Unit 6: Mechanical Systems

Content Area: **Technology**
Course(s): **Engineering Design 1**
Time Period: **March**
Length: **8 blocks**
Status: **Published**

Enduring Understandings

1. Even complex mechanical devices are made up of simple mechanisms and these simple mechanisms are made up of simple machines such as levers and pulleys.

2. The efficiency of a mechanical system is calculated by comparing the ideal mechanical advantage of the system and comparing it to the actual mechanical advantage.

3. The concept of having mechanical systems transmit motion has been used for thousands of years.

4. Incorporating mechanical advantage into a system allows for a relatively small input force to be converted to a large output force.

5. There are a series of classical mechanisms that make up just about every mechanical system.

6. Many mechanical systems require structures to be built that can withstand the mechanical force exerted by the system.

7. Mechanisms follow Newton's three laws of motion.

8. Mechanisms lose efficiency through friction.

Essential Questions

1. Why is the actual mechanical advantage of a system more important than ideal mechanical advantage?

2. What factors can limit the efficiency of a mechanical system?

3. How can simple machines be grouped together to form mechanisms?

4. How can mechanisms be grouped together to change the type of motion produced from input to output?

5. How can Newton's laws of motion be used to develop mechanical systems?

6. How are the concepts of mechanical advantage used when solving a mechanical engineering problem?

7. How are forces, motion and energy concepts connected?

8. How does friction affect the design of a mechanical system?

Content

Vocabulary:

Dynamics, Wedge, Momentum, Screw, Mechanism, Class 3 lever, Links, Inclined plane, Rotary motion, Torque, Cam & follower, Linear motion, Work, Crown gear, Mechanical advantage, Oscillating motion, Rack & pinion, Gear, Kinematics, Machine, Reciprocal motion, Wheel & axle, Pulley, Class 2 lever, Crank & slider, Worm gear, Lever, Power, Force, Class 1 lever, Statics, Bevel gear, Intermittent motion

Skills

1. Evaluate a mechanism to determine the types of simple machines located within it.

2. Evaluate a mechanical system to determine the types of motion found within it.

3. Calculate the mechanical advantage of a simple machine.

4. Calculate the mechanical advantage of a mechanism.

5. Evaluate a mechanical system to calculate the input and/or output speed.

6. Generate brainstorming ideas for a mechanical system that changes the type of output motion.

7. Create complete possible solutions for a mechanical system that changes the type of output motion.

8. Formulate a design brief and identify specifications for a mechanical engineering problem.

9. Apply the design process to design a mechanism that meets instructor created specifications.

10. Construct physical mechanisms that perform specific tasks.

11. Calculate the mechanical advantage of a physical mechanism.

12. Document the design process through the use of an engineering portfolio.

Resources

Engineering drawing tools (various)

Engineering drawing paper

Calipers

Physical objects to be measured

Teacher presentation device

Document camera

Desktop computers

Research database access

2D & 3D CAD systems

3D printer

Laser cutter

Color laser printers

Large format printer

Prototyping equipment (hand-held and power tools)

Prototyping materials

Prototyping furniture

Presentation device

Standards

TECH.8.1.12.B.CS1	Apply existing knowledge to generate new ideas, products, or processes.
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.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.
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.