

Fairfax Collegiate

2026 Summer Program

Robotics Engineering Course Syllabus

Rising Grades 4-6



Course Description

Use engineering to evolve robots.

Use the engineering process to invent and refine robots such as GolfBot, SpinBot, EducatorBot, TrackBot, and GyroBot.

Learn about torque, force, gear ratios, EV3 programming, sensors, robot vision, treads, and gyroscopes.

Students are able to design, test, and improve mechanical systems, with hands-on challenges that encourage them to think like engineers. With structured guidance and creative freedom, students gain confidence in both building and programming robots.

Students follow the engineering design process to brainstorm, prototype, test, and refine their creations. Programming lessons help them connect logic and movement in meaningful ways.

Students leave with stronger engineering skills and pride in the robots they designed and improved.

Learning Objectives

Course Goals	<p>Intermediate Principles of Mechanical Engineering: Students learn about engineering principles such as torque, force, mechanical advantage, and gear ratios using EV3. They apply these to design and modify Lego robots.</p> <p>Understand Programming Using the EV3 Language: Students learn how to program mobile robots using the EV3 programming language and how to utilize sensor feedback systems for conditional logic.</p> <p>Advanced Engineering and Problem-Solving Skills: Students apply measurement and geometry to optimize robot navigation and path planning and work in teams to develop creative robots and solutions for challenges. They integrate what they learn about sensors, programming, and robot design to create complex robot behaviors and builds.</p>
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Course Topics	<p>Engineering Principles: Students learn about force and torque, leverage, mechanical advantage, electricity and energy, and electrical motors.</p> <p>Robotics Design Principles: Students learn about gear ratios, stability and center of gravity, articulation and motorized limbs, optimum sensor placement, and relative advantages of wheels and treads.</p> <p>Sensors and Feedback: Students use tilt, color, ultrasonic, and touch sensors. They use sensor input, feedback, math, and sensor programming blocks.</p> <p>EV3 Programming: Students use the EV3 Programming language, custom programming blocks, control loops and datawires, programming sequences, and logic.</p> <p>Engineering Process: Students work on defining problems, researching, specifying requirements, brainstorming, development, prototyping, testing, and improving.</p>
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Course Schedule

Class Meeting 1	<p>Class Welcome: Students are introduced to the class and rules and then form groups.</p> <p>Lesson: Introduction to Engineering: Students become familiar with the engineering design process and how they will use this process to invent and improve their creations.</p> <p>Challenge: Top Spinning: Students go through the steps of the engineering design process to create tops that spin for the longest amount of time.</p>
Class Meeting 2	<p>Challenge: Mini Golf: Students design motorized golf clubs to play a game of robotic golf.</p>
Class Meeting 3	<p>Build EducatorBot: Students build the EV3 EducatorBot to complete tasks using car controls.</p> <p>Lesson: Introduction to Programming: Students learn the basics of programming with the EV3 software.</p> <p>Activity: Movement Checklist: Students complete a checklist to confirm they understand how to program movement in EV3.</p>
Class Meeting 4	<p>Lesson: Introduction to Sensors: Students learn about the different sensor control options available to them.</p>
Class Meeting 5	<p>Activity: Sensor Checklist: Students complete the sensor checklist and get familiar with different options available to them.</p>
Class Meeting 6	<p>Challenge: Touch Sensor Battle: Students use the touch sensor to activate a designed weapon when pressed.</p>

Class Meeting 7	<p>Build TrackBot: Students build Trackbot, the tank robot that utilizes treads.</p> <p>Lesson: Gyro Sensor: Students learn about the nuances of programming with the gyroscopic sensor.</p>
Class Meeting 8	<p>Activity: Line Following: Students combine their knowledge of the switch block and the color sensor to create a program that allows for the Educator Bot to follow a complex line.</p>
Class Meeting 9	<p>Challenge: Sumo: Students customize the Trackbot and compete in a head to head competition.</p>
Class Meeting 10	<p>Class Wrap Up: Students review the design, programming, and scientific material they've covered in the course. Students then disassemble their robots, inventorying their kits in the process.</p>