

COURSE SYLLABUS



COURSE TITLE: ECET 234- PLC Control 1

CLASS SECTION:

TERM: 2024 Fall

COURSE CREDITS:3

DELIVERY METHOD(S): Lecture

Camosun College campuses are located on the traditional territories of the Ləkʷəŋən and W̱SÁNEĆ peoples. We acknowledge their welcome and graciousness to the students who seek knowledge here.
Learn more about Camosun's

Camosun College requires mandatory attendance for the first class meeting of each course. If you do not attend, and do not provide your instructor with a reasonable explanation in advance, you will be removed from the course and the space offered to the next waitlisted student.

INSTRUCTOR DETAILS

NAME: **Dr. Mozhgan Bacon**

EMAIL: **Baconm@camosun.ca**

OFFICE: TEC 216

LECTURE HOURS: 3hrs /week

LAB HOURS: 2.5hrs /week

OFFICE HOURS: 1hrs /week

As your course instructor, I endeavour to provide an inclusive learning environment. However, if you experience barriers to learning in this course, do not hesitate to discuss them with me. Camosun College is committed to identifying and removing institutional and social barriers that prevent access and impede success.

CALENDAR DESCRIPTION

Public holidays:

(Week 1)	Sep 2 nd Monday	labour day
(Week 5)	Sep 30 th Monday	National Day for Truth and Reconciliation
(Week 7)	Oct 14 th Monday	Thanksgiving Day
(Week 11)	Nov 11 th Monday	Remembrance Day

Exam dates:

Exam Type	Exam Date and Time	Syllabus
Quiz-1	25 th September 2024, (Week 4)	Lecture 01 to 06 + Boolean
Quiz-2	09 th October 2024, (Week 6)	Lecture 07, 08
Midterm	28 th October 2024, (Week 9)	Lecture 01 up to 11
Quiz-3	27 th November 2024, (Week 13)	Lecture 11 up to 18
Final Exam	As per college date	Week1 to Week14

PREREQUISITE(S): ECET 165
CO-REQUISITE(S): None
EXCLUSION(S): None

COURSE LEARNING OUTCOMES / OBJECTIVES

Upon successful completion of this course a student will be able to:

- Use knowledge of PLC systems and functions to design and execute PLC programs.
- Draft a PLC ladder diagram for programming purpose.
- Use a variety of basic and more advanced PLC instructions in order to implement more complex programs.
- Explain interrupts and how to use them in a PLC program.
- Operate a PLC's analog I/O module to convert analog signals to digital form.

REQUIRED MATERIALS & RECOMMENDED PREPARATION / INFORMATION

- Access to D2L (Course Notes, Labs, Assignments/Problem sets, Quizzes, Tests)
- Max Rabiee, **Programmable Logic Controllers: Hardware and Programming**, 3rd Edition, G-W Publisher, ISBN: 978-1-60525-945-1 (Optional)

COURSE SCHEDULE, TOPICS, AND ASSOCIATED PREPARATION / ACTIVITY / EVALUATION

Course outline:

COURSE CONTENT

1. **Introduction to PLCs**
 - 1.1 Description of a PLC
 - 1.2 History of the PLC
 - 1.3 Function of the PLC
 - 1.3.1 Compared to traditional relay control systems
 - 1.3.2 Compared to microprocessor-based systems: PC, etc.
 - 1.3.3 Typical PLC Controller
 - 1.4 PLC Applications
 - 1.5 PLC Instruction
 - 1.5.1 Main part
 - 1.5.2 Extension parts
 - 1.6 Typical PLC control unit and system
 - 1.7 How PLCs function
2. **Introduction to PLC Programming**
 - 2.1 File Structure
 - 2.1.1 Program Files

- 2.1.2 Data Files
- 2.1.3 Function Files
- 2.2 Addressing
 - 2.2.1 I/O Address
 - 2.2.2 Data file Address
- 2.3 Construction of Logix500 programming window
- 2.4 Basic ladder diagram edition
- 2.5 Project verification

