# CHEMENG 3I03
# Data Acquisition and Analysis
# Fall 2024 Course Outline

## Calendar/Course Description

This course acquaints students with the principles of data acquisition and analysis as it pertains to engineering applications. Topics will cover important aspects related to statistics, sampling, error analysis, calibration, and data interpretation, as well as familiarize the student with the measuring technologies typically used in Chemical Engineering. Understanding the relevance of measurements collected from different types of physical sensors will be developed through lectures covering operating principles and reinforced through lab experiments.

## Pre-Requisites and Anti-Requisites

**Prerequisite(s):** Registration in Level III or above of any Chemical Engineering program
Antirequisite(s): CHEMENG 2I03

## Instructor Office Hours and Contact Information

Dr. Vince Leung
JHE A412
leungv@mcmaster.ca

Office Hours:
By Appointment

## Teaching Assistants and Contact Information

Kyle Jackson
jacksk1@mcmaster.ca

Salma Abdelrahman
abdels8@mcmaster.ca

Logan Groves
grovel2@mcmaster.ca

Mya Sharma
sharmm57@mcmaster.ca

Lisa Bertolo
bertoll@mcmaster.ca

## Learning Outcomes

| Learning Outcomes |
|---|
| LO.01 Design appropriate experiments based on previous experimental results or theory |
| LO.02 Use statistics to properly analyze and present data |
| LO.03 Select appropriate sensors for engineering applications and justify the selection |
| LO.04 Properly calibrate, place, and use different types of sensors |
| LO.05 Able to explain the theory behind sensor operation |
| LO.06 Properly record data using principles of data acquisition |
| LO.07 Perform experiments and collect data given a set of instructions |

### CEAB Indicators

| Indicators | LO |
|---|---|
| 3.1 Selects appropriately from relevant knowledge base to plan appropriate data collection methods and analysis strategies. | LO.01 |
| 3.2 Synthesizes the results of an investigation to reach valid conclusions. | LO.02 |
| 5.1 Evaluates engineering tools, identifies their limitations, and selects, adapts, or extends them appropriately. | LO.03 |
| 7.2 Composes an effective written document for the intended audience. | LO.02, LO.05 |
| 11.1 Applies economic principles in decision making. | LO.03 |

For more information on CEAB Accreditation, please visit: https://www.engineerscanada.ca

## Course Materials

Course material posted on Avenue
Eye protection is required for laboratory

## Course Overview

| Week of | Topic | Labs/Tutorials | Due |
|---|---|---|---|
| 1. Sept. 2 | Introduction and Data Reporting | No Lab | |
| 2. Sept. 9 | Statistics and Data Analysis | Excel Lab 1 | Excel Lab 1 |
| 3. Sept. 16 | Statistics and Data Analysis | Excel Lab 2 | Excel Lab 2 |
| 4. Sept. 23 | Comparing Data | Excel Lab 3 | Excel Lab 3 |
| 5. Sept. 30 | Data Acquisition | No Lab | |
| 6. Oct. 7 | Sampling and Calibration | Excel Challenge | |
| 7. Oct. 14 | Reading Week | Reading Week | |
| 8. Oct. 21 | Temperature/Pressure Sensors | Lab 1 | Lab 1 Assignment |
| 9. Oct. 28 | Flow/Level Sensors | Lab 2 | Lab 2 Assignment |
| 10. Nov. 4 | Piping and Instrumentation Diagram | Lab 3 | Lab 3 Assignment |
| 11. Nov. 11 | Instrumentation in Industry | Lab 4 | Lab 4 Assignment |
| 12. Nov. 18 | Midterm (Nov 22) | P&ID | P&ID Assignment |
| 13. Nov. 25 | Other Sensors and Case Study | Case Study Work Period | |
| 14. Dec. 2 | No Lecture | No Lab | Case Study Report (Dec 4) |

## Assessment

| Component | Weight |
|---|---|
| Excel Labs (3) | 15% (5% each) |
| Excel Challenge | 10% |
| Lab Assignments (4) | 20% (5% each) |
| P&ID Assignment | 5% |
| Case Study Report | 20% |
| In-class Participation | 10% |
| Midterm | 20% |
| Total | 100% |

Notes:

- The instructor reserves the right to alter the evaluation scheme if necessary.
- Grading will be determined from the instructor's gradesheet not marks listed on Avenue. In the case of discrepancies between the two, the marks on Avenue will be disregarded.

## Course Grading

The overall percentage for the course will be converted to a letter grade using the scale recommended by the Office of the Registrar. The instructor reserves the right to adjust marks up or down. Graded reports will be kept in the department for a minimum of one year, in accordance with Senate regulations.

## Methods of Communication

Announcements, labs, case studies, and lecture slides will be posted on Avenue to Learn (http://avenue.mcmaster.ca/). All assignments will be submitted and graded on Avenue to Learn. The most up-to-date course outline will be posted on Avenue.

