PASSAIC COUNTY TECHNICAL INSTITUTE
45 Reinhardt Road
Wayne, NJ

Career and Technical Education Curriculum Unit Planner

Innovations & Inventions

Course # S7110

August 2018

PASSAIC COUNTY TECHNICAL INSTITUTE
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Career and Technical Education Curriculum Unit Planner

Content Area:	Innovations and Inventions	**Grade(s)**	9 -12
Unit Plan Title:	Unit 1 Creative Design		

NJSLS/CCTC Standard(s) Addressed in this unit

Technology Standards

8.2.12.A.2 Analyze a current technology and the resources used, to identify the trade-offs in terms of availability, cost, desirability and waste.

8.2.12.C.4 Explain and identify interdependent systems and their functions.

8.2.12.C.5 Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.

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.

Career Ready Practices

CRP1. Act as a responsible and contributing citizen and employee.
CRP2. Apply appropriate academic and technical skills.
CRP3. Attend to personal health and financial well-being.
CRP4. Communicate clearly and effectively and with reason.
CRP5. Consider the environmental, social and economic impacts of decisions.
CRP6. Demonstrate creativity and innovation.
CRP7. Employ valid and reliable research strategies.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP9. Model integrity, ethical leadership and effective management.
CRP10. Plan education and career paths aligned to personal goals.
CRP11. Use technology to enhance productivity.
CRP12. Work productively in teams while using cultural global competence.

Essential Questions (3-5)

How can the engineering design process be applied to a design problem?
Why is it important to be able to produce design drawings with annotations?
Why is it important to document project work?

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Instructional Goals of Unit
The core concepts of technology. The application of engineering design. How to document their design project work.
Short & Informational Texts (3-5)
N/A
Expected Proficiencies of the Unit
Use and maintain technological products and systems. Effectively document their design project work.
Formative & Summative Assessments
Performance Task(s): ● Short term project results ● Project documents Other Evidence: ● Contributions toward the group project. ● Oral presentations and discussions.
Resources (websites, Canvas, LMS, Google Classroom, documents, etc.)
Materials & resources: ● Balsa ● Dowels ● Foam Core ● Hot glue guns / sticks ● Hand & Power tools Developmental activities: ● "Balloon Burst" (~3 weeks) ○ Design Loop ○ General and Tool Safety ○ CAD

- Assemblies
- Shared Files

Closing Activities:

- Presentations of student solutions and supporting documentation.

Suggested Time Frame:	10 Weeks

Content Area:	Innovations and Inventions	**Grade(s)**	9 -12
Unit Plan Title:	Unit 2 Energy and Power		

NJSLS/CCTC Standard(s) Addressed in this unit

Technology Standards

8.2.12.C.4 Explain and identify interdependent systems and their functions.

8.2.12.C.5 Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.

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.

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.

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.

Career Ready Practices

CRP1. Act as a responsible and contributing citizen and employee.
CRP2. Apply appropriate academic and technical skills.
CRP3. Attend to personal health and financial well-being.
CRP4. Communicate clearly and effectively and with reason.
CRP5. Consider the environmental, social and economic impacts of decisions.
CRP6. Demonstrate creativity and innovation.

CRP7. Employ valid and reliable research strategies.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP9. Model integrity, ethical leadership and effective management.
CRP10. Plan education and career paths aligned to personal goals.
CRP11. Use technology to enhance productivity.
CRP12. Work productively in teams while using cultural global competence.

Essential Questions (3-5)

Why are energy and power concepts important when applied in a design to solve a problem?
How do engineering drawings convey a design to others?
What role does prototyping play in the design process?

Instructional Goals of Unit

Apply the design process.
Use and maintain technological products and systems.
Assess the impact of products and systems.
Effectively use machines and resources available during design projects.

Short & Informational Texts (3-5)

N/A

Expected Proficiencies of the Unit

Use and maintain technological products and systems.
Assess the impact of products and systems.
Effectively use machines and resources available during design projects.

Formative & Summative Assessments

Performance Task(s):

- Major flywheel project results and documentation.
- Tests and quizzes regarding sub-topics.

- Materials testing results and explorations.

Other Evidence:

- Contributions toward major group projects.
- Oral presentations and discussions.

Resources (websites, Canvas, LMS, Google Classroom, documents, etc.)