- 3. **Bit Instructions**
 - 3.1 What are bit instructions
 - 3.2 Main applications of bit instructions
 - 3.3 XIC bit instruction
 - 3.4 XIO bit instruction
 - 3.5 OTE bit instruction
 - 3.6 OTL bit instruction
 - 3.7 OUT bit instruction
 - 3.8 OSR bit instruction

- 4. **Software Usage**
 - 4.1 Overview on debugging
 - 4.2 Force On and Force Off

- 5. **Logical Operations**
 - 5.1 Main types of logic
 - 5.3 Logic AND, Logic OR, Logic NOT
 - 5.3 Realization of logics

- 6. **Advanced PLC Instruction**
 - 6.1 Timer Instructions
 - 6.1.1 What are timer instructions
 - 6.1.2 Structure of timer instructions
 - 6.1.3 How timer instructions work
 - 6.1.4 Application of timer instructions
 - 6.2 Counter Instructions
 - 6.2.1 How counter instructions work
 - 6.2.2 CTU and CTD
 - 6.2.3 Usages of counter instructions
 - 6.3 Compare Instructions
 - 6.3.1 What is a compare instruction?
 - 6.3.2 How compare instructions work
 - 6.3.3 Common compare instructions: EQU, NEQ, GRT, GEQ, LES, LEQ, MEQ, and LIM
 - 6.3.4 Usage of compare instructions

- 6.4 Subroutine Instructions
 - 6.4.1 What is a subroutine?
 - 6.4.2 Why use a subroutine?
 - 6.4.3 How subroutines work
 - 6.4.4 Usage of subroutine instructions
- 6.5 Sequencer Instructions
 - 6.5.1 Why sequencer instructions are popular?
 - 6.5.2 Sequencer instructions SQC, SQO, and SQL
 - 6.5.3 Mask and its effects
 - 6.5.4 Steps and sequencer operation
- 6.6 Move Instructions
 - 6.6.1 Move instructions MOV and MVM
 - 6.6.2 Move instructions' role in resetting and initializing PLC systems

7. **Advanced PLC Instructions II**

- 7.1 Math Instructions
 - 7.1.1 Structure of math instructions
 - 7.1.2 ADD, SUB, MUL, DIV, SQR, CLR, NEG
 - 7.1.3 How the PLC handles math instructions
 - 7.1.4 Math status bits
- 7.2 Shift Instructions
 - 7.2.1 Construction of shift instruction BSL
 - 7.2.2 How shift instructions work
 - 7.2.3 Other instructions: BSR, BSL FFL, FFU, LFL, LFU
- 7.3 Logic Instructions
 - 7.3.1 Logical functions
 - 7.3.2 Ways to use logical functions
 - 7.3.3 Logical instructions: AND, OR, XOR, and NOT
- 7.4 Data Conversion Instruction
 - 7.4.1 DCD, INC, TOD, FRD Instructions

8. **Analog Control Modules**

- 8.1 A typical Digital System
- 8.2 Introduction to ADC and DAC
- 8.3 Analog Input Module 1762-IF4
- 8.4 Analog Output Module 1762-OF4
- 8.5 Input/output Module Configuration

9. **Interrupts**

- 9.1 What is an interrupt?
- 9.2 How the Micrologix 1200 handles interrupts
- 9.3 When interrupts can be responded too
- 9.4 Interrupt priority
- 9.5 Interrupt instructions: INT, UIE, UID, and UIF
- 9.6 Interrupt configuration: EII

Labs (Subject to change):

Various lab exercises will be performed to practice and reinforce the lecture material.

