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# Table of Contents

Overview of Technology Education Curriculum Framework ........................................5

**Middle School Rationale** ........................................................................................................7

- Explorations of Technology ..................................................................................8
- Exploring Communication Technology ...............................................................10
- Exploring Manufacturing/Construction Technology .............................................12
- Exploring Energy and Power Technology .............................................................14

**High School Rationale** .........................................................................................................17

- Introduction to Technology I ...............................................................................18
- Introduction to Technology II .............................................................................20
- Communication Technology .............................................................................23
- Drafting Technology: Introduction ....................................................................26
- Drafting Technology Mechanical .......................................................................28
- Drafting Technology Architectural ......................................................................30
- Graphic Arts Technology ....................................................................................32
- Materials and Processes Technology I ...............................................................34
- Production Technology I ......................................................................................36
- Production Technology II .....................................................................................39
- Energy and Power Technology ............................................................................43
- Electricity/Electronics Technology ......................................................................45
- Research and Development ...............................................................................47
- Pre-Engineering Technology ...............................................................................49
- Engineering Applications ......................................................................................52

**Acknowledgments** ........................................................................................................55
Introduction / Need

There is a growing movement throughout the nation on the part of educators to strive for excellence in teaching youth about industry and technology. Several new curriculum ventures, such as the Technology for All Americans and the Georgia Academic Standards for Technology Education, are beginning to serve as resources for program development. However, neither of these documents was designed to provide the classroom teacher with an operational-level guide for curriculum planning. Teachers are left to develop course materials with little guidance from educational agencies outside of their local areas. These forms of curriculum development efforts have led to an assortment of course offerings that varies throughout the state in both quality and organization. Past efforts in curriculum planning led to the development of numerous detailed curriculum guides stipulating a step-by-step approach for the daily/weekly/monthly class agenda. These materials tended to be short lived in usefulness and were quickly outdated.

A curriculum framework is needed that provides consistency in the appropriate intellectual methods and processes (e.g., analyzing, designing, communicating, experimenting) that are used when solving technological problems while at the same time utilizing the academic standards established for teachers and students in Georgia. This curriculum framework will provide teachers with an overall organizational structure to aid in curriculum consistency throughout Georgia. This format for curriculum planning will also provide professional educators with flexibility to design and adapt their curriculum to meet local needs and to adjust their curriculum as technological advances require.

This document is designed to synthesize the ideas from the Georgia Academic Standards for Technology Education, Standards for Technological Literacy, Quality Core Curriculum (QCC), and other materials with established technology education curriculum objectives in an effort to provide local curriculum designers/developers with an implementation guide for their curriculum.

Document Goal

This document links the basic content standards and the specific performance standards statements as presented in the Georgia Academic Standards for Technology Education and the Standards for Technological Literacy with the Quality Core Curriculum (QCC) competencies to each state-approved course curriculum option. In addition, sample instructional activities are included for each of the approved courses. The sample instructional activities will be integrated with appropriate intellectual methods and processes.

* Quality Core Curriculum objectives addressed in this document are from the 1999-2000 academic year.
Students in the middle-level grades explore the scope of technology. From personal and classroom experiences, students become familiar with specific ways in which technology is dynamic, and teachers should build on these experiences by reinforcing the idea that technology is constantly changing. Classroom activities in grades 6-8 should help students understand that technology enables people to improve current technologies, to further their understanding of other technological ideas, to evaluate the impacts of technology on society, and to develop new technologies (Standards for Technological Literacy, 2000, p. 27).

The goals of middle school technology education in Georgia are to help develop critical-thinking and problem-solving skills that lead to students becoming technologically literate. Class projects employ research and design strategies that encourage deeper thinking and begin to introduce students to career options associated with technology.

