DELAWARE VALLEY SCHOOL DISTRICT

PLANNED INSTRUCTION

A PLANNED COURSE FOR:

Technology Systems

Grade Level:9-12

Date of Board Approval: _____

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Planned Instruction

Title of Planned Instruction: Technology Systems

Subject Area: Technology Education Grade(s): 9-12

Course Description: Student(s) will explore & complete activities involving technological systems, focusing on the areas of Transportation and Construction. Applying the ten steps of the Engineering Design Process, students will design & build working models of various modes of transportation. In construction technology, students design & build a scaled working model of a structure. Specific topics include: Mouse Trap Powered Vehicles, Crane Building, Force Creating Machines, CO2 Airplanes and Solid Fuel Rocketry.

Time/Credit for the Course: 1 Semester (70 Hours) / ½ Credit

Curriculum Writing Committee: Eric Thiele

Course Weighting

Participation	**10%**
Work Ethic	**10%**
Shop Clean-up	**5%**
Projects	**75%**
Total	**100%**

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Curriculum Map

Overview: This course will introduce concepts used in technology including lineal measurement, drafting tools and techniques, single and multi-view drawings, planning and documentation of a project, designing structures to withstand different stresses, creating scale models of structures, testing and evaluating structural designs, safely using machines and equipment, assembling multi-part mechanisms and proper application of various finishes.

Goals:

1. **Marking Period 1- Overview based on 45 days**
   - Student(s) will recognize that technological systems are designed to satisfy human needs & wants.
   - Student(s) will identify that all systems have inputs, a process and outputs.
   - Student(s) will demonstrate how the basic systems model can be used to analyze all kinds of systems.
   - Student(s) will explain in a technological system; a technological process combines resources to provide an output in response to a command input.
   - Student(s) will tell how feedback is used to make the actual result of a system come close as possible to the desired result.
   - Student(s) will differentiate between desirable and undesirable outputs of a system.
   - Student(s) will discuss how subsystems can be combined to produce a more powerful system.
   - Student(s) will demonstrate safe operation of various power tools used for processing materials.

2. **Marking Period 2- Overview based on 45 days**
   - Student(s) will identify and utilize the Engineering/Design Model (ten steps) to design a CO2 airplane to specified tolerances.
   - Student(s) prepare a set of sketches and scaled drawing of their CO2 airplane air foil & fuselage using appropriate drafting equipment.
   - Student(s) will examine the physical properties that act on a heavier-than-air vehicle i.e. Bernoulli's Law, center of gravity, center of lift, chord-line, force, lift, thrust, pressure and angle of attack.
   - Student(s) will identify the major parts of an airplane: fuselage, wing, horizontal stabilizer and vertical stabilizer.
   - Student(s) will select appropriate materials for construction of their CO2 airplane.

- Student(s) will practice safe operation of machines & hand tools for production of their CO2 airplane.
- Student(s) will produce a foam model airplane according to specifications of the activity.
- Student(s) will prepare airplane for flights; assemble all parts, find C.G. point, and balance the plane.
- Student(s) will conduct a bungee cord glide test on airplanes to establish straight & level flight. (increase or decrease angle of attack)
- Student(s) will perform powered flight of their planes; and collect & complete data sheet based upon performance of the airplane.
- Student(s) will analyze and interpret data from the performance of the flight and adjust their plane (feedback).
- Student(s) will summarize activity by completing post-evaluation activity.

Unit 1:

Big Ideas:

- Technology is created, used, and modified by humans.
- Knowledge and skills are essential for humans to make sound decisions about creating, using, and modifying technologies.
- Decisions about the use of products and systems can result in known and unexpected consequences.
- Creating optimal solutions under constraints is a primary component of technological problem solving (e.g., tools/machines, materials, information, people, capital, energy, and time).
- Technological design is a creative process that anyone can do which may result in new inventions and innovations, both expectedly and unexpectedly.
- Technological design & problem solving requires the ability to clearly communicate engineered solutions.
- Technological design & problem solving utilizes a series of steps that take place in a well-defined sequence.
- Technological design & problem solving requires the application of hands-on abilities such as sketching, prototyping, and fabricating.

