

# FOUNDATIONS TO

# ROBOTICS | INTRODUCTION TO STEM ROBOTICS

## MINDS-i STEM INTEGRATED ROBOTICS: FOUNDATIONS LAB – 4x4

The Foundations Lab 4x4 is an introduction into the world of STEM and Robotics. It is designed as an interactive approach to applied science, technology, engineering and math. In this course students will become familiar with the basics of robotics and programming in a team based environment.

### STEM as a System

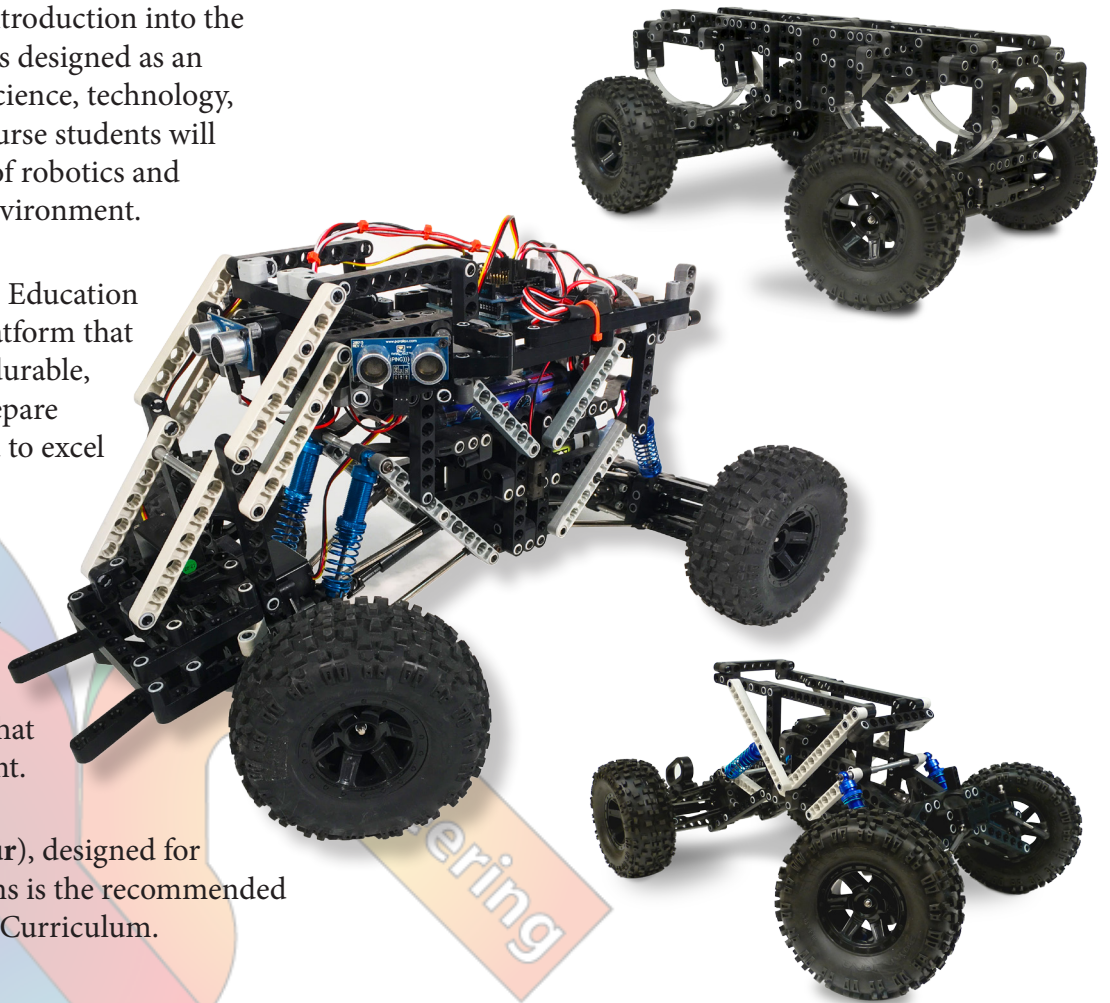
MINDS-i is rocking the Robotics Education world with a high-technology platform that is simple to use, extraordinarily durable, infinitely modifiable, and will prepare students with the skills they need to excel in the 21st century.