1. Lab 1 – Review of Ladder Logic, the LogixPro PLC Simulator, and RSLogix
2. Lab 2 – Garage Door Simulation-Exercise 1
3. Lab 3 – Garage Door Simulation-Exercise 2&3
4. Lab 4 – Silo System Simulation
5. Lab 5 – Traffic Control Exercises utilizing TON (1)
6. Lab 6 – Traffic Control Exercises utilizing TON (2)
7. Lab 7 – Traffic Control utilizing Word Comparison
8. Lab 8 – Bit Shift Instructions-Bottle Line
9. Lab 9 – Allen-Bradley PLCs and RSLogix 500
10. Lab 10 – Batch Mixing Utilizing Counters
11. Lab 11 – Dual Compressor
12. Lab 12 – Multi Floor Elevator

Lesson Plan:

The following schedule and course components are *subject to change*, as deemed appropriate by the instructor.

Week	Day	Date	Time	Lecture	Problem Set	Quiz/Test
Week 1	Monday Lab	September 2, 2024	09:30	Lab0: -----	Problem set 1 (Lecture 01-03) September 3, 2024 Due Date: September 17, 2024, 13:30	
	Tuesday	September 3, 2024	13:30	(1) Lecture 0: Info Session		
	Wednesday	September 4, 2024	12:30	(2) Lecture 1: Introduction to PLC		
	Wednesday	September 4, 2024	13:30	(3) Lecture 2: PLC Application- Boolean Refresher		
Week 2	Monday Lab	September 9, 2024	09:30	Lab1: Review of Ladder Logic, the LogixPro PLC Simulator, and RSLogix		
	Tuesday	September 10, 2024	13:30	(1) Boolean Refresher (Cont.)		
	Wednesday	September 11, 2024	12:30	(2) Lecture 3a: Karnaugh Map		
	Wednesday	September 11, 2024	13:30	(3) Lecture 3: PLC Programming		
Week 3	Monday Lab	September 16, 2024	09:30	Lab2: Garage Door Simulation-Exercise 1	Problem set 2 (Lecture 04-08) September 17, 2024 Due Date: October 8, 2024, 13:30	
	Tuesday	September 17, 2024	13:30	(1) Lecture 4: BIT Instruction		
	Wednesday	September 18, 2024	12:30	(2) Lecture 5: Software Usage		
	Wednesday	September 18, 2024	13:30	(3) Lecture 6: Logical Operation		
Week 4	Monday Lab	September 23, 2024	09:30	Lab3: Garage Door Simulation-Exercise 2&3		
	Tuesday	September 24, 2024	13:30	(1) Lecture 7: Timer Instruction		
	Wednesday	September 25, 2024	12:30	(2) Lecture 7: Timer Instruction		
	Wednesday	September 25, 2024	13:30	(3) Lecture 7: Timer Instruction		
Week 5	Monday Lab	September 30, 2024	09:30	Lab4: Holiday		
	Tuesday	October 1, 2024	13:30	(1) Lecture 8: Counter Instruction		
	Wednesday	October 2, 2024	12:30	(2) Lecture 8: Counter Instruction		