Unit:2

Big Ideas:

- Technology is created, used, and modified by humans.
- **K**nowledge and skills are essential for humans to make sound decisions about creating, using, and modifying technologies.

- Decisions about the use of products and systems can result in known and unexpected consequences.
- Creating optimal solutions under constraints is a primary component of technological problem solving (e.g., tools/machines, materials, information, people, capital, energy, and time).
- Technological design is a creative process that anyone can do which may result in new inventions and innovations.

Primary Textbook(s) Used for this Course of Instruction

Name of Textbook: **Technology Engineering & Design**
Textbook ISBN #: **978-0-07-876810-1**
Textbook Publisher &Year of Publication: **Glencoe/McGraw-Hill 2008**
Curriculum Textbook is utilized in **Technology Systems**

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Curriculum Plan

Unit: 1 **Time Range in Days:40**

Standard(s): 3.5 Technology and Engineering
Standards Addressed: 3.5.9-12A, 3.5.9-12O, 3.5.9-12Q, 3.5.9-12U, 3.5.9-12AA

Objectives:

- Student(s) will identify and utilize the Engineering/Design Model (ten steps) to design an MTPV. (Level 1)
- Student(s) will identify all the subsystems of an MTVP. (Level 1)
- Student(s) design a set of sketches and scaled drawing of their MTVP using appropriate drafting equipment. (Level 4)
- Students will apply the concepts of multi-view projection (orthographic projection) to their final/working drawing. Centering and dimensioning of their drawing will also be encouraged. (Level 4)
- Student(s) will examine the physical properties that act on vehicle i.e. friction, inertia, force, acceleration, momentum, center of mass, rotational inertia, potential energy, kinetic energy and mechanical advantages (MA). (Level 4)
- Student(s) will select appropriate materials for construction of their MTPV. (Level 3)
- Student(s) will practice safe operation of machines & hand tools for construction of their MTVP. (Level 3)
- Student(s) will test their vehicles; and collect & complete a data sheet based upon performance of the vehicle. (Level 3)
- Student(s) will calculate & solve miles per hour (MPH), feet per second (F/S), averages of distance traveled and time (sec) of their vehicles. (Level 4)
- Student(s) will analyze and interpret data from the performance of the vehicle and make modifications to their design (feedback). (Level 4)
- Student(s) will summarize activity by completing post-evaluation activity. (Level 1)

Core Activities and Corresponding Instructional Methods:

Introduction to Design Briefs

- Lecture/Discussion on MTPV requirements and materials.
- Watch video “Mouse Trap Car.” (Mark Rober)
- Distribute resource material for project planning.

Designing a MTPV

- Lecture/discussion on the physical properties that act on a vehicle such as friction, inertia, force, acceleration, momentum, center of mass,

rotational inertia, potential energy, kinetic energy and mechanical advantage (MA).

- Hands on: Students will research their design using resource materials provided.
- Students will complete design brief.
- Students will illustrate their designs by completing a multi-view drawing to scale with dimensions.
- Students will provide a materials list to construct their MTPV.
- Students will submit plans for approval prior to construction of the vehicle.

Construction of MTPV's

- Students will gather materials and supplies needed for the activity.
- Students will layout materials to be processed.
- Students will practice safe operational use of equipment for construction of their vehicles.
- Students will assemble their vehicle and prepare for testing. (modification)
- Students will submit vehicles for evaluation of construction quality and specifications.

Testing of MTPV's

- Students will test their MTPV's and compile the results in a data sheet.
- Students will calculate MPH, FPS and average distance traveled and travel time.
- Students will summarize activity by completing post evaluation questions and will also identify the subsystems of their MTPV.