Modular instruction of technology topics is typical in many Georgia technology education programs. In addition to technology modules, students are introduced to a wide variety of instructional methods that encourage them to connect their learning with real-world issues and problems. Instruction in technology education at the middle school level is delivered through the following courses:

- Explorations in Technology
- Exploring Communication Technology
- Exploring Manufacturing/Construction Technology
- Exploring Energy and Power Technology
Course: Explorations in Technology
Course number: 21.022

State Course Description
Explorations in Technology exposes students to a variety of ten-hour technology education-based activities. Activities in robotics, computer-aided design (CAD), computer numerical control (CNC), computer-aided publishing (CAP), electricity, electronics, flight, and space are provided. Students also participate in group activities, give oral and written reports, and are provided opportunities to reinforce basic math and science competencies.

Detailed Course Description
This course is designed to allow students to examine interrelated areas of production, energy and power, transportation, communication, and bio-related technologies. Students explore key historical developments in technology and assess the impacts on society. As students move through the technologies, they solve problems by analyzing, critiquing, and evaluating information. In addition, students apply academic learning—math, science, language arts, and social studies—in the investigation of technology.

Objectives
The student will perform and/or demonstrate the following:
- Describe technology in terms of a definition.
- Understand the difference between science and technology.
- Use, manage, and understand various tools of technology by operating technical equipment.
- Describe the relationship between technology and other areas of knowledge.
- Understand technology as an evolving, dynamic area of knowledge.
- Demonstrate the ability to effectively read, comprehend, and express technical information.
- Demonstrate competency in the knowledge and skills necessary to become an independent researcher.

Georgia Academic Standards for Technology Education for 6th–8th Grades
- Nature of Technology 1-7
- Human Ingenuity 1, 2, 3, 4, 6, 7
- Technological Systems 1, 2, 3, 6
- Impact of Technology 1-7

Quality Core Curriculum for 6th–8th Grades
- TECHED: 6-8.1-10

National Standards for Technological Literacy for 6th–8th Grades
- Design – 8: E, F; 9: F, G; 10: G

Sample Instructional Activity
Paper Beam

Description
Students design and construct a paper beam that will support 30 pounds.

Concepts
In completing this activity students become engaged in the following concepts:

Technology Education Concepts
- How to apply problem-solving methods to construct this device.
- How to demonstrate sketching techniques.
- How to demonstrate the steps of the design process.
- How to construct a working prototype.

Mathematics Concepts
- Measurement
- Parallel and perpendicular lines
- Geometric construction
- Ratio strength to weight
**Science Concepts**
- Students develop the basic knowledge needed to develop products and processes.
- Students learn how forces on objects result in stress, strain, etc.

**Social Science Concepts**
- What are some of the methods to approaching design?
- How are design and creativity related and how does it affect us?

**Communication Concepts**
- Students demonstrate idea development.
- Students write a technical report about the development and construction of the beam.

**Procedure**
Design and construct a paper beam that will support a weight of 30 pounds. Be sure your project includes the following:

1. Title page – An appropriate page that states as simply as possible the design task and includes the following information:
   - Designer
   - Submitted to
   - Date submitted
   - Approved date

2. The written report must include:
   - A sketch showing the side and end view of beam.
   - The list of materials.
   - A written procedure of beam construction.

3. Task specifications for a paper beam:
   - The beam is to be 1”x 1”x12” with a tolerance of +/- 1/8”.
   - The beam must be constructed from a paper product.
   - Light must be able to pass through the length of the beam.
   - Adhesive must be used (no tape or staples).
   - Any type of coating material may be used to add strength to the beam.

**Equipment/Supplies**
- Assorted paper products
- Scissors/x-acto knife
- Rulers
- Cutting boards
- Assorted adhesives
- Various coating materials
- Rubber bands for clamping the beam while the adhesive dries

**Method of Evaluation**
1. Title page 05 pts.
2. Written report (typed) 25 pts.
3. Paper beam 10 pts.
5. 30-pound weight held 50 pts.
   **Total** 100 pts.

