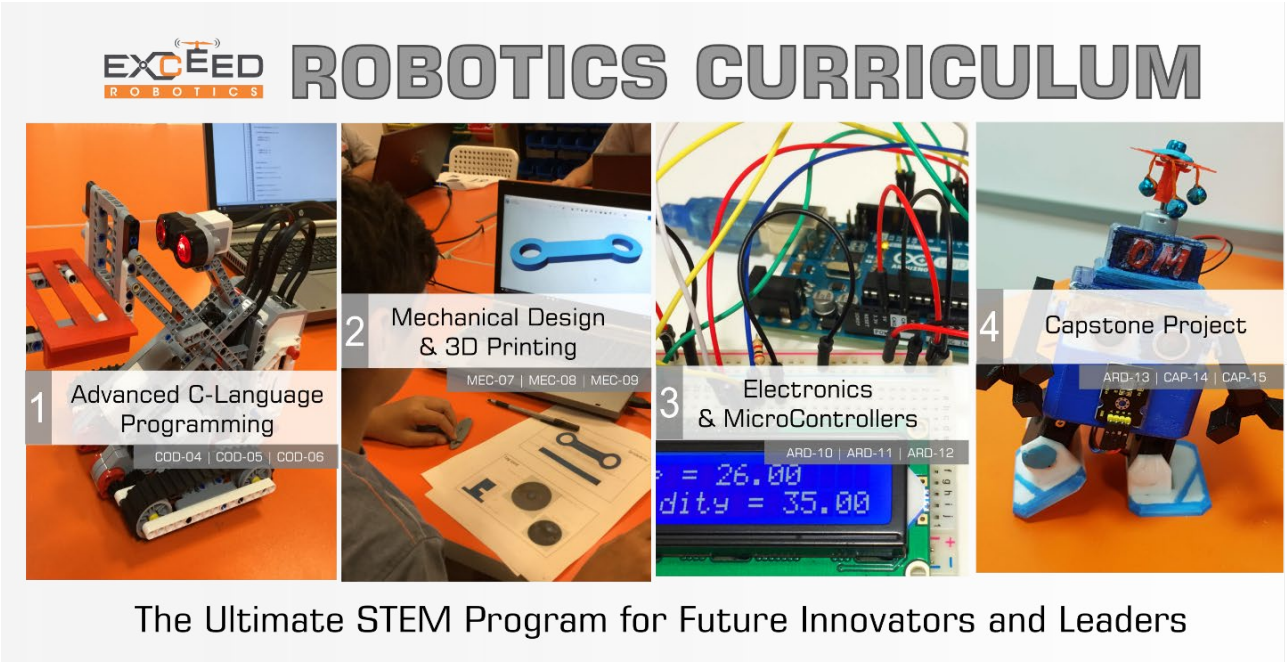
EXCEED ROBOTICS

ROBOTICS CURRICULUM

AGES 12 - 15



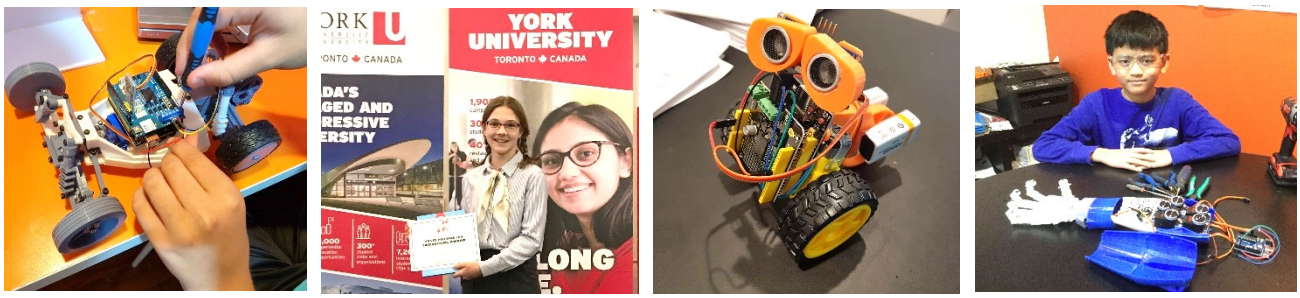
The Robotics curriculum teaches students essential STEM skills including **Programming**, **Computer Design, 3D Printing** and **Electronic Circuits** with a hands-on, step-by-step approach.