Assessments:

Diagnostic:

Oral Response

Visual Inspection of daily progress of the MTPV activity

Formative:

Student testing of MTPV's

Visual observation of performance of MTPV's

Collecting performance data of vehicles and recording it on a data sheet

Summative:

Evaluation of vehicle Construction

Post evaluation questions

Performance data sheet calculations

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Unit: 2 **Time Range in Days:30**

Standard(s): 3.5 Technology and Engineering
Standards Addressed: 3.5.9-12.A, 3.8.9-12.C, 3.5.9-12.I, 3.5.9-12.K, 3.5.9-12.N, 3.5.9-12.O, 3.5.9-12.Q, 3.5.9-12.Y, 3.5.9-12.AA,

Objectives:

- Student(s) will identify and utilize the Engineering/Design Model (ten steps) to design a model crane. (Level 1)
- Student(s) will recall the types of modern crane designs. (Level 1)
- Student(s) prepare a set of sketches and scaled drawing of their structure using appropriate drafting equipment. (Level 1)
- Student(s) will explore the roles of a Civil Engineer: drafting, surveying, soil science, mathematics, materials & processes, transportation, physics, and environmental issues. (Level 2)
- Student(s) will compare the physical properties that act on structure i.e. friction, equilibrium, elasticity, thrust line, stress & strain: compression, tension, shear, torsion, and bending. (Level 3)
- Student(s) will identify that all structures experience several types of force/load: dead, live, static, and dynamic. (Level 1)
- Student(s) will examine how geometric shapes effect structural design i.e. arches, and triangles. (Level 2)
- Student(s) will select appropriate materials for construction of their crane. (Level 2)
- Student(s) will practice safe operation of machines & hand tools for construction of their crane. (Level 2)
- Student(s) will test their structures; and collect & complete a data sheet based upon performance of the structure. (Level 4)
- Student(s) will calculate & solve efficiency rating. (Level 4)
- Student(s) will analyze and interpret data from the performance of their structure for future planning. (feedback). (Level 4)
- Student(s) will summarize activity by completing post-evaluation activity. (Level 2)

Core Activities and Corresponding Instructional Methods:

Designing a model crane

- Student(s) will complete design brief /problem solving form
- Student(s) will research their design using resource materials provided.
- Student(s) will illustrate their designs by completing a multi-view
- drawing to scale with dimensions.
- Student(s) will provide a materials list to construct their crane.
- Student(s) will submit plans for approval prior to construction of the
- crane.

Construction of a Crane

- Student(s) will gather materials & supplies needed for the activity.
- Student(s) will layout material to be cut.
- Student(s) will practice safe use of equipment for construction of their crane.
- Student(s) will glue and assemble their crane and prepare for testing. (modification)
- Student(s) will submit crane for evaluation of construction.

Testing of Crane

- Student(s) will test their crane and compile their results (data) and record them on data sheet.
- Student(s) will calculate efficiency of structure with provided formula.
- Student(s) will summarize activity by completing post-evaluation questions.

Assessments:

Diagnostic: Oral Response
Visual inspection of daily progress of the crane building activity

Formative: Student testing of cranes/structures
Visual observation of performance of the cranes/structures
Collecting performance data of cranes and recording it on a data sheet.

Summative: Student testing of cranes/structures
Post evaluation questions
Performance and data sheet calculations

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Unit: 3 **Time Range in Days:10**

Standard(s): 3.5 Technology and Engineering

Standards Addressed: 3.5.9-12.F, 3.5.9-12.I, 3.5.9-12.O, 3.5.9-12.W, 3.5.9-12.Y, 3.5.9-12.AA, 3.5.9-12.QQ,

Objectives:

