

# 09 Fluid Power

Content Area: **Technology**  
Course(s):  
Time Period: **Full Year**  
Length: **2.5 Weeks**  
Status: **Published**

## **General Overview, Course Description or Course Philosophy**

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This full year honors course continues to emphasize the application of integrated STEM (Science, Technology, Engineering and Mathematics) principles and the design method to invent solutions to real world problems through robotic applications. Students will identify problems, research, design and fabricate solutions. Problem solving, critical thinking and design skills are taught through a variety of activities. Hands-on themes include structural and robotic systems, as well as system control technology. This course provides all students with valuable skills such as: problem solving, design, creative thinking, systems thinking, team work, documentation, programming and computer applications.

## **OBJECTIVES, ESSENTIAL QUESTIONS, ENDURING UNDERSTANDINGS**

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Students will understand how fluid power pumps and actuators are used to increase power or speed in a technological system, how to calculate mechanical advantage for power and distance and how to design and build fluid power systems incorporating levers and linkages for movement and mechanical advantage.

## **CONTENT AREA STANDARDS**

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TECH.8.2.12.D.1	Design and create a prototype to solve a real world problem using a design process, identify constraints addressed during the creation of the prototype, identify trade-offs made, and present the solution for peer review.
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## **RELATED STANDARDS (Technology, 21st Century Life & Careers, ELA Companion Standards are Required)**

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MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.K-12.8	Look for and express regularity in repeated reasoning.
CRP.K-12.CRP2	Apply appropriate academic and technical skills.

CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP11	Use technology to enhance productivity.
CCSS.Math.Practice.MP3	Construct viable arguments and critique the reasoning of others.
CCSS.Math.Practice.MP4	Model with mathematics.

## **STUDENT LEARNING TARGETS**

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### **Declarative Knowledge**

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Students will understand that:

- Fluid power is used to increase power or distance in a technological system.
- Accurate calculations can be completed to determine mechanical advantage in a fluid power system.
- They can design and build simple and complex (compound) fluid power systems to solve problems.
- Knowing how to calculate mechanical advantage is an important step in designing a fluid power system.

### **Procedural Knowledge**

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Students will be able to:

- Determine when to increase or decrease mechanical advantage in a system.
- Demonstrate the ability to design, build and incorporate different sized pumps in a system to increase or decrease mechanical advantage in order to solve a problem.
- Calculate the mechanical advantage of fluid power systems.

## **EVIDENCE OF LEARNING**

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### **Formative Assessments**

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- Observation of “Do Now” mechanical advantage problems during and after lessons.

- Observation of fluid power systems designed and built by students.
- Drawings and calculations of fluid power system and how to calculate its MA.
- Quiz on Mechanical Advantage in Fluid Power.

### **Summative Assessments**

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- Design project and engineering log - design and build a fluid power based hydraulic arm to solve a real world problem; calculate mechanical advantage and explain rationale. Include sketches, orthographic drawings, rationale, and how to improve.
- Questions on Unit Test following Robotic Arm Unit.

### **RESOURCES (Instructional, Supplemental, Intervention Materials)**

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- Teacher notes on fluid power.
- Teacher notes on calculating mechanical advantage in fluid power.
- Mechanical advantage worksheets.
- Fluid power pumps, tubing and actuators.
- Problem solving design brief: Fluid Powered Robotic Arm .

### **INTERDISCIPLINARY CONNECTIONS**

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- Modeling with Mathematics and Make sense of problems and persevere in solving them.

### **ACCOMMODATIONS & MODIFICATIONS FOR SUBGROUPS**

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See link to Accommodations & Modifications document in course folder.