	Wednesday	October 2, 2024	13:30	(3) Lecture 8: Counter Instruction			
Week 6	Monday Lab	October 7, 2024	09:30	Lab5: Silo System Simulation	Problem set 3 (Lecture 09-10) October 8, 2024 Due Date: October 22, 2024, 13:30	Quiz 2-Week 6 (Lecture 07-08) October 9, 2024	
	Tuesday	October 8, 2024	13:30	(1) Lecture 9: Compare Instruction			
	Wednesday	October 9, 2024	12:30	(2) Lecture 9: Compare Instruction			
	Wednesday	October 9, 2024	13:30	(3) Lecture 9: Compare Instruction			
Week 7	Monday Lab	October 14, 2024	09:30	Lab6: Holiday			
	Tuesday	October 15, 2024	13:30	(1) Lecture 10: Subroutine Instruction			
	Wednesday	October 16, 2024	12:30	(2) Lecture 10: Subroutine Instruction			
	Wednesday	October 16, 2024	13:30	(3) Lecture 10: Subroutine Instruction			
Week 8	Monday Lab	October 21, 2024	09:30	Lab7: Traffic Control Exercises utilizing TON (1) (2)		Problem set 4 (Lecture 11-12-13) October 22, 2024 Due date: November 5, 2024, 13:30	
	Tuesday	October 22, 2024	13:30	(1) Lecture 11- 12: MOV Instruction- Math Instruction			
	Wednesday	October 23, 2024	12:30	(2) Lecture 11- 12: MOV Instruction- Math Instruction			
	Wednesday	October 23, 2024	13:30	(3) Lecture 11- 12: MOV Instruction- Math Instruction			
Week 9	Monday Lab	October 28, 2024	09:30	Lab: Midterm (28-Oct-2024)			
	Tuesday	October 29, 2024	13:30	(1) Lecture 13: Sequencer Instruction			
	Wednesday	October 30, 2024	12:30	(2) Lecture 13: Sequencer Instruction			
	Wednesday	October 30, 2024	13:30	(3) Lecture 13: Sequencer Instruction			
Week 10	Monday Lab	November 4, 2024	09:30	Lab8: Traffic Control utilizing Word Comparison	Problem set 5 (Lecture 14-15-16-17) 05-11-2024 13:30 Due Date: November 19, 2024, 13:30		
	Tuesday	November 5, 2024	13:30	(1) Lecture 14: Shift Instruction			
	Wednesday	November 6, 2024	12:30	(2) Lecture 14: Shift Instruction			
	Wednesday	September 4, 2024	13:30	(3) Lecture 14: Shift Instruction			
Week 11	Monday Lab	November 11, 2024	09:30	Lab9: Holiday			
	Tuesday	November 12, 2024	13:30	(1) Lecture 15: Logic Instruction			
	Wednesday	November 13, 2024	12:30	(2) Lecture 16: Data Conversion Instruction			
	Wednesday	November 13, 2024	13:30	(3) Lecture 17: Analog Control Module			
Week 12	Monday Lab	November 18, 2024	09:30	Lab10: Allen-Bradley PLCs and RSLogix 500			
	Tuesday	November 19, 2024	13:30	(1) Lecture 18: Interrupts			
	Wednesday	November 20, 2024	12:30	(2) Lecture 18: Interrupts			
	Wednesday	November 20, 2024	13:30	(3) Lab 9: Bit Shift Instructions			
Week 13	Monday Lab	November 25, 2024	09:30	Lab11: Dual compressor			Quiz 3-Week 13 (Lecture 11-up to 18) November 27, 2024
	Tuesday	November 26, 2024	13:30	(1) Practice exercises			
	Wednesday	November 27, 2024	12:30	(2) Bottle Line Batch Mixing Utilizing Counters			
	Wednesday	November 27, 2024	13:30	(3) Practice exercises			
Week 14 (Review)	Monday Lab	December 2, 2024	09:30	Lab: Makeup Week			
	Tuesday	December 3, 2024	13:30	(1) Course review			
	Wednesday	December 4, 2024	12:30	(2) Course review			
	Wednesday	December 4, 2024	13:30	(3) Course review			

Students registered with the Centre for Accessible Learning (CAL) who complete quizzes, tests, and exams with academic accommodations have booking procedures and deadlines with CAL where advanced noticed is required. Deadlines scan be reviewed on the [CAL exams page](http://camosun.ca/services/accessible-learning/exams.html). <http://camosun.ca/services/accessible-learning/exams.html>

EVALUATION OF LEARNING

Problem Sets	10%
Quizzes/Tests	15%
Midterm	15%
Final Exam	40%
Total theory	80%
Laboratory Evaluation	20%
Total	100%

If you have a concern about a grade you have received for an evaluation, please come and see me as soon as possible. Refer to the [Grade Review and Appeals](http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.14.pdf) policy for more information.
<http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.14.pdf>

COURSE GUIDELINES & EXPECTATIONS

GRADING ACCORDING TO COLLEGE POLICY (GPA)

A minimum of 60% must be achieved in both the theory and lab portions to pass the course. Less than 60% in either portion will result in a failure of the entire course and **minimum of 50% must be achieved in Final exam to pass the course.**

- To earn credit for the course, it is essential to complete *all labs and lab reports* satisfactorily.
- Please ensure that you submit your lab reports by the specified due date on D2L.

