

**CAMOSUN COLLEGE**  
**Mechanical Engineering Technology**  
***MENG 181 - Mechanical Control Programming***  
**Course Outline**

**Calendar Description:**

Using programming of microcontroller-based control systems, students will be introduced to the creation of automated control systems for electro-mechanical applications. Programmable logic controllers (PLCs) and stand-alone microcontrollers will be programmed and used. Program design and programming language syntax will be detailed. Devices such as switches, potentiometers, lights, a variety of sensors, and R/C servo motors will be used. Flowcharts and other programming related topics will be covered.

Offered:	Fall Semester
Credit:	3
In-Class Workload:	3 Hours Lecture, 2 Hours Laboratory
Out-Of-Class Workload:	4 Hours
Prerequisites:	None.

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**Objectives:**

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

1. Identify and describe the various components of a control system and their functions.
  2. Describe a variety of control modes and the systems in which they will be used..
  3. Set up and use a PLC control system (using ladder logic).
  4. Identify, select and use the most appropriate on/off (buttons, contacts, opto-interrupt) and position (optical encoder, acceleration, temperature, etc.) sensors for a control system.
  5. Describe and create a control sequence using flowchart and other descriptive techniques.
  6. Apply the features of a stand-alone microcontroller including: I/O (digital, analogue, etc.), communication protocols, memory, peripheral devices, etc.
  7. Use a high-level computer programming language for control systems.
  8. Assemble and program a working electronic circuit with a stand-alone microcontroller system at its core that can interact with the real world in real time.
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**Outline:**

<b>Week</b>	<b>Content</b>
1 & 2	<i>Introduction to the Arduino Uno Microcontroller Board</i> Microcontroller Architecture I/O Pins and Registers Clocks and Resonators Packages and Ratings Memory
3 & 4	<i>Interfacing to Microcontrollers</i> Inputs & Outputs Basic Electricity Resistors and Potentiometers Voltage Dividers Switches Pull-Up and Pull-Down Resistors LEDs
5	<i>Midterm #1 (2 Hours)</i>
5 & 6	<i>Preparing to Programming</i> Flowchart Blocks and Signals Flowchart Applications Electronic Circuit Diagrams I/O Pin Tables Programming the Arduino Uno
7	<i>Numbering Systems</i> Decimal, Binary, Octal and Hexadecimal Conversion between Numbering Systems Binary Numbers – Addition & Subtraction
8 & 9	<i>Programming Languages</i> C-Language, Assembler, Machine Language <i>Arduino Uno Programming Language</i> Ports and Registers Variables, Constants, Strings and Arrays Comments <i>Program Flow</i> If-Else Statement For Loops While Statement Goto and Line Labels Select Case <i>Advanced Program Flow</i> Subroutines Interrupts

<b>Week</b>	<b>Content</b>
10	Midterm #2 (2 Hours)
10	Introduction to PLCs
11	Introduction to Ladder Logic
12	Ladder Logic Continued
13	Advanced Ladder Logic
14	Summary of PLCs – Preparation for Final Exam
15	Final Exam

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**Distribution of Marks:**

Midterm Exam #1	20%
Midterm Exam #2	20%
Laboratories	30%
Final Exam	30%
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	100%

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**Grading:**

A+	90 - 100%	B-	70 - 72%
A	85 - 89%	C+	65 - 69%
A-	80 - 84%	C	60 - 64%
B+	77 - 79%	D	50 - 59%
B	73 - 76%	F	< 50%

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**Reference Website:**

<http://online.camosun.ca>

This course is fully supported by Desire-2-Learn.

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**Laboratory Supplies:**

Laboratory kits will be available in the labs at the beginning of the quarter. Other laboratory supplies will be available at the time of the lab. Students are encouraged to obtain supplies of their own to enable further experimentation with microcontrollers at home.

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**Laboratory Reports:**

Formal laboratory reports are expected for each lab. The reports are due one week after the lab period. There will be one lab report for each group.

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**Instructors:**

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**Assignments:**

No late assignments or laboratory reports will be accepted.

Assignments and labs will be reviewed in class shortly after the due date. If identical assignments or labs are handed in, the marks will be divided up evenly between the students.

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**Midterms & Final Exam:**

All tests in this course will be closed notes only.

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