### Continuous Learning and Improvement

We inspire a rigorous college and career relevant experience through STEM Robotics in the everyday classroom in a format that can impact each and every student.

### Course Design

Each lab is one semester (90 Hour), designed for three to five students. Foundations is the recommended prerequisite to the Drones Lab + Curriculum.



Gear Reducer



Tachometer



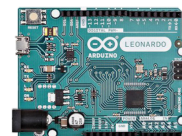
Multimeter



Torque meter



RC Control



Controller



Catapult



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MCK-FDLB-4X4

# Curriculum Outline - 90 Hour

## Unit 1: Introduction to MINDS-i

- 1.1 Introduction to MINDS-i
- 1.2 Student Performance Development Process
- 1.3 What is a Robot?

## Unit 2: Continuous Learning & Improvement

- 2.1 Model for Inquiry
- 2.2 The Importance of Data
- 2.3 Parts & Purposes
- 2.4 Simple Machines

## Unit 3: Variable of Force & Motion

- 3.1 Force & Motion
- 3.2 Parts & Purposes
- 3.3 Gear Ratios; Speed & Torque
- 3.4 Friction
- 3.5 Inertia

## Unit 4: Software Programming; Sensors & Servos

- 4.1 Why Programming?
- 4.2 Parts & Purposes
- 4.3 Testing the Micro-controller
- 4.4 Creating the Breadboard; Servo
- 4.5 Adding to the Breadboard; Esc
- 4.6 Adding to the Breadboard; Radio Transmitter
- 4.7 Adding to the Breadboard; Ultrasound Sensor
- 4.8 Adding to the Breadboard; QTI Sensor
- 4.9 Core Syntax

## Unit 5: Autonomous Robotics

- 5.1 What Makes a Robot Autonomous
- 5.2 Basic Control Structures
- 5.3 Autonomous Obstacle Avoidance
- 5.4 Line Following

## Unit 6: Mechanical & Structural Engineering

- 6.1 Levers, Cams & Span
- 6.2 Structural Design
- 6.3 Robot Arm & End of Arm Tool