All Robotics courses follow a structured curriculum with daily challenges designed to promote critical thinking and experiential learning. The end goal of the Robotics curriculum is to develop a technical and soft skill set for students to start creating their advanced robots, paving the way for innovation.

PROGRAM DETAILS

- 2-year curriculum
- Classes once per week classes
- One-hour in duration
- 6 max students per class

The Robotics curriculum was created by a team of mechatronics engineers with 25+ years of global industry experience to advance STEM education amongst Canada's youth. The Robotics program's vision is to create a community of young innovators by developing computer science and engineering skills and directing them towards solving real-world problems.



Robotics Alumni Projects

1 ADVANCED PROGRAMMING & ROBOTICS

COD-04: C-LANGUAGE FUNDAMENTALS

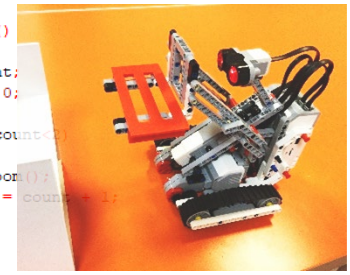
Prerequisite: PRG-03

After developing the logic of programming robots using modular programming, text-based programming with C-language is introduced. C-language is the most powerful and useful programming language which is commonly used in the industry.

The course begins with teaching variables, datatypes, loops and conditional statements that are used to program robots. This course moves beyond graphical programming towards language-based coding which offers greater control for robot design and development.

A new robot platform is introduced, allowing students to confidently

```
void Grab()
{
  moveMotor(armMotor,-0.2,rotations,50);
  forward (3.41,rotations,50);
  moveMotor(armMotor,0.2,rotations,50);
  backward(10,rotations,50);
  moveMotor(armMotor,-0.15,rotations,50);
}

task main()
{
  int count;
  count = 0;

  while (count
  {
    NextRoom();
    count =
  }

  Grab();
}
```



COD-05: AUTONOMOUS STRUCTURE

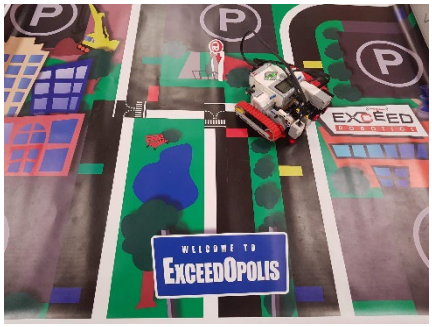
Prerequisite: COD-04

This course focuses on programming structures for autonomous robot control. Learning about autonomous control is a key step for students as they start programming robots to make decisions using sensors. This skill is important for real-world applications like self-driving cars and factory robots. Students are introduced to a variety of sensors, including ultrasonic, touch, colour, and gyro sensors, which they use to tackle advanced programming challenges.

COD-06: SMART CITIES CHALLENGE

Prerequisite: COD-05

This advanced programming course is inspired by Exceed's Smart Cities competition, originally designed for Ryerson engineering students in 2019. In this course, students will program robots equipped with multiple sensors and motors to autonomously navigate a virtual city. They'll develop code for tasks such as line following, flag detection, gyro-based turning, and crash avoidance, all with the goal of completing the urban challenge in the shortest possible time.



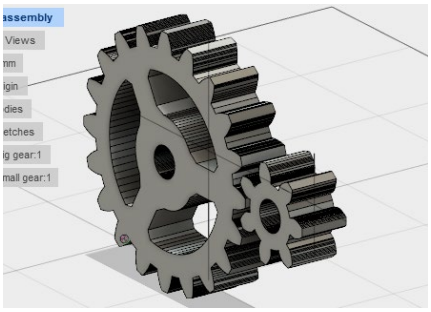
2 MECHANICAL DESIGN & ELECTRONICS

MEC-07: COMPUTER DESIGN FUNDAMENTALS

Prerequisite: COD-06

The first course in the Mechanics series focuses on designing 3D-printed mechanical parts. Students will use Autodesk Fusion 360 to learn a range of design tools, starting with basic sketching.