**Correlation to Standards**

**Georgia Academic Standards for Technology Education for 6th-8th Grades**
- Nature of Technology 1, 3, 4, 5, 7
- Human Ingenuity 1, 2, 3, 6, 7
- Technological Systems 3, 6
- Impact of Technology 1, 4, 7

**Qualitative Core Curriculum for 6th-8th Grades**
- TECHED: 6-8.1, 3, 6, 7, 8, 9, 10

**National Standards for Technological Literacy for 6th-8th Grades**
- Technology and Society – 4: E; 5: E; 6: D; 7: C
- Design – 8: E, F; 9: F, G; 10: G
Course: Exploring Communication Technology  
Course number: 21.022

State Course Description

The Exploring Communication Technology course provides a wide variety of related experiences in communication. Content includes exploratory experiences in drafting, graphic arts, and electronic communication coupled with related career information.

Detailed Course Description

This course is designed to allow students to examine many different areas of communications technology. As students progress through the exploration, they learn that communication technology is a reaction to problems and opportunities, a human adaptive system. Students learn that communications technological systems are made up of many parts that require the use of tools. Students are introduced to the problem-solving and design process, with emphasis on the testing, evaluating, and communicating of design solutions.

Objectives

The student will perform and/or demonstrate the following:

• Describe communication technology in terms of level of development, economic structure, number of people involved, and type of product or services produced.
• Discuss high communication technology and the development of society.
• Describe the development and operation of communication technology by a private enterprise.
• Demonstrate an understanding of how people use communication technology to make our world work.
• Explain why communication technology systems work the way they do.
• Describe the ways communication technology affects both people and our planet.

Georgia Academic Standards for Technology Education for 6th-8th

• Nature of Technology 1-7
• Human Ingenuity 1-7
• Technological Systems 1-7

Quality Core Curriculum for 6th-8th Grades

• TECHED: 6-8.1 - 10

National Standards for Technological Literacy for 6th-8th Grades

• Technology and Society – 4: D, E, F, G; 5: F; 6: D, E, F, G; 7: C, D, F

Sample Instructional Activity

Technological Literacy Poster Contest

Description

Students select one technology that is widely used today (e.g., car, telephone, television, computer). They then create a poster that shows the positive and negative impacts that the chosen technology has had on society, including social, cultural, and environmental impacts.

Concepts

In completing this activity students become engaged in the following concepts:

Technology Education Concepts

• Explain the history of technology systems.
• Explain the economic impacts of technology systems.
• Explain the social impacts of technology systems.
• Explain the environmental impacts of technology systems.

Mathematics Concepts

• Students demonstrate the ability to use a ruler in achieving a balanced arrangement of items.

Science Concepts

• Researching, visually preparing, and verbally
presenting this project promotes the students understanding of how scientific concepts contribute to technological advances.

**Social Science Concepts**
- The project shows that students understand how technology relates to the development of societal needs.
- Students demonstrate an understanding of society’s role in the development of technologies.
- Students make reasonable judgments regarding the role of technology in society.

**Communication Concepts**
- Students demonstrate the use of language skills necessary to convey messages in brief headlines, explanations, and captions under items.
- Students use language skills in presenting the concepts of their poster to the class and on videotape.

**Procedure**
The students should be prepared to present their posters on videotape. Students may draw, cut out pictures from magazines, and use newspaper articles or other artifacts that can be attached to their poster board. These posters will be displayed in the class for all to see.

**Supplies**
- 22” x 17” poster board
- Elmer’s glue
- Scissors
- Markers
- Magazines
- Newspaper
- Internet print-outs

**Method of Evaluation**
1. Teacher observation.
2. Comparison of students’ posters to teacher-created rubric.
3. Students’ presentations.

**Correlation to Standards**

**Georgia Academic Standards for Technology Education for 6th-8th**
- Nature of Technology 1-7
- Human Ingenuity 2, 4, 5
- Technological Systems 1, 2, 3, 5, 6
- Impact of Technology 1-7

**Quality Core Curriculum for 6th-8th Grades**
- TECHED: 6-8.1 – 4, 6 - 10

**National Standards for Technological Literacy for 6th-8th Grades**
- Technology and Society – 4: D, E, F; 5: F; 6: D, E, F, G; 7: C, D, F
**Course:** Exploring Manufacturing/Construction Technology  
**Course number:** 21.023

**State Course Description**
The Exploring Manufacturing/Construction Technology course provides a variety of experiences in manufacturing and construction. Role-playing is an important part of this exploratory class. Simulated manufacturing companies allow students to get practical experience in manufacturing. Exposure to masonry, frame construction, and electrical wiring helps students explore construction.

