Chemical Engineering 2DW1

Problem Solving Strategies

Course Outline - Fall 2025

Course Details

Instructor:	**Dr. Jake Nease**	**neasej@mcmaster.ca** **(905) 599-3165**	**JHE/373**
Teaching Assistant:	Annika Yardy Pratham Shah	yardya@mcmaster.ca shahp85@mcmaster.ca	See A2L* See A2L*
Website:	Avenue2Learn	avenue.mcmaster.ca	
Lectures:	See A2L*	See A2L*	See A2L*
Tutorials:	N/A	N/A	N/A
Office Hours:	MON	13:30 – 16:30	JHE/373
Prerequisites:	Enrolment in any Chemical Engineering program		
Software:	This course will require the application of MS Office		
Course Materials:	Lecture slides and workshops, assignments, videos, and solutions will be posted on A2L Grades will also be posted on A2L but are not official until released on MOSAIC		
Recommended Textbooks:	Strategies for Creative Problem Solving (Fogler) The Visual Display of Quantitative Information (Tufte)		

*Based on McMaster's safety and inclusion policy, scheduling information is available separately only on A2L.

Formal Course Description

Developing problem solving awareness, planning strategies, creativity, analysis methods, interpersonal skills, and networks in the context of a themed team project.

Informal Course Description

Chemical Engineering at McMaster prides itself on training critical thinkers that celebrate open-ended problems and uncertainty. This course intends to build character, community, and camaraderie with your peers and yourself. Problem solving is as much about mindset as it is about technical skills and clear communication. Embrace the challenge. *I want to, and I can!*

Learning Objectives

This course is meant to introduce critical skills identified by engineering professionals, alumni, and stakeholders of McMaster Chemical Engineering. Make no mistake, these are not "soft" skills. They are common traits to leaders, engineers, and those that influence their professional field or practice. These skills, when practised, will differentiate you, help to secure co-ops and jobs, and enable you to progress in your career after McMaster University. These skills can be practised, and everyone has capacity to improve.

Those that complete CHEMENG 2DW1 are intended to fulfill the following:

L.1. Discuss the key outcomes of **personality typologies** (Myers-Briggs and Emotional Intelligence) as they relate to yourself and others and apply those outcomes to improve team dynamics.

L.2. **Document** the formation and evolution of a diverse team.

L.3. Develop a proposal, set project goals, identify measurement criteria, and create and adhere to accountability metrics in the context of a term-long **course project**.

L.4. Identify potential sources for group **conflict** and resolve those conflicts using resolution methods.

L.5. Apply the **Socratic Method** as a strategy to apply critical thinking to an open-ended scenario.

L.6. Make and justify **assumptions** about engineering problems and assess the validity of assumptions made by others and artificial intelligence (AI).

L.7. Define problems with **measurable outcomes** from open-ended or ill-understood scenarios.

L.8. Apply a well-documented **problem-solving method** to solve problems derived from open-ended or ill-understood scenarios.

L.9. **Write an effective** email, technical memo, or abstract that consolidates information, makes demands, and defines clear outcomes as appropriate.

L.10. **Critique figures** and illustrations through the lenses of technical accuracy, appropriateness of visualization, and richness of information.

Why This Course Exists

Industry stakeholders have identified the above learning outcomes as imperative for success in chemical engineering graduates (e.g., securing your first job and progressing in your career). This course is meant to reframe your approach to problem-solving, celebrate learning, and empower community within the chemical engineering program. In addition to the learning outcomes above, 2DW1 endeavours to:

- Offer a chance at building a **community** among the students.
- Provide a low-stakes and (essentially) consequence-free environment to **take risks**.
- Give students a chance to gain perspective on **process** and **documentation** as they relate to setting and achieving goals.
- Emphasize the **growth mindset** and build confidence when dealing with the unknown or unexpected.

Course Website and Material Distribution

This course has an **Avenue to Learn (A2L)** course shell. All lecture notes, videos, project information, and announcements will be made on A2L. It is expected that you will check A2L daily, and it is your responsibility to ensure that you caught up on all course material.

Lecture Recordings

All lecture in this course will be in-person at the scheduled days and times. Echo360 software will be used to record the lectures. Recordings will be posted to the course YouTube channel. I make no guarantees about the stability, reliability, or quality of Echo360. Please make a habit of coming to class live as we will be having frequent discussions that benefit live participation, and your grade depends on it!

Grading Policies

This course is graded as **pass/fail**. There is no numerical grade associated with the course, and individual graded components are all graded on a pass/fail basis. The intention is to keep workload manageable and appropriate for a one-unit course offering. To show competency, you are required to pass **ALL** course components to receive a passing grade in the class. Some components are group-based, and some are individual.

INDIVIDUAL COMPONENTS

- LECTURE ATTENDANCE [×11]
    - Up to **three** lectures may be missed throughout the term (*reflection required*; see below).
    - Attendance taken the "good old-fashioned way" with pen and paper :].
- AFTER-LECTURE ACTIVITIES [Weekly; included at end of each lecture slot]
    - Occasional short reflection activities or surveys.

