10 Technological Problem Solving - Hydraulic Arm

Content Area: **Technology**
Course(s):
Time Period: **Full Year**
Length: **5 Weeks**
Status: **Published**

General Overview, Course Description or Course Philosophy

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

Application of new and previously learned knowledge in order to design and build a working robotic arm with a focus on producing a solution to a problem through application of the design process. The robotic arm will utilize levers and linkages, as well as fluid power, to accomplish a specific task.

CONTENT AREA STANDARDS

TECH.8.1.12.A.2	Produce and edit a multi-page digital document for a commercial or professional audience and present it to peers and/or professionals in that related area for review.
TECH.8.2.12.C.5	Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.
TECH.8.2.12.C.7	Use a design process to devise a technological product or system that addresses a global problem, provide research, identify trade-offs and constraints, and document the process through drawings that include data and materials.
TECH.8.2.12.D.3	Determine and use the appropriate resources (e.g., CNC (Computer Numerical Control) equipment, 3D printers, CAD software) in the design, development and creation of a technological product or system.
TECH.8.2.12.D.CS1	Apply the design process.

RELATED STANDARDS (Technology, 21st Century Life & Careers, ELA Companion

Standards are Required)

MA.K-12.1	Make sense of problems and persevere in solving them.
CCSS.Math.Practice.MP1	Make sense of problems and persevere in solving them.
CCSS.Math.Practice.MP3	Construct viable arguments and critique the reasoning of others.
CCSS.Math.Practice.MP4	Model with mathematics.
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.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP7	Employ valid and reliable research strategies.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP11	Use technology to enhance productivity.
CCSS.ELA-Literacy.WHST.11-12.6	Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.

STUDENT LEARNING TARGETS

Declarative Knowledge

Students will understand that:

- There are specific engineering log requirements they must follow to be successful.
- Accurate orthographic drawing requirements must be followed.
- The rules associated with lab, eye and machine safety.
- They must use safety equipment, hand tools and all machines properly and safely.
- Identifying errors when processing material is essential.
- They must identify, design and produce a variety of levers and linkages.
- They are required to define the purpose of different types of gears.
- They must explain when and how to utilize different types of levers, linkages and mechanical advantages..
- Proplerly calculating mechanical advantage is required to succesfully complete the project and design a working solution.

Procedural Knowledge

Students will be able to:

- Utilize a variety of methods to research possible solutions.
- Sketch, compare and contrast possible robotic arm solutions.
- Select the best solution for the problem, and defend rationale for final chosen solution.
- Create and format an engineering log.
- Create and annotate an orthographic drawing.
- Select, rationalize and calculate mechanical advantage in fluid power.
- Properly utilize lab tools and equipment to build a robotic arm that incorporates mechanical advantage through linkages, levers and fluid power.
- Test the rover and research methods to improve issues with: Power, friction, mechanical advantage, and others.
- Research, propose and document what would happen if changes were made to the solution.

EVIDENCE OF LEARNING

Formative Assessments

- Weekly log check(s).
- Orthographic drawing check.
- Mechanical advantage in fluid power check.
- Levers/linkages design check.
- Levers/linkages modeling check.
- Initial testing and evaluation.

Summative Assessments

- Final Testing of Robotic Arm
- Final Grading of Engineering Log
- Unit Test

RESOURCES (Instructional, Supplemental, Intervention Materials)

- Teacher Notes and lessons: material processing, levers and linages, calculating mechanical advantage in fluid power.
- Engineering log template.
- Project planning template.
- Robotic Arm project rubric.

INTERDISCIPLINARY CONNECTIONS

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

ACCOMMODATIONS & MODIFICATIONS FOR SUBGROUPS

See link to Accommodations & Modifications document in course folder.