CTE Introduction to the 6-Axis Arm – Letter Home

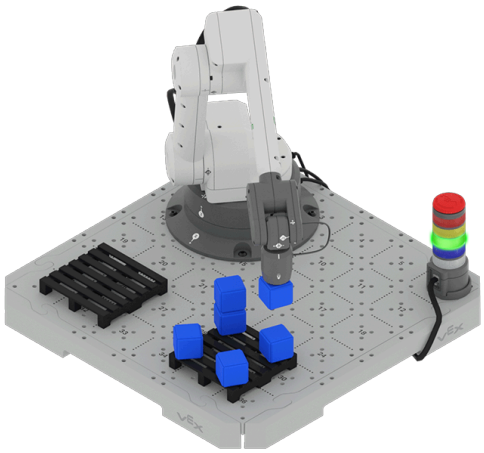
Support student learning at home

Your student is currently engaged in the VEX CTE Workcell course, Introduction to the 6-Axis Arm. In this course, your student will explore the VEX CTE 6-Axis Robotic Arm to learn about factory automation through hands-on STEM learning in robotics and coding with real-world applications. Read and keep this Letter Home for an introduction to what your student will be doing and learning in the CTE course, so that you can support their learning and curiosity at home.

The CTE Introduction to the 6-Axis Arm Course and Industrial Robotics

Factory automation has revolutionized how goods are manufactured and handled around the world. Central to this automation, is the concept of a workcell, an efficient arrangement of equipment and machinery designed to optimize production processes. Within a workcell, robotic arms have become seamlessly integrated and indispensable tools in automated systems. Robotic arms enhance the speed, precision, and safety of production.

Throughout this course, students will delve into the dynamic world of factory automation, exploring the mechanics and applications of robotic arms. Through hands-on exploration and activities, students learn about the role robotic arms play in manufacturing. Students are exposed to the principles guiding these machines, coordinate systems they rely on, and the computer science concepts needed to carry out tasks in real-world scenarios. They gain practical experience in not only the control of a robotic arm, but also the persistence, problem solving, collaboration, and creativity needed to take part in a career in industrial robotics, or any other field.



Sequence of the Course

Use this overview to give you an idea of what students will be doing and learning in each Unit of the course.

- **Unit 1 – Introduction to Robotic Arms**
  - Students will set up the VEX CTE Workcell and their engineering notebook for the course. They will explore the Cartesian coordinate system, and learn about how robotic arms are used in industry.
- **Unit 2 – Using the Teach Pendant**
  - Students will use the Teach Pendant to control the movement of the 6-Axis Robotic Arm to pick up and place Disks on the Tile with the Magnet Pickup Tool.
- **Unit 3 – Coding Movements**
  - Students will be introduced to block-based coding, learn to code the 6-Axis Arm to move along the x, y, and z-axes, and how to combine these behaviors to move the 6-Axis Arm to various locations on the CTE Tile.
- **Unit 4 – Controlling the Path**
  - Students will build on their coding skills to code the 6-Axis Arm to use the Pen attachment to draw on a Whiteboard, and move around obstacles on the CTE Tile.
- **Unit 5 – Coding Shapes**
  - Students will dive deeper into how the 6-Axis Arm moves along the x, y, and z-axes to draw shapes with the Pen.
- **Unit 6 – Absolute and Relative Movements**

    - Students will learn how to use both absolute and relative movements to draw shapes with the Pen and the 6-Axis Arm. They will build on their computer science knowledge to make more complex shapes and patterns by incorporating variables and Repeat loops in their projects.

- **Unit 7 – Transporting and Palletizing Objects**
    - Students will learn about the role that pallets play in manufacturing and logistics, and begin to code the 6-Axis Arm to pick up and place Cubes onto pallets attached to the CTE Tile. Students will use variables and If then blocks to build projects that place multiple Cubes on pallets, mimicking a factory scenario.

- **Unit 8 – Stacking Objects**
    - Students will dive deeply into project planning, and learn how to break down a large task into the smallest robot behaviors possible. They will also learn about how to stack Cubes using the 6-Axis Arm.

- **Capstone – Engineering Design Process**
    - Students will apply everything that they have learned throughout the course to complete the Pack and Ship Challenge! In this open-ended challenge, students will be challenged to code the 6-Axis Arm to fulfill invoices and pack pallets effectively and efficiently.

What you can do at home:

Ask your students about what they are doing and learning with the 6-Axis Arm in class, and how they think that would be useful with a real robotic arm in an industrial setting. The more opportunities students have to think and talk about what they are learning, and connect it to real world applications, the better they can reflect on their learning in class. This can also help spark interest in future career paths.

Engineering Notebooks in this Course

Students will be using an engineering notebook to create a comprehensive record of their learning throughout the course. Not only will they document what they did with the 6-Axis Arm, they will also be documenting their reflections, questions, discussions, problem solving strategies, and more. The goal of the engineering notebook is not only to document projects, but to help students better understand themselves as a learner.

Engineering notebooks are shared and discussed regularly between students and teachers, and are a core component of the student-centered assessment that is emphasized in the course structure.

What you can do at home:

Ask your student to share their notebook with you, and talk with them about what, how, and why they documented their learning in the way that they did. The more opportunities that students have to explain their thinking and verbalize their reasoning, the better they will understand the concepts at hand, and be able to reflect on their learning and documentation strategies as well.

Collaboration with the CTE Workcell

Students will be working in groups to complete the Lessons and Activities of the course. They will have many opportunities for collaborative decision making, building communication skills, and taking on varied roles within the group. Being able to work together with others to solve a problem or accomplish a task is something that students will need to do in their future, no matter their career path. The collaboration skills and strategies that students learn throughout the course are also something that they will be documenting in their engineering notebooks.

What you can do at home:

Talk with your student about the ways in which collaboration is part of your adult life – whether it be at work, or at home. Helping students to connect their experiences in class to life outside of school can reinforce the importance of things like communication. Be open with your student, and share stories of positive communication experiences, as well as how you resolved moments of miscommunication.