TEAM COMPONENTS

- TEAM CHARTER
    - Profiles of team members.
    - Team contract.
- PROJECT PROPOSAL
    - Objective and final deliverable.
    - Strategies for evidence collection.
    - Timeline, milestones, and goals.
    - Intended Showcase participation modality.
- FINAL PROJECT
    - Documentation of evidence throughout project.
    - Participation in final showcase.

Lecture Attendance

Lecture attendance in this course is **mandatory**. Sign-in sheets will be used to track attendance throughout the term. Students are allowed to miss up to **three** lectures at their discretion. It is expected that students will miss lecture only when ill or participating in another professional function.

On A2L there will be drop boxes for each lecture. For **missed lectures only**, students are expected to watch the recorded lecture and submit a 1/3-1/2 page reflection on the content they missed, graded on a pass/fail basis. Any students attending and participating in lecture are excused from this activity.

Group Work and Digital Submissions

Your project team will be codified into A2L. All team-based submission will be made via A2L by someone representing their team. Once feedback is provided, your team may be asked to re-submit an updated version. This will be required to pass the assessment.

Academic Honesty

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. The online nature of courses now that we are coming out of the **C19 pandemic** will test these principles like never before.

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. **Note that these consequences will be enforced even when submitting OPTIONAL components**. It is your responsibility to understand what constitutes academic dishonesty. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at http://www.mcmaster.ca/academicintegrity.

- All graded submissions are to be completed **in your group only**, with no additional collaboration.
- Plagiarism, improper collaboration, copying unauthorized tests or aids, and other academic dishonesty will not be tolerated. **Your first offence will be reported** to the Office of Academic Integrity.
- The default penalty for academic dishonesty is a zero on the entire project / assignment / exam, even if the dishonesty occurred on just one portion or question of that project / assignment / exam. However, if Academic Integrity chooses to hold a hearing, they will determine the penalty.

MSAF Policy

There are no formally graded components to this course. Deadlines for participation activities should be met without significant issues, but in extreme circumstances please email the course instructor to determine the best course of action. Using an MSAF without following up will result in a 72-hour extension (and is, frankly, a waste of an MSAF).

Course Policy on Generative Artificial Intelligence (AI)

Generative AI tools such as ChatGPT, MS Copilot, and Google Gemini are powerful tools that can aid in your learning. You are permitted to use such tools for learning and preparation purposes. You are also allowed to use these tools to aid in the drafting of assignments and project documents, but you are expected to **disclose** the use of such tools for this purpose. Reflective exercises and other pieces of work expected to be the original thoughts of the author will be nailed for academic dishonesty if shown to actually be the work of Generative AI.

Accessibility and Mental Health

The instructor aims to make this class accessible to all students. Please forward and optionally discuss any accommodation granted by Student Accessibility Services (SAS) with the instructor *before the third week of the course*. Please raise any other accessibility issues with the instructor as soon as possible, e.g. accessibility of the course website and course materials.

I am certified with the McMaster Professor Hippo on Campus Program for mental health awareness and aid to students in need. My office is a **safe space** to discuss issues both academic and otherwise, and you are welcome to contact me at any time to chat. If I reach out to you at any time, be aware that it is not to embarrass or penalize you; it is because I care.

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

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**.

Anticipated Schedule of Topics

The topics that we should be able to cover in 2DW1 this year will include those in the following table. Note that coverage and sequencing is subject to change.

Lecture Date	Topic	Lecture Content
Week 01	Course Introduction	• Processes and procedures • Purpose of course • Icebreaking activities
Week 02	Knowing Yourself	• Emotional Intelligence • MB personality types • Class makeup of MB archetypes
Week 03	Project Management	• Setting goals • SMART objectives • Data collection and management skills • Effective proposals
Week 04	Teamwork (I)	• Stages of team formation • Typical team dynamics and relationships • EDI and team roles
Week 05	Teamwork (II)	• Functional and complementary team members • Common problems • The Drama Triangle • Conflict resolution techniques
Week 06	<NO CLASS>	• Open discussion/drop in for project or other topics
Week 07	Problem Solving (I)	• Critical thinking and what it means • Socratic questioning • Fact and figure checking/analysis

Week 08	Problem Solving (II)	• First steps to problem solving
		• Gathering information
		• Making appropriate assumptions
		• Problem analysis tools (1-2):
		  ○ Restatement technique
		  ○ Dunker technique

Week 09	Problem Solving (III)	• Problem analysis tool (3): Kepner Tregoe • Solution generation methods
Week 10	Problem Solving (IV)	• Problem analysis tool (4): Don Woods • Class workshops on problem solving
Week 11	Communications (I)	• Composing effective written arguments • Emails and making demands • Skimming information and reading abstracts • Using literature review resources
Week 12	Communications (II)	• Effective figures • How to lie with figures and data • How to emphasize the truth with figures and data

McMASTER APPROVED ADVISORY STATEMENTS

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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

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. Avenue to Learn, 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, 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

In the event of an absence for medical or other reasons, students should review and follow the Policy on 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, Avenue to Learn and/or McMaster email.