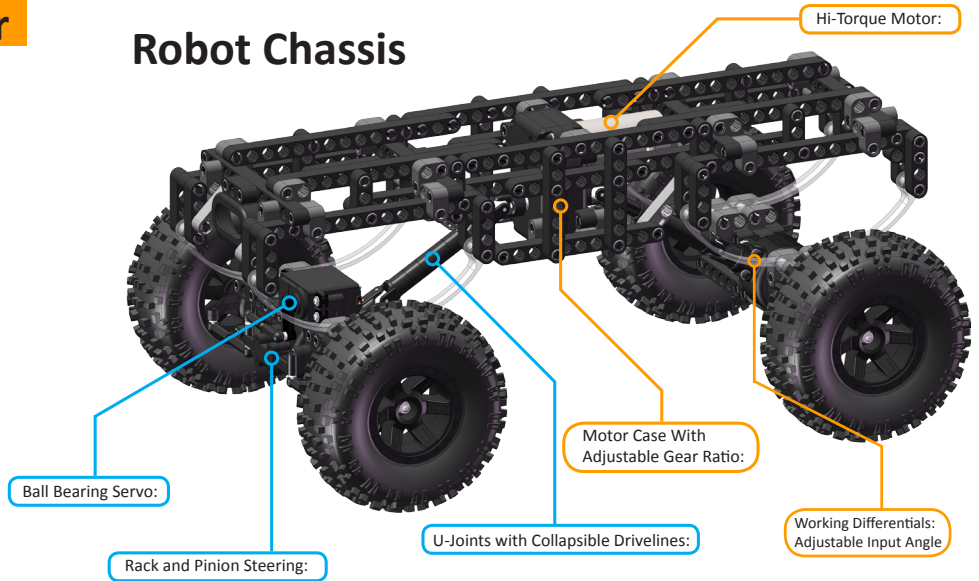
## Unit 7: Culminating Project

- 7.1 Preparing for the Challenge
- 7.2 Cleanup / Organizing

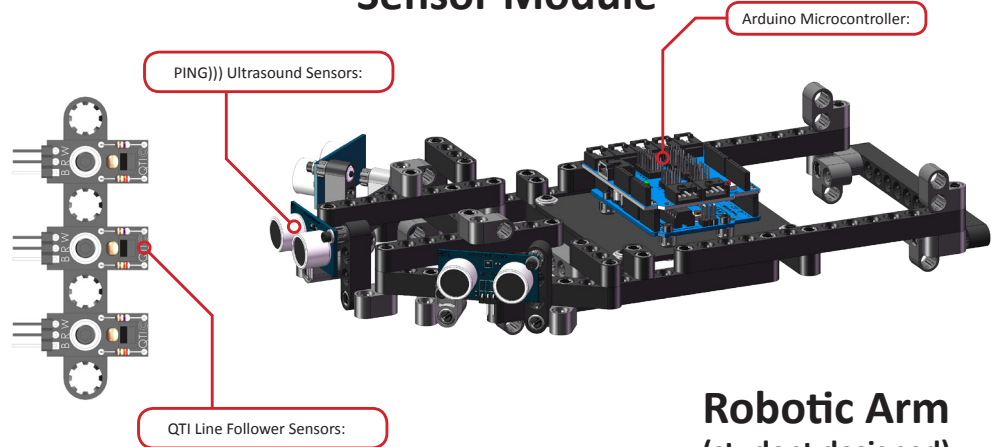
STEM Integrated Robotics Foundations covers a multitude of engineering concepts including

- Programming
- Physics
- Mechanical Systems
- Electrical and Electronic Systems
- Hands on Activities and Capstone Projects in each Semester

## Robot Chassis

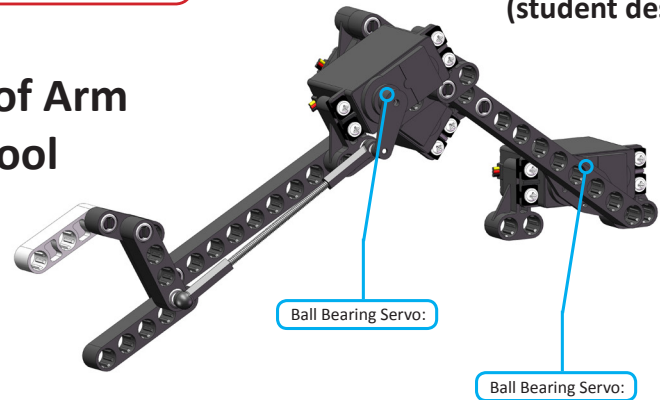


## Sensor Module



## Robotic Arm (student designed)

## End of Arm Tool



## Arduino Programming Software & Leonardo Hardware

- 20 digital I/O pins
- 7 PWM channels
- 12 analog Input channels (with ADC)
- Serial & I2C communication ports
- 32 KB flash memory & 16 MHz
- Full set of sample code in library
- Windows 10, OS X & Linux Ready
- Digital ports can operate servos, motors and sensors

```

PingSensor | Arduino 1.6.7
File Edit Sketch Tools Help
PingSensor
15 Servo drive, steer;
16
17 void setup() {
18 //set a pin for the ESC/steering servo to use
19 drive.attach(4);
20 steer.attach(5);
21
22 //set the initial throttle/direction for the ESC/servo
23 drive.write(90);
24 steer.write(90);
25
26 //delay 2 seconds for arming
27 delay(2000);
28
29 //turn the wheel
30 steer.write(120);
    
```