

**CHEMENG 4W06**

**Chemical Plant Design and Capstone Project**

Fall 2024-Winter 2025

Chemical Engineering Department

**Capstone Project Proposal**

**Call for Submission**



**Summer 2024**

**Course Info**

The department of Chemical Engineering at McMaster University has developed a final-year capstone project structure that is focused on industry-student collaborations to solve or investigate a problem posed by potential industrial partners. The over-arching goal of this new capstone stream is to provide students opportunities to solve real-world problems while simultaneously providing value to the companies willing to support them.

Upon a successful pilot run, all graduating students of Chemical Engineering Department are now required to participate in this new structure of capstone course. This will allow all our students have the invaluable opportunity to solve real-world problems as a part of their capstone experience.

This document is meant to provide some context on potential projects and collaborations, including time commitments, degree/course requirements, and potential project scopes. What follows below is a series of potential questions or concerns that our industry partners may have along with preliminary answers.

Also, I am delighted to share with you our [Capstone Webpage](https://www.eng.mcmaster.ca/research-innovation/student-research-innovation/capstone/chemical-engineering/) which highlights the projects that our students have been working on during past couple of years.

If you decide to support our students serve as one of industry partners of the course, you can complete and submit this document to be contacted as industry partner of the capstone course for Fall 2024- Winter 2025. This document should be submitted to myself via email, [shelir.ebrahimi@mcmaster.ca](mailto:shelir.ebrahimi@mcmaster.ca) by **July 15, 2024**

. Although I will not be the faculty mentor for all of the projects, I am co-ordinating this capstone course and will be helping students with finalizing their projects with the industry partner through the proposal they submit. I will reach out to you to discuss the details.

I look forward to developing meaningful capstone projects for our students and industry partners and I thank you for your time and efforts to make this dream a reality.

Regards,

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## Industry partner involvement and requirements

Each project under the new capstone stream requires an industry partner willing to dedicate time and attention to the proposed student project. This time will likely be voluntary by the industry partner. Commitments of the partner over the course of the project will include:

* Working with the students to define the scope of a (primarily engineering DESIGN) project, including deliverables required by the supporting company, expected deadlines, and student expectations.
* Meeting with and guiding students throughout the tenure of the project. Specific time commitments are up to the industry partner, but an estimate is two hours per week of face-to-face or email correspondence, with additional time toward the end of the project.
* Identify and assist with processing any project logistics (NDAs, anonymization of data, IP agreement, etc.).
* Evaluate and provide feedback on team’s progress reports (5 in total) as well as final report of the project. Proposed grading scheme and rubrics will be provided.
* Attending the year-end capstone final presentation session and Mac ENG Capstone Expo Day in April 2025.

## Potential industry benefits of participation in this capstone project

There are numerous potential benefits for industry partners participating in the new capstone stream. Such benefits may include (but are not limited to):

* An opportunity to explore an expansive or intriguing project that may not have funding or work-hours otherwise available.
* An opportunity to interact with a keen group of undergraduate students, including the chance to assess work habits, expertise, time management, communication skills, and other skills critical for successful employment.
* A potential collaboration with a professor in a specific subject area, that may also have access to specialized lab equipment that can be used for lab/bench scale work.
* A chance to establish ties with the chemical engineering department at McMaster University and professors with research interests related to potential industry projects.
* The potential to establish long-running capstone project partnerships that will result in value additions to the company in the long run.
* A meaningful value addition to the company through supervising a group of young passionate engineering graduates.

## Expected Project Team Experience

The experience of each project team will vary and should be discussed prior to the project progressing beyond the proposal stage. It can be guaranteed that each student will be in their final year of undergraduate studies and will thus have a functional knowledge of mass/heat transfer, stagewise operations, control systems, process design and simulation, reactor design, and fluid mechanics, Optimization, simulation using ASPEN Plus, etc. Students will also gain in-depth experience on engineering economics, including cost estimations and financial projections. They also have laboratory skills (Design and performing experiments and Data analysis) in different fields including transport phenomena, fluid mechanics, reaction kinetics, reactor design and process control.