Through various design projects, they'll practice using essential tools and features in mechanical design. These projects will allow students to independently apply their skills, create functional mechanical components that are ready for 3D printing.



MEC-08: MACHINE DESIGN AND SIMULATION

Prerequisite: MEC-07

Building robots isn't complete without understanding how designed parts should fit together. This machine design course teaches students the basics of machine design, including fits and clearances, structure design, levers, gears, and more. Students will design each part of a machine and assemble them in design software. By learning about joints and constraints, they'll create virtual simulations of their creations. In the industry, design simulation is an essential tool engineers use to predict functionality and performance before building a prototype.

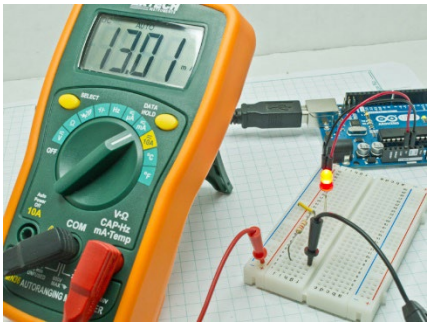
MEC-09: ELECTRONIC CIRCUITS

Prerequisite: MEC-08

The final course in this Mechatronics series focuses on electronic circuits. After mastering the basics, students will engage in lab assignments where they build and test their own circuits.

They'll learn about the principles of electricity and Ohm's law, exploring the relationships between voltage, current, and resistance. By using multimeters, students will take measurements to gain a deeper understanding of how different electronic components behave.

The course covers essential components such as resistors, switches, motors, and transistors, preparing students for the upcoming Microcontroller Programming series.



3 MICROCONTROLLER PROGRAMMING

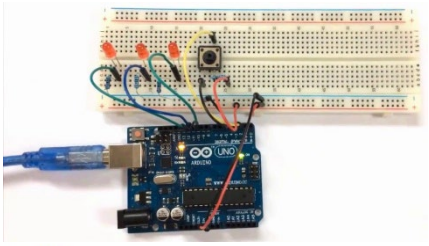
ARD-10: INTRODUCTION TO MICROCONTROLLERS

Prerequisite: MEC-09

The Arduino microcontroller is a popular and versatile development board used by makers and hobbyists to build robots and many other devices.

In this course, students will be introduced to Arduino-controlled circuits and will learn about both digital and analog devices.

Their prior experience with C-language programming in the Programming & Robotics courses (COD-04, -05, -06) has thoroughly prepared them for microcontroller programming, which also utilizes functions from the C language.



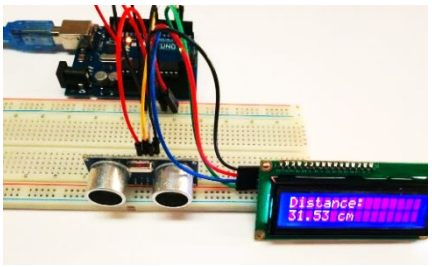
```
void setup() {
  // initialize the digital pin as an output.
  // Pin 13 has an LED connected on most Arduino
  pinMode(13, OUTPUT);
}

void loop() {
  digitalWrite(13, HIGH);   // set the LED on
  delay(1000);              // wait for a second
  digitalWrite(13, LOW);    // set the LED off
  delay(1000);              // wait for a second
}
```

ARD-11: ADVANCED MICROCONTROLLERS I

Prerequisite: ARD-10

The second microcontrollers course advances to wiring and programming circuits with more complex sensors and advanced output devices. Throughout the course, students will gain hands-on experience wiring and coding circuits using various electronic components.

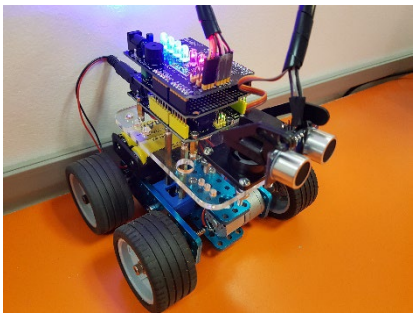
The goal is to ensure students feel confident in programming microcontrollers to make decisions or adjust outputs based on different sensor inputs.