- Student(s) will identify and utilize the Engineering/Design Model (ten steps) to design a CO2 airplane to specified tolerances. (Level 1)
- Student(s) prepare a set of sketches and scaled drawing of their CO2 airplane air foil & fuselage using appropriate drafting equipment. (Level 2)
- Student(s) will examine the physical properties that act on a heavier-than-air vehicle i.e. Bernoulli's Law, center of gravity, center of lift, chord-line, force, lift, thrust, pressure, angle of attack. (Level 2)
- Student(s) will identify the major parts of an airplane: fuselage, wing, horizontal stabilizer, vertical stabilizer. (Level 1)
- Student(s) will select appropriate materials for construction of their CO2 airplane. (Level 3)
- Student(s) will practice safe operation of machines & hand tools for production of their CO2 airplane. (Level 2)
- Student(s) will produce a foam model airplane according to specifications of the activity. (Level 3)
- Student(s) will prepare airplane for flight; assemble all parts, find C.G. point, and balance the plane. (Level 3)
- Student(s) will conduct a bungee cord glide test on airplanes to establish straight & level flight. (increase or decrease angle of attack) (Level 2)
- Student(s) will perform powered flight of their planes; and collect & complete data sheet based upon performance of the airplane. (Level 3)
- Student(s) will calculate & solve averages of distance, rate, time aloft (sec) of their airplanes. (Level 4)
- Student(s) will analyze and interpret data from the performance of the flight and adjust their plane (feedback). (Level 4)
- Student(s) will summarize activity by completing post-evaluation activity. (Level 2)

Core Activities and Corresponding Instructional Methods:

Introduction to CO2 AIRPLANES (Powered Flight Transportation)

- Lecture /discussion of CO2 airplane requirements & materials.
- Distribute handouts & resource materials for project planning.
- Student(s) will read CO2 airplane curriculum packet by Production
- Systems (No Author or Copyright) and complete study guide
- Student(s) will be administered a CO2 airplane quiz upon
- completion of study guide.

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Planning & Designing a CO2 AIRPLANE

- Student(s) will complete design brief / problem solving form
- Lecture /discussion on the physical systems that act on vehicle, i.e.
- Bernoulli's Law, center of gravity, center of lift, chord-line, force, lift, thrust, pressure, angle of attack.
- Student(s) will research their design using resource materials provided.
- Student(s) will illustrate their designs by completing a multi-view drawing to scale with dimensions.
- Student(s) will provide a materials list to produce their CO2 airplane.
- Student(s) will submit plans for approval prior to production of their CO2 airplane.

Production of CO2 AIRPLANE

- Student(s) will gather materials & supplies needed for the activity.
- Student(s) will layout material to be cut & shaped.
- Student(s) will practice safe use of equipment for production of their plane.
- Student(s) will shape fuselage, air foils, & stabilizers to final dimensions.
- Student(s) will prepare airplane for flight: assemble all parts of the plane, and using a C.G. locator student will find the C.G. point of airplane.
- Student(s) will conduct a bungee cord glide test on airplane to establish straight & level flight. Students will increase or decrease the angle of attack by placing shims between fuselage & air foil at either the leading edge or the trailing edge of the wing.
- Student(s) will submit airplane for evaluation of production.

Testing of CO2 AIRPLANE (2 Days)

- Student(s) will perform Powered Flight of their CO2 Airplanes with the intent to establish straight & level flight and compile their results (data) and record in data sheet.
- Student(s) will calculate miles per hour (MPH), averages of rate, time (sec) of their CO2 airplanes with provided formulas.
- Student(s) will summarize activity by completing post-evaluation questions, and will also identify the subsystems of their CO2 airplanes.

Assessments:

Diagnostic: Oral Response
Visual inspection of daily progress of the CO2 airplanes

Formative: Student testing of CO2 Airplanes
Visual observation of performance of the CO2 Airplanes
Collecting performance data of planes and recording it on a data sheet

Summative: Student testing of CO2 Planes
Post evaluation questions
Performance and data sheet calculations

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Unit: 4 **Time Range in Days:20**

Standard(s): 3.4 Technology and Engineering

Standards Addressed: 3.5.9-12.F, 3.5.9-12.I, 3.5.9-12.O, 3.5.9-12.W, 3.5.9-12.QQ

Objectives:

