**W.Booth School of Engineering Practice &Technology**

**PROCTECH 3PL3**

**Advanced PLC Programming and Control**

*Fall 2023*

## Instructor Information

Rubaid Khan

**Email:** khanru@mcmaster.ca

**Office:** Mohawk College Fennell campus

**Office Hours:**

By appointment

## Course Information

This is the advanced PLC programming course in the program of studies.

**Course Dates:** 09/05/2023 - 12/06/2023
**Units:** 3.00
**Course Delivery Mode:** In Person
**Course Description:** Advanced PLC programming concepts such as files, subroutines and indexing, industrial networks, PID and PWM, HMI, AC and DC drives integration and implementation in PLCs, and automation design project. Three lectures, one lab (three hours); first term Prerequisite(s): PROCTECH 2PL3 and registration in level III or above of Automation Systems Engineering Technology.

## Instructor-Specific Course Information

Students taking the course should be able to design and implement advanced PLC programming control techniques by using files, subroutines and program flow management. They will learn the principles of various industrial PLC networks (ControlNet, DeviceNet and Ethernet) including: configuration, wiring and programming. The final component of the course will focus on the application of PLC programming in the field of motor drive control involving analog I/O, PWM and PID control. These elements will also be reinforced using industrially recognized Human Machine Interfaces (HMI) (VTS software package) and how it applies to efficient process automation design.

## Meeting Details

All labs are mandatory and missing labs without a medical notice can result in failure of the course.

Lecture attendance is strongly required and evaluated.

Any additional meetings with instructors need to be mutually arranged between the student and instructor based on availability. Meetings may be held in person or virtually. Students need to send an email to the instructor to request a meeting.

## Important Links

- [Mosaic](#)
- [Avenue to Learn](#)
- [Student Accessibility Services - Accommodations](#)
- [McMaster University Library](#)
- [eReserves](#)

## Course Learning Outcomes

For accreditation reasons, these learning outcome statements must be tied back to CEAB graduate attributes (GAs), including those that are measured in this course. If you are unsure how to do this, please contact the Associate Chair Undergraduate in your department.

- Solve simple automation problems by using the ControlLogix5000 PLC

- Create PLC ladder logic programs utilizing DeviceNet, ControlNet and Ethernet networks

- Program PLCs to control analog devices and solve practical industrial problems

- Write PLC programs to solve industrial closed loop control system problems

- Integrate PLC programs with modern HMI programs to create alarms and trends

## Course Learning Goals

- Understand the basics of and use the Logix5000 Controller and RSLogix5000 software

- Understand the differences between modern PLC communication networks and how to configure them

- Become familiar with modern Human Machine Interface (HMI) platforms

- Understand how to apply PWM and PID control theory techniques in PLC programming

## Required Materials and Texts

**Textbook Listing:** https://textbooks.mcmaster.ca

**Allen Bradley reference manuals**
**Authors:** Rockwell Automation
These manuals will be provided through the Avenue course content

## Optional Course Materials

**Textbook Listing:** https://textbooks.mcmaster.ca

**Industrial Automation and Process Control**

**ISBN:** 0-13-033030-2

**Authors:** Jon Stenerson

**Publisher:** Prentice Hall

## Class Format

In Person

## Course Evaluation

Quizzes - 10%

Lecture participation - 5%

Midterm - 15%

Final exam - 25%

Labs - 45%

## Course Evaluation Details

Quizzes will be held online and made available for specific periods. Students are responsible for keeping track of this and completing them on time.

Lecture participation will be short problem solving exercises handed in on paper.

Midterm will be held during class time around reading week break.

Final exam will be held during final exam week in December and scheduled by the registrars office.

Labs are divided into lab reports and tests. Lab reports are submitted in groups of two students.

## Grading Scale

| Grade | Equivalent Grade Point | Equivalent Percentages |
|---|---|---|
| A+ | 12 | 90-100 |
| A | 11 | 85-89 |
| A- | 10 | 80-84 |
| B+ | 9 | 77-79 |
| B | 8 | 73-76 |
| B- | 7 | 70-72 |
| C+ | 6 | 67-69 |
| C | 5 | 63-66 |
| C- | 4 | 60-62 |
| D+ | 3 | 57-59 |
| D | 2 | 53-56 |
| D- | 1 | 50-52 |
| F | 0 | 0-49 |

## Course Schedule

Lectures - 3 hours per week

Labs - 3 hours per week

## Absences, Missed Work, Illness

General University MSAF guidelines apply.

## Generative AI: Use Prohibited

Students are not permitted to use generative AI in this course. In alignment with McMaster academic integrity policy, it "shall be an offence knowingly to … submit academic work for assessment that was purchased or acquired from another source". This includes work created by generative AI tools. Also state in the policy is the following, "Contract Cheating is the act of "outsourcing of student work to third parties" (Lancaster

& Clarke, 2016, p. 639) with or without payment." Using Generative AI tools is a form of contract cheating. Charges of academic dishonesty will be brought forward to the Office of Academic Integrity.

# APPROVED ADVISORY STATEMENTS

## 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-proceduresguidelines/

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](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](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.

## Academic Advising

For any academic inquires please reach out to the Office of the Associate Dean (Academic) in Engineering located in JHE-Hatch 301.

Details on academic supports and contact information are available from:

https://www.eng.mcmaster.ca/programs/academic-advising

## 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](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.