**Detailed Course Description**
This course is designed to allow students to examine many different areas of production and construction technology. As students progress through this exploration, they learn that production and construction technologies are a reaction to problems and opportunities, a human adaptive system. Students learn that production and construction technology systems are made up of many parts that require the use of tools. Students are introduced to the problem-solving and design process, with emphasis on the testing, evaluating, and communicating of design solutions.

**Objectives**
The student will perform and/or demonstrate the following:
- Describe manufacturing and construction technology in terms of level of development, economic structure, number of people involved, and type of product or services produced.
- Discuss high manufacturing and construction technology and the development of society.
- Describe the development and operation of manufacturing and construction technologies by a private enterprise.
- Understand how people use manufacturing and construction technology to make our world work.
- Explain why manufacturing and construction technological systems work the way they do.
- Describe the ways manufacturing and construction technology affects both people and our planet.

**Georgia Academic Standards for Technology Education for 6th-8th**
- Nature of Technology 1-7
- Human Ingenuity 1-7
- Technological Systems 1-7
- Impact of Technology 1-7

**Quality Core Curriculum for 6th-8th Grades**
- TECHED: 6-8.1 – 10

**National Standards for Technological Literacy for 6th – 8th Grades**
- Technology and Society – 4: D, E, F; 5: D, E, F; 6: E, F; 7: C, D, E, F

**Sample Instructional Activity**
“NASA, we have a problem!”

**Description**
The Point Cast Manufacturing Company has just received a contract with NASA to manufacture a control panel for their Mars spacecraft. As a designer, your job is to design a control panel that will meet NASA’s standards as well as be functional and cost efficient. If your design is chosen, you will receive a $5,000 bonus.

**Concepts**
In completing this activity students become engaged in the following concepts:

**Technology Education Concepts**
- How to apply problem-solving methods to construct this device.
- How to demonstrate sketching techniques.
- How to demonstrate the steps of the design process.
- How to prepare a technical drawing manually.
- How to construct a full-scale mockup or a scale-down mockup.
Mathematics Concepts
• Measurement
• Parallel and perpendicular lines
• Geometric construction

Science Concepts
• Students develop the basic knowledge needed to develop products and processes.

Social Science Concepts
• What are some of the methods of approaching design?
• How are design and creativity related and how does it affect us?
• What impact does design have on society?

Communication Concepts
• Designers develop ideas for the product and decide what size, shape, and color the product will be.
• Students use language skills in presenting the concepts of their posters to the class and on videotape.

Procedure
Design a mock electronic control and read-out panel for the new NASA Mars spacecraft.
Be sure your project includes the following:
• Title Page – An appropriate page stating as simply as possible the design task (goal, to whom submitted, designer’s name, date, etc.).

Designer_____________________
Submitted to__________________
Dept. of______________________ for review and criticism
Date submitted________________
Approved date________________
• Task Specifications or Factors – A list of factors to be accomplished to solve the assigned task (What? How? Where? Why?).

• Task Specifications for Electronic Control Panel
  1. Panel is to be 9” x 23”.
  2. Control and read-out should be arranged in a linear or circular pattern.
  3. No item can be closer than one inch to the edge of the panel.

  4. The panel should contain the following items:
     A. One toggle switch, ?” in diameter with the word “on” above it and “off” below it in gothic caps.
     B. One read-out panel, 4” x 6” with 5 vertical numbered columns, each column 1/2” wide with one to nine plus numbers.
     C. One oscilloscope face, 4” square with a circular glass tube face.
     D. Two ammeter faces, 2 1/2” x 2 3/4” horizontal.
     E. Two dials, 1 1/2” in diameter, must relate to ammeter faces.
     F. Two dials, 1” in diameter, must relate to read-out panel.
     G. Two output jacks, one labeled “earphone,” one “recording” (jacks ?” in diameter).
     H. One green light, 1/2” in diameter, must relate to oscillator input control.
     I. One dial, 1 1/2” in diameter, labeled “oscillator input control.”
     J. One input plug, 1” in diameter.
     K. One nameplate, 1/2” x 2”.