- Student(s) will identify and utilize the Engineering/Design Model (ten steps) to design a rocket to specified tolerances. (Level 1)
- Student(s) will read "The Laws of Motion and Model Rocketry" curriculum packet by Robert L. Cannon, Estes Industries, 1979; and complete a quiz on each of Newton's Laws of Motion. (Level 1)
- Student(s) will compare the physical properties that act on a rocket i.e.: thrust, gravity, propulsion, velocity, drag, altitude, orbit, momentum, mass, unbalanced force, inertia, feet per second, acceleration. (Level 2)
- Students will identify the major parts of a rocket: body tube, launch lug, nose cone, shock cord, recovery parachute, fins, engine mount, engine w/ igniter. (Level 1)
- Student(s) will select appropriate materials for construction of their rocket kit. (Level 2)
- Student(s) will practice safe operation of hand tools for production of their rocket. (Level 1)
- Student(s) will create a model rocket according to specifications of the activity. (Level 4)
- Student(s) will construct rocket for launch: install wadding, pack parachute, install rocket engine w/ igniter. (Level 3)
- Student(s) will safely launch and recover their rockets; and complete data sheet based upon performance of the Rocket. (Level 3)
- Student(s) will calculate & solve for height of rocket, angle of apex, altitude, baseline, velocity, and feet per second of their rocket. Utilizing computers, students will enter data in tables and use formulas and functions to analyze data. (Level 3)
- Student(s) will analyze and interpret data from the performance of the launch and adjust their rocket (feedback). (Level 3)
- Student(s) will summarize activity by completing post-evaluation activity. (Level 1)

Core Activities and Corresponding Instructional Methods:

Introduction to Rocketry (Space Transportation)

- Lecture /discussion of rocketry activity requirements & materials.
- Student(s) will view "Ignite The imagination" video by Estes 1996
- Distribute handouts & resource material for project.
- Student(s) will read "The Laws of Motion and Model Rocketry"
- curriculum packet by Robert L. Cannon, Estes Industries,1979 and complete study guide.
- Student(s) will be administered a rocketry quiz for each of Newton's Laws of Motion studied in curriculum packet.

Planning & Procedures for Rocket Construction

- Student(s) will complete design brief / problem solving form
- Lecture / discussion on the physical properties that act on a rocket i.e.: thrust, gravity, propulsion, velocity, drag, altitude, orbit, momentum, mass, unbalanced force, inertia, feet per second, acceleration.
- Instructor demonstration of the main body tube & fin layout and construction.

Construction of Model Rocket

- Student(s) will gather materials & supplies needed for the activity.
- Student(s) will follow step-by-step building procedures for their model rocket.
- Student(s) will practice safe use of hand tools & equipment for construction of their rocket.
- Student(s) will prepare rocket for launch: install wadding, pack parachute, install rocket engine w/ igniter.
- Student(s) will conduct a balance chord test on rocket to establish straight launch.
- Student(s) will submit rocket for evaluation of construction.

Testing of Rocket

- Student(s) will launch & recover rockets with two different size engines 1st launch with A8-3 engine approx. distance 100 – 150 ft. 2nd launch with B6-4 engine approx. distance 200 – 250 ft.
- Student(s) will measure altitude with an altimeter, time with stopwatch, and compile their results (data) and record in data sheet.
- Student(s) will calculate height of rocket, angle of apex, altitude, baseline, velocity, and feet per second of their rocket with provided formulas.
- Utilizing computers, the students will enter data in tables and use formulas and functions to analyze data in a spreadsheet format.
- Student(s) will summarize activity by completing post-evaluation questions, and will also identify the subsystems of their rockets.

Assessments:

Diagnostic: Oral Response
Visual inspection of daily progress of the rocketry activity

Formative: Student testing of rockets
Visual observation of performance of the rocket
Collecting performance data of planes and recording it on a data sheet.

Summative: Evaluation of rocket construction
Post evaluation questions
Performance and data sheet calculations

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