(Typically, lab reports are expected to be turned in at the beginning of the next week's lab session.)

- For every day your labs are late, there will be a 10% deduction from your score.
- You are required to attend and be on time for ALL labs.
- Failure to attend a lab without a valid excuse may result in being assigned a failing grade for that lab.
- If you cannot attend a lab (for a valid reason) please inform your lab instructor (ahead of time if possible) and arrange to make it up.

Lecture Attendance

To get the most out of this course, students are expected to attend all classes and be on time. It is your responsibility to acquire all information given during a class missed, including notes, hand-outs, changed exam dates etc.

Exam Procedures

All exams must be written at the scheduled times with the exception of students requiring an accommodation by CAL. It is understood that emergency circumstances do occur (e.g. severe illness or family emergency); for such circumstance's accommodation may be offered at the discretion of the instructor, provided the student:

- a) notifies the instructor in advance of the exam (not after), and
- b) provides documented evidence of the circumstance (e.g. medical certificate).

If an exam is missed with an excused absence, it is up to the instructor's discretion as to how the mark will be made up. In most cases, an oral exam will be scheduled for the student as soon as possible.

Be sure not to make travel plans for the end of semester until the final exam schedules are finalized and posted. Please ask any family members who might make travel plans on your behalf to consult you before booking tickets.

Please note: the use of cell phones during a test or quiz is not allowed and may result in a zero for that assessment.

Study Habits

Good and regular study habits are essential to do well in this course. You should plan on a weekly minimum of 5 hours outside of scheduled class time for the completion of readings, assignments and for general studying. Joining a study group can help make this more achievable.

Lecture presentations will be uploaded to the course website. These should be used as a study guide, not as your sole source of information. You will need to write down additional key words for examples and explanations given during lecture and review text and videos to support your understanding. It is also recommended practice to transform lecture notes into a study-friendly format after each lecture, incorporating additional information from your textbook. Study these notes before the next class to prepare yourself for new material, which will often build on previously covered material.

Please take advantage of office hours if you need extra clarification and help.

SCHOOL OR DEPARTMENTAL INFORMATION

Electronics and computer Engineering

STUDENT RESPONSIBILITY

Enrolment at Camosun assumes that the student will become a responsible member of the College community. As such, each student will display a positive work ethic, assist in the preservation of College property, and assume responsibility for their education by researching academic requirements and policies; demonstrating courtesy and respect toward others; and respecting expectations concerning attendance, assignments, deadlines, and appointments.

SUPPORTS AND SERVICES FOR STUDENTS

Camosun College offers a number of services to help you succeed in and out of the classroom. For a detailed overview of the supports and services visit <http://camosun.ca/students/>.

Academic Advising	http://camosun.ca/advising
Accessible Learning	http://camosun.ca/accessible-learning
Counselling	http://camosun.ca/counselling
Career Services	http://camosun.ca/coop
Financial Aid and Awards	http://camosun.ca/financialaid
Help Centres (Math/English/Science)	http://camosun.ca/help-centres

Indigenous Student Support	http://camosun.ca/indigenous
International Student Support	http://camosun.ca/international/
Learning Skills	http://camosun.ca/learningskills
Library	http://camosun.ca/services/library/
Office of Student Support	http://camosun.ca/oss
Ombudsperson	http://camosun.ca/ombuds
Registration	http://camosun.ca/registration
Technology Support	http://camosun.ca/its
Writing Centre	http://camosun.ca/writing-centre

If you have a mental health concern, please contact Counselling to arrange an appointment as soon as possible. Counselling sessions are available at both campuses during business hours. If you need urgent support after-hours, please contact the Vancouver Island Crisis Line at 1-888-494-3888 or call 911.

