Introduction to Engineering Design

The *Introduction to Engineering Design* course provides students with hands-on experience in key engineering principles, including **CAD modeling, programming, and robotics**. The course is structured around three core components: **Fusion 360 certification, block coding, and VEX EXP robotics**, culminating in a series of class competitions.

Fusion 360 Certification & 3D Printing

The course begins with an in-depth introduction to **Autodesk Fusion 360**, a powerful 3D design and modeling software used in engineering and manufacturing. Students will follow **GMetrix video tutorials** and complete practice exercises to develop proficiency in CAD modeling. Their understanding of Fusion 360 will be assessed through the **Fusion 360 Certification Exam**, which serves as the midterm assessment.

Once proficient in Fusion 360, students will have the opportunity to **design and 3D print custom parts** for their robots. This hands-on experience allows them to apply their CAD skills to real-world applications, improving the functionality and performance of their designs.

VEX EXP Robotics & Coding

After certification, students transition to hands-on robotics engineering using the **VEX EXP** system. Working in teams of three—two builders and one programmer—students will construct and modify robots to complete various tasks. They will build three different robot designs:

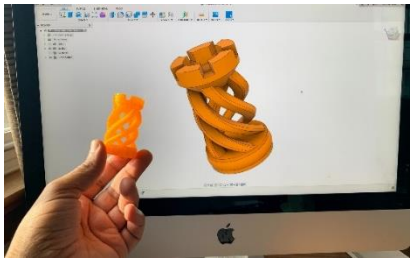
- **Basic Bot** – A fundamental design to understand VEX EXP components.
- **Claw Bot** – A robot with a functional claw mechanism.
- **Catapult Bot** – A robot designed to launch projectiles.

Programming is introduced using **block coding**, allowing students to develop automation and control their robots efficiently.

Competitions & Performance Optimization

To test their engineering and problem-solving skills, students will participate in class competitions. Teams will demonstrate their robots' driving and operational capabilities, then analyze their designs to make strategic modifications for improved performance. With the ability to **design and 3D print custom parts**, students can enhance their robots and gain deeper insight into mechanical design and engineering problem-solving.

By the end of the course, students will have gained **hands-on experience in CAD modeling, 3D printing, robotics engineering, and programming**, preparing them for more advanced STEM opportunities in the future.



Students will use Fusion to design and 3D print robot parts.

VEX EXP Clawbot

Principles of Engineering

The *Principles of Engineering* course provides students with an in-depth exploration of engineering concepts, technologies, and real-world applications. Using **zSpace computer systems** and the **Roots robotic arm system**, students will engage in interactive, hands-on learning focused on **Electricity, Computer Science, and Advanced Manufacturing**, including **hydraulic and pneumatic systems**.

Fundamentals of Engineering & Certification Preparation

The course begins with preparation for the **Fundamentals of Engineering test**, which serves as an introduction to core engineering disciplines. Topics covered include:

- **History of Engineering & the Space Program**
- **Electrical, Mechanical, and Computer Science Fundamentals**
- **Introduction to Chemistry & Aerospace Engineering**
- **Manufacturing Processes & Safety**

Students must pass this initial test to qualify for advanced certification opportunities.

Specialized Engineering Exams & Certifications

After passing the Fundamentals of Engineering test, students can work toward earning **Pre-Engineering and Robotics certifications** by taking specialized exams in:

1. **Electrical Engineering**
2. **Computer Science**
3. **Mechanical Engineering**

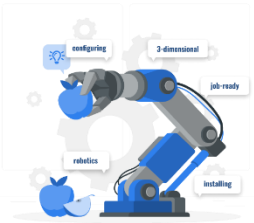
- Passing **two** of these exams grants the **Pre-Engineering Certification**.
- Passing **all three** earns both the **Pre-Engineering and Robotics Certifications**.

Hands-On Learning with zSpace & Roots Robotic Arm

Students will apply their knowledge through hands-on experiences with **zSpace**—an advanced augmented reality (AR) system for engineering simulations—and the **Roots robotic arm system**, which introduces real-world automation and robotics concepts. They will also explore **hydraulic and pneumatic systems**, gaining practical skills in advanced manufacturing processes.

By the end of the course, students will have a **strong foundation in multiple engineering disciplines, hands-on experience with cutting-edge technology, and the opportunity to earn industry-recognized certifications**, preparing them for future STEM careers and further engineering studies.

Student using a zSpace computer 1



Roots Robotic Arm System