Lectures will be held on MS Teams at the scheduled times. Recording of the lectures will be posted on MS Stream. The instructor and the teaching assistants will primarily communicate with students via their McMaster email address. If there are any questions, please email the instructor or the teaching assistants at the email addresses provided above.

## Working in Groups – Submission of Shared Work

The instructor of this course fully supports the importance of engineering students learning to work in groups. But there are often problems with everyone contributing equally as the group grows large in size.
In such cases of working together, it is important that proper acknowledgement be given. A form, the Group Declaration page, must be downloaded from Avenue and attached to the front of a submission with the signature of all persons shown. No grade will be given if there is no signature. Signatures cannot be added after the submission is graded.

## Missed Work

Any missed work in this course (presentation, assignment or lab) will be exempt upon receiving a McMaster Student Absence Form (MSAF). A lab period may be rescheduled if missed provided there is sufficient time to do so. The grade value of all missed work will be added to the value of other assessments determined the instructor.

A MSAF *must be received within a span of two-weeks or before the examination ban, whichever is shortest.* No MSAF will be accepted once the lectures have ended for the course. Students are reminded that it is the policy of the Engineering faculty that students are responsible to follow up with the instructor directly once filing an MSAF, and ensure it was received. This is important since often students may enter the wrong email address for the instructor and the MSAF will never be received. It is not the responsibility of the instructor to follow up on such matters.

## Lectures

One 110-minute lecture per week. Lectures will be in-person and recorded using ECHO360. Topics covered will include: the technical aspects of statistics, data collection, data analysis, sensor operation and measurement/sampling error.

## Avenue to Learn

This course uses the university's learning management system, Avenue to Learn, to allow communication between the students and to provide access to grades. Marks posted on Avenue are given for information purposes only – the final grade of the course is determined from the instructor's gradesheet. It is important that students understand how the system is used by the teaching staff to avoid problems throughout the course.
The instructor (and possibly the TAs) will use this medium to communicate announcements and provide grades whenever the assignments/labs etc. are marked. Neither the e-mail nor discussion board features on Avenue are monitored by the teaching staff. The discussion board is intended for students to collaborate on their reports. Report any misuse of the board to the instructor.

Reports/assignments are due in the Avenue dropboxes. All files (except relevant Excel files) must be in LEGIBLE pdf format.

## Laboratory

All labs will be conducted in-person in ABB-C207. Students must wear eye-protection in the lab. Students will work in groups of 3 in the lab but submit individual lab assignments.

The purpose of the labs is to gain practical experience with Excel, data collection, sampling, calibration and use of sensors. For excel labs, the lab manual and the datasets will be provided on Avenue. The excel lab assignments are due two days after the lab is assigned. The lab assignments are to be submitted on Avenue.

There are also experimental labs which will explore the use of temperature sensors, pressure sensors, flow sensors, and chemical sensors. The lab assignment is due six days after the lab. Failure to hand in the report on time will result in a penalty of 20% per day late, with first day late starting after 11:59 pm the day it was due. The lab reports are to be completed individually. Please refer to the lab manual and the lab report writing guidelines for details regarding the requirements for the lab reports.

## 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 or MS Teams 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 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 about McMaster's use of Turnitin.com please go to www.mcmaster.ca/academicintegrity.

## 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.

## 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.

## Academic Accommodations for Relief for Missed Academic Term Work

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.

## Inclusive Environment Statement

We consider this classroom to be a place where you will be treated with respect, and we welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability – and other visible and non-visible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class. We will gladly honour your request to address you by an alternate name or gender pronoun. Please advise us of this preference early in the term.

## Courses with an Online Element

Some courses may use online elements (e.g. e-mail, Avenue to Learn (A2L), MA Teams, 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, usernames 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 online 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. CHEMENG 3I03 will NOT using any online proctoring software.

## 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.

## 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.

## Reference to Research Ethics

The two principles underlying integrity in research in a university setting are these: a researcher must be honest in proposing, seeking support for, conducting, and reporting research; a researcher must respect the rights of others in these activities. Any departure from these principles will diminish the integrity of the research enterprise. This policy applies to all those conducting research at or under the aegis of McMaster

University. It is incumbent upon all members of the university community to practice and to promote ethical behaviour. To see the Policy on Research Ethics at McMaster University, please go to https://reo.mcmaster.ca/.

## 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.

## Notice Regarding Possible Course Modification

The instructor and 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. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes.

## Use of AI Tools in the Course

Students may use generative AI for [editing/translating/outlining/brainstorming/revising/etc.] their work throughout the course so long as the use of generative AI is referenced and cited following citation instructions given in the syllabus. Use of generative AI outside the stated use of [editing/translating/outlining/brainstorming/revising/etc] without citation will constitute academic dishonesty. It is the student's responsibility to be clear on the limitations for use and to be clear on the expectations for citation and reference and to do so appropriately.

## 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.

- Professionalism
- Responsibility
- Ownership
- Curiosity
- Empathy
- Selflessness
- Service

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**.