-terms (MT) | 33 % (2 X 16.5%) |
| MT Questions (MTQ) | 2 % (2 X 1%) |
| Term project | 10 % |
| Final Exam Q (FEQ) | 4 % |
| Assignments | 6 % (2 X 3%) |
| Final exam | 30 % |
| Total | 100% |

**You will be writing the in-class test, the midterms, and the final exam in person, but submitting a copy online on avenue by taking pictures using a device and uploading**. You will be given additional time to do this. If you do not have access to such a device, please let the teaching team know, in which case your handwritten copy will be submitted.

The graded workshops will be done on Avenue.

For the ICT and MTs, you are required to create questions which are different from those in the graded and practice workshops, and yet within the scope of the material (i.e., it should not be from further ahead in the course, and it should be in line with the material covered thus far). For no submission, or posing a question that already exists in the material, you will get a zero. For a submission that is very similar to existing questions, you will get a half mark. Questions that are deemed to be sufficiently novel to appear on a test/exam will be given full marks. You are **encouraged** to solve the questions that you pose (it is often a good way for yourself to determine the challenge level of the question) but will not lose marks for incorrect solutions.

Your final grade in the course will be **at least as** much as your score in the final exam. Thus, if you score a 81% in the final exam, and your overall course mark otherwise would be 77%, your final grade in the course will be 81 %.

Revisions to the assignments/solutions/grades/Tutorials and announcements will be posted on avenue. **All tests and graded tutorial workshops are to be done individually. The practice workshops, the assignments, Term project, the questions for the ICT, midterms and Final Exam are to be done in groups of three. The first activity for the course will be a workshop (and graded workshop) on January 12$^{th}$.**

The final percentage grades will be converted to letter grades using the Registrar's recommended procedure. Adjustments to final grades may be done at the discretion of the instructor. No make-up tests will be given. Marks of missed tests (with an official absence form) will be moved to the final exam.

**Note:** Late submissions of any graded activities will not be accepted.

**Required Texts**:

1. Lecture slides (PDF available on avenue)
2. Course pack (PDF available on avenue)

**Supplementary References:**

1. H.S. Fogler, *Elements of Chemical Reaction Engineering*, Prentice-Hall, 4$^{rd}$ Edition, 2006, Chapters 1-6, 8, 11, parts of Chapters 13&14.
2. J.M. Smith, *Chemical Engineering Kinetics*, McGraw-Hill (1981), 3rd Edition.
3. O. Levenspiel, *Chemical Reaction Engineering*, 2$^{nd}$ Edition, Wiley (1972). 3$^{rd}$ Edition (1999).

**Outline**

| Date | Material/Activity |
|---|---|
| Jan 12 | Graded WS 1 |
| Jan 19 | Graded WS 2 |
| Jan 26 | Graded WS 3 |
| Jan 30/Feb 3 | In Class Test 1 |
| Feb 2 | Graded WS 4 |
| Feb 9 | Graded WS 5 |
| Feb 12 | Mid Term 1, Covering upto GWS 5 |
| Feb 16-20 | Term Break (Family Day) |
| Feb 23 | Graded WS 6 |
| Mar 2 | Graded WS 7 |
| Mar 9 | Graded WS 8 |
| Mar 12 | Midterm 2: Covering up-to GWS 8 |
| Mar 16 | Graded WS 9 |
| Mar 23 | Graded WS 10 |
| Mar 30 | Graded WS 11 |
| Apr 6 | Graded WS 12 |
| Apr 7 | Classes End |

**Objectives**

To develop a fundamental understanding of the application of principles of chemical kinetics, material balances, heat transfer and mass transfer to the modeling and design of chemical reactor systems. Students should be able to apply this knowledge to the formulation and solution of the following problem types:

a) Given the starting or inlet conditions and the specifications of a reactor type, determine the output concentrations and temperature of that reactor (rating problem).

b) Given the starting or inlet conditions and the desired output conditions, calculate the size of a and kind of reactor required (design problem).

c) Given a set of data for a reaction, establish a rate equation for that reaction.

| Course outcomes | Corresponding CEAB indicator |
|---|---|
| Recognize that several reactor configurations could yield the desired product | 1.3 Competence in Engineering Fundamentals<br>1.4 Competence in Specialized Engineering knowledge<br>2.1 Identifies and states reasonable assumptions and suitable engineering fundamentals, before proposing a solution path to a problem.<br>4.2 Explores a breadth of potential solutions, considering their benefits and trade-offs as they relate to the project requirements<br>5.2 Successfully uses engineering tools. |
| Determine a criteria for choosing a particular configuration | 1.3 Competence in Engineering Fundamentals<br>1.4 Competence in Specialized Engineering knowledge<br>4.2 Explores a breadth of potential solutions, considering their benefits and trade-offs as they relate to the project requirements |
| Evaluate the options to determine the best fit to the criteria | 4.4 Justifies and reflects on design decisions, giving consideration to limitations, assumptions, constraints and other relevant factors. |
| Recognize the availability of software, thus avoiding making too many simplifying assumptions in problem solving | 5.2 Successfully uses engineering tools. |
| Solve problems using software such as Matlab | 5.2 Successfully uses engineering tools. |

The above outcomes and indicators are for your information. Graduating from an accredited institution has many advantages. Please read more about it here: http://www.engineerscanada.ca/accreditation

# The P.R.O.C.E.S.S.

As some of you may already be aware, the department of Chemical Engineering has a storied history of education. In addition to teaching and learning, the department is proud of our graduates not only for their academic success, but their more intrinsic traits that make them respected members of the engineering community.

Recently, several high-ranking graduates from the McMaster Chemical Engineering Program employed in various industries (oil/gas, financials, *etc*.) were interviewed to ask what traits they look for when hiring for engineering positions. Using this information, the department would like to present to you the **PROCESS**: a code of conduct that we hope will guide our students throughout this program and their careers to come.

- **P**rofessionalism
- **R**esponsibility
- **O**wnership
- **C**uriosity
- **E**mpathy
- **S**elflessness
- **S**ervice

It is up to YOU to interpret these traits and apply them to your time at McMaster and your career as you see fit. These traits will not be assessed for grades but will be strongly encouraged throughout your time at McMaster. We hope that you identify with these character traits and what they mean to you, and that you **trust the process**.

**POLICY REMINDER**:

**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:
•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 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.

## 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.

**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