Materials & resources:

- Thick Stock 1⁄2" and up for CNC (aluminum, plastic (cast acrylic), MDF, machinable wax or similar)
- Thin stock under 1⁄2 -illustration board, plywood, cast acrylic
- Gears
- Dowels
- Axles

Developmental activities:

- Flywheel Project (Tractor Puller, Tightrope Walker, Hill Climber, Dragster, Boat, Motorized, etc.)
  - Laser Cutter
    - Illustrator Software
      - General Navigation
      - General Tools
      - Importing (.dxf, .svg, etc.)
      - Editing
      - Printer settings
    - Laser usage and safety
    - Focusing
  - CNC
    - CAM Software
      - Importing
      - Roughing pass
      - Finishing pass

- Machine usage and safety
  - Bits
- Gears
  - Simple Ratio
  - Compound Ratio
  - Worm
- Flywheel
  - Calculating energy
- Excel
  - Equations
- Designing flywheel machines

Closing Activities:

- Final machine testing and documentation.

Suggested Time Frame:	10 Weeks

Content Area:	Innovations and Inventions	**Grade(s)**	9 -12
Unit Plan Title:	Unit 3 Sustainable Design		

NJSLS/CCTC Standard(s) Addressed in this unit

Technology Standards

8.2.12.B.1 Research and analyze the impact of the design constraints (specifications and limits) for a product or technology driven by a cultural, social, economic or political need and publish for review.

8.2.12.B.2 Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation and maintenance of a chosen product.

8.2.12.C.3 Analyze a product or system for factors such as safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, and human factors engineering (ergonomics).

8.2.12.C.5 Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.
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.
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.
8.2.12.D.2 Write a feasibility study of a product to include: economic, market, technical, financial, and management factors, and provide recommendations for implementation.
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.
8.2.12.D.4
Assess the impacts of emerging technologies on developing countries.
8.2.12.D.6 Synthesize data, analyze trends and draw conclusions regarding the effect of a technology on the individual, society, or the environment and publish conclusions.
8.2.12.E.2 Analyze the relationships between internal and external computer components.
8.2.12.E.3 Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games).

Career Ready Practices
CRP1. Act as a responsible and contributing citizen and employee.
CRP2. Apply appropriate academic and technical skills.
CRP3. Attend to personal health and financial well-being.
CRP4. Communicate clearly and effectively and with reason.
CRP5. Consider the environmental, social and economic impacts of decisions.
CRP6. Demonstrate creativity and innovation.
CRP7. Employ valid and reliable research strategies.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
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CRP11. Use technology to enhance productivity.
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Essential Questions (3-5)

What is sustainability and what are some specific examples of how the concept can be applied during design?
How does technology impact developing countries?

Instructional Goals of Unit

The cultural, social, economic and political effects of technology.
The effects of technology on the environment.
The application of engineering design.
The role of troubleshooting, research and development, invention and innovation and experimentation in problem solving.

Short & Informational Texts (3-5)

N/A

Expected Proficiencies of the Unit

Use and maintain technological products and systems.
Assess the impact of products and systems.
Effectively use machines and resources available during design projects.

Formative & Summative Assessments

Performance Task(s):

- Major biodynamic farming project results and documentation.
- Major alternative energy project results and documentation.
- Tests and quizzes regarding sub-topics.
- Materials testing results and explorations.

Other Evidence:

- Contributions toward major group projects.
- Oral presentations and discussions.

Resources (websites, Canvas, LMS, Google Classroom, documents, etc.)

Materials & resources:

- Electronics
  - Arduinos.
  - Battery Snaps, Battery Holders, Breadboards, Jumper Wires
  - Resistors Capacitors Potentiometers LEDs
  - Wire (solid, stranded, multi conductor)
  - DC Motors
  - LCD Display
  - Heat Shrink
  - Wire Strippers
  - Power Supplies, Multimeters, Soldering Irons
  - Solar Panels
- Hydroponics
  - 2-liter bottles
  - Nutrient solutions
  - Growing medium (rockwool / fired clay)
  - 250 gph submersible pump. & tubing.
  - Fluorescent lighting fixtures
  - 20-gallon tank
  - Heating cable or mat.
  - PH meter, PH up & PH down solutions

- http://www.ciese.org/sage/
- http://www.homehydrosystems.com/nutrients/nutrients_page.html

Developmental activities:

- Biodynamic Farming (Aquaponics)
  - Identify science of systems overview

	○ Identify classrooms system constraints ○ Design system & Components ○ Build. ○ Gathering data of plants ● Alternative Energy Challenge (Solar, Wind, and Hydro) ○ Introduce science of solar & wind power generation and associated electronics. ○ Introduce challenge constraints ○ Students brainstorm ideas ○ Design, plan, build prototypes Closing Activities: ● Students present project documentation and findings. ● Students pitch inventions.
Suggested Time Frame:	26 Weeks