**Important Note:** Project team (including faculty mentor and industry partners) need to ensure the attributes/indicators required by the Canadian Engineering Accreditation Board (CEAB) are measured. The most important aspect of accreditation is DESIGN. All capstone projects should have a design component (either design of a new process or equipment or re-design of an existing process or equipment). This means, research-based project and projects that are looking at ONLY feasibility studies or simulation are not acceptable as a capstone project.

The course coordinator will monitor the overall progress of projects and deals with any admin work of the project. Each team of students is also supervised by a faculty mentor with enough background in the related field of the project.

## Expected Students’ Time Commitments

It is anticipated that each student commits to **10-15 hours of work per week** over approximately **7 months** (September to mid April, and considering the break during December). Thus, for a group of 5 students, the project should require approximately:

10-15 hrs/week × 4 weeks/month × 7 months × 5 students/group = **1400 -** **2100 work-hours per project.**

Of course, it is anticipated that project scopes may require slightly more or less time than the above estimate on a project-to-project basis, but this serves as a baseline for interested industry partners. Moreover, it should also be clear that the time commitments of each group are not obliged to be 15 hours per week every week. Some weeks will undoubtedly require more time while others (during exams and the holiday season, for example) will likely have lower productivity.

## Project Timeline and Deliverables

**Project Timeline:**

Although projects are very diverse with unique scopes, it is expected that all of them to follow a general timeline:

**Term 1, Sep to Dec 2024:**

* Team formation and project selection
* Project proposal
* Literature review to fully understand the background of the project
* Review of potential solutions
* Finalization of design selection(s)

**Term 2, Jan to Apr 2025:**

Deliverables for term 2 can be flexible based on the scopes of the projects. However, most of the capstone projects are expected to have the following deliverables. Details can be discussed with the course coordinator at the beginning of term 2.

* Approval of the final project solution and scope (with industry and course coordinator)
* Final Design, simulations, and optimization (including PFD and/or P&ID)
* Other analysis depending on the project including but not limited to HAZOP, economic evaluations, Environmental assessments, optimization
* Final report and presentations

**Project Deliverables**

Note that the following deliverables will be required foreach project. However, the industry partner may require further documentation or deliverables depending on the project:

* Project proposal that must be approved by the capstone coordinator from McMaster University.
* Project management documents (Gantt chart, Group meeting log/minutes, etc.)
* Progress reports.
* Final project documents including final report.
* Final presentation at capstone showcase including project video.
* Reflections and Peer Evaluations.

## Engineering design software available

Chemical Engineering students at McMaster University have access to academic licenses for the following simulation, design and productivity software packages. This is a shortlist of potentially important software.

* Aspen Plus, Aspen Dynamics, Aspen Energy Analyzer, Aspen HYSYS
* MATLAB
* Microsoft Visio
* Pipe-Flo
* AutoCAD, Autodesk Inventor
* Python
* ANSYS
* General Algebraic Model Solver (GAMS): Optimization software
* Bio-Win

Note: Other software required for the project can be available to students through educational licences whenever needed.

**McMaster Chemical Engineering Capstone Project Proposal - 2024/2025**

The information provided in this document will be made available to the students in September 2023 so they can decide about their top 3 choices of their capstone projects based on their interests and technical skills. Later within the course, we will build on this document to create the project proposal. We understand that some pieces of the project may change in future so, provide the information to the best of your knowledge at this point.

**Project Title:**

**Project Description:**

Briefly describe the main scopes of the project; what are the main challenges that the client is facing and need to be address by this project? If there is any possibility or expectations of lab or field work, please specify that in this section. Also, please address special considerations for this project; e.g. specific background knowledge, software expertise, …

**Project Deliverables:**

If possible, provide a list of intended deliverables of the project.

**Industry Partner (company) Name:**

**Industry Partner Contact Person:**

**Industry Partner Contact Email Address:**

**Has Any student(s) reached out to you to initiate this conversation? If yes, please mention their names.**

**Do you think you will be sharing confidential information with students throughout the project? In other words, does you project require NDA agreement? (Yes, No, Maybe)**

**Are you expecting to have the rights to use the project outcome beyond the duration of the project (8-months) that may require IP agreement? (Yes, No, Maybe)**