ARD-12: ADVANCED MICROCONTROLLERS II Prerequisite: ARD-11

Building on the foundation of creating circuits with analog sensors, this course advances skills in programming and controlling various types of motors (DC, servo, and stepper). This enables the design and programming of intricate microcontroller circuits.

Combined with knowledge from previous Mechanical Design courses, mastering these advanced microcontroller circuits is the final step in creating fully customized robots.



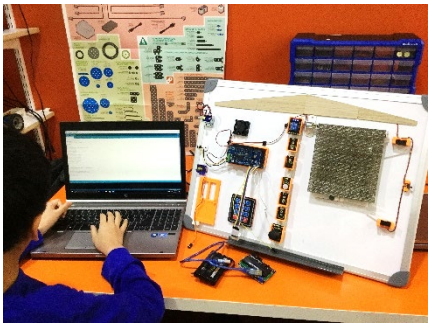
4 CAPSTONE PROJECT

ARD-13: SMART HOME AUTOMATION

Prerequisite: ARD-12

As the culmination course in electronics and microcontroller programming, students are provided with a smart home equipped with a range of electronics, sensors, and motors.

This course challenges students to apply the skills acquired in the previous three microcontroller courses to develop and program smart home systems. From using a temperature sensor to activate the air conditioning fan, a motion sensor to turn on the garage light, or a light sensor to close the blinds at dusk, our homes are becoming smarter thanks to the creativity and expertise of our students!

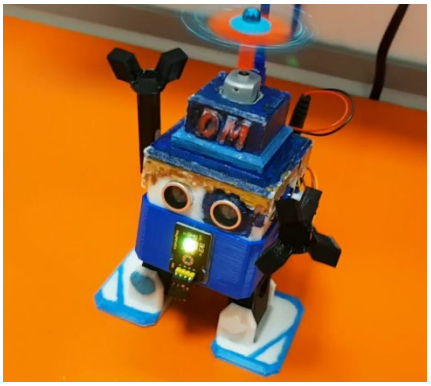


CAP-14: CAPSTONE COMPETITION I

Prerequisite: ARD-13

Students put their talents in programming, mechanical design and electronic circuits on full display by creating their own competition robot from scratch. This means computer designing, 3D printing, wiring electric circuits, assembling and programming to create a competition robot.

They'll also get to combine their creativity with their technical skills to impress the judges. This first course focuses on designing, 3D printing, assembling mechanical parts, and wiring electronic circuits before moving on to programming.



CAP-15: CAPSTONE COMPETITION II

Prerequisite: CAP-14

In the final capstone course, students will focus on programming their robots and creating a YouTube video to enter the Capstone Competition with all graduating students from Exceed.

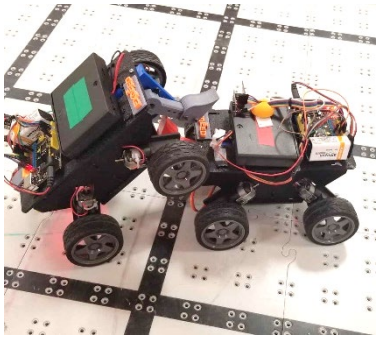
The competition will be judged on technical skills and include a public vote to add a marketing element.

On the last day of class, Graduation Day, students will showcase their robots and videos to parents and instructors in a private screening and celebrate their achievements!

ALUMNI WORKSHOP

open to Robotics and Python graduates



Where all the magic happens…

For graduates eager to continue learning beyond graduation, the Alumni Workshop offers a fantastic opportunity to apply technical skills and take on larger robotics projects.

This environment is designed to accelerate personal growth by working on cutting-edge projects and learning essential real-world skills like conducting research, managing budgets, and setting timelines.

The vision behind Exceed Robotics started with the idea of a workshop where engineers mentor students to create amazing projects—the robotics curriculum was developed as the pathway to achieve this vision.

What's Next?

This is the recommended next step for students aged 11 and up who have completed the Robotics curriculum and gained workshop experience. It is designed for workshop students who want to continue learning programming to add Artificial Intelligence (AI) capabilities to their creations. The first four courses focus on programming fundamentals through game design before.

Another option that also emphasizes programming is our latest Web Development curriculum. This program teaches students aged 11 and up the essentials of front-end web development, including HTML, CSS, PHP, SQL, and other related languages.