COLLEGE-WIDE POLICIES, PROCEDURES, REQUIREMENTS, AND STANDARDS

Academic Accommodations for Students with Disabilities

The College is committed to providing appropriate and reasonable academic accommodations to students with disabilities (i.e. physical, depression, learning, etc). If you have a disability, the [Centre for Accessible Learning](#) (CAL) can help you document your needs, and where disability-related barriers to access in your courses exist, create an accommodation plan. By making a plan through CAL, you can ensure you have the appropriate academic accommodations you need without disclosing your diagnosis or condition to course instructors. Please visit the CAL website for contacts and to learn how to get started: <http://camosun.ca/services/accessible-learning/>

Academic Integrity

Please visit <http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.13.pdf> for policy regarding academic expectations and details for addressing and resolving matters of academic misconduct.

Academic Progress

Please visit <http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.1.pdf> for further details on how Camosun College monitors students' academic progress and what steps can be taken if a student is at risk of not meeting the College's academic progress standards.

Course Withdrawals Policy

Please visit <http://camosun.ca/about/policies/education-academic/e-2-student-services-and-support/e-2.2.pdf> for further details about course withdrawals. For deadline for fees, course drop dates, and tuition refund, please visit <http://camosun.ca/learn/fees/#deadlines>.

Grading Policy

Please visit <http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.5.pdf> for further details about grading.

Grade Review and Appeals

Please visit <http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.14.pdf> for policy relating to requests for review and appeal of grades.

Mandatory Attendance for First Class Meeting of Each Course

Camosun College requires mandatory attendance for the first class meeting of each course. If you do not attend, and do not provide your instructor with a reasonable reason in advance, you will be removed from the course and the space offered to the next waitlisted student. For more information, please see the “Attendance” section under “Registration Policies and Procedures” (<http://camosun.ca/learn/calendar/current/procedures.html>) and the Grading Policy at <http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.5.pdf>.

Medical / Compassionate Withdrawals

Students who are incapacitated and unable to complete or succeed in their studies by virtue of serious and demonstrated exceptional circumstances may be eligible for a medical/compassionate withdrawal. Please visit <http://camosun.ca/about/policies/education-academic/e-2-student-services-and-support/e-2.8.pdf> to learn more about the process involved in a medical/compassionate withdrawal.

Sexual Violence and Misconduct

Camosun is committed to creating a campus culture of safety, respect, and consent. Camosun’s Office of Student Support is responsible for offering support to students impacted by sexual violence. Regardless of when or where the sexual violence or misconduct occurred, students can access support at Camosun. The Office of Student Support will make sure students have a safe and private place to talk and will help them understand what supports are available and their options for next steps. The Office of Student Support respects a student’s right to choose what is right for them. For more information see Camosun’s Sexualized Violence and Misconduct Policy: <http://camosun.ca/about/policies/education-academic/e-2-student-services-and-support/e-2.9.pdf> and camosun.ca/sexual-violence. To contact the Office of Student Support: oss@camosun.ca or by phone: 250-370-3046 or 250-3703841

Student Misconduct (Non-Academic)

Camosun College is committed to building the academic competency of all students, seeks to empower students to become agents of their own learning, and promotes academic belonging for everyone. Camosun also expects that all students to conduct themselves in a manner that contributes to a positive, supportive, and safe learning environment. Please review Camosun College’s Student Misconduct Policy at <http://camosun.ca/about/policies/education-academic/e-2-student-services-and-support/e-2.5.pdf> to understand the College’s expectations of academic integrity and student behavioural conduct.

Changes to this syllabus: Every effort has been made to ensure that information in this syllabus is accurate at the time of publication. The College reserves the right to change courses if it becomes necessary so that course content remains relevant. In such cases, the instructor will give the students clear and timely notice of the changes.