• Task Specification for Report
  Write a one-page report on your control panel that contains the following information.
  A. Introduction statement.
  B. Purpose of control panel. (What is it controlling?)
  C. State the design purpose and function (components placement and workability).
  D. State panel scale.
  E. Give a 30-second to 1-minute presentation.

Equipment/Supplies
• Ridged material (cardboard, gypsum board, foam board, etc.)
• Folder
• Colored pen or pencils
• Three 8 ?” x 11” sheets of paper
• Different design components (knobs, toggle switch, ammeters, oscilloscope face, input plugs, jacks, etc.)
Method of Evaluation

The student’s grade will be based on the following:

1. Title page 15 pts.
2. Written report (typed) 20 pts.
3. Mock panel 30 pts.
5. Presentation 15 pts.

Total: 100 pts.

Teacher Notes

• A mini-lesson on design must be taught before doing this activity.
• The panel may be scaled down. (If scaled down, components must be scaled as well.)
• The panel components may be purchased, made, or drawn.
• The panel must be colorful.
• The mockup may be 3-D or single view.
• NASA’s Web site (various past spacecraft designs) may be useful.
• Various magazines on electronics are a useful resource.
• View existing control panels of various products.

Correlation to Standards

Georgia Academic Standards for Technology Education for 6th-8th

• Nature of Technology 3, 4, 5, 7
• Human Ingenuity 1, 2, 3, 5, 6, 7
• Technological Systems 2, 3, 4, 5, 6, 7
• Impact of Technology 3, 6, 7

Quality Core Curriculum for 6th-8th Grades

• TECHED: 6-8.1 - 10

National Standards for Technological Literacy for 6th-8th Grades

• Technology and Society – 4: D, F; 5: D, E, F; 6: E; 7: C, D, E, F

Course: Exploring Energy and Power Technology

Course number: 21.024

State Course Description

The Exploring Energy and Power Technology course provides a variety of experiences in the areas of energy and power technology. Exposure to alternative energy sources; the generation, transmission and safe use of energy; and experiences with mechanical, electrical, and fluid systems are provided.

Detailed Course Description

This course is designed to allow students to examine many different areas of energy and power technology. As students progress through the exploration, they learn that energy and power technology is a reaction to problems and opportunities, a human adaptive system. Students learn that energy and power technological systems are made up of many parts that require the use of tools. Students are introduced to the problem-solving and design process with emphasis on the testing, evaluating, and communicating of design solutions.

Objectives

The student will perform and/or demonstrate the following:

• Describe energy and power technology in terms of level of development, economic structure, number of people involved, and type of product or services produced.
• Discuss high energy and power technology and the development of society.
• Describe the development and operation of energy and power technology by a private enterprise.
• Understand how people use energy and power technology to make our world work.
• Explain why energy and power technology systems work the way they do.
• Describe the ways energy and power technology affects both people and our planet.
Georgia Academic Standards for Technology Education for 6th-8th

- Nature of Technology 1-7
- Human Ingenuity 1-7
- Technological Systems 1-7
- Impact of Technology 1-7

Quality Core Curriculum for 6th-8th Grades
- TECHED: 6-8.1 - 10

National Standards for Technological Literacy for 6th-8th Grades
- Technology and Society – 4: D, E, F, G; 5: D, E, F; 6: E, F; 7: C, D, E, F

Sample Instructional Activity

**Turn it on!**

**Description**

Energy chains examine how energy is never created or destroyed. Energy just changes from one form to another. Using any research materials available, study how fossil fuels are used to turn on your favorite appliance in your home. Using the materials provided, draw a chart showing the complete chain of energy changes from petroleum-based fossil fuels to the moment when the appliance is switched on.

**Alternative:** If your favorite appliance is a portable (battery-operated) device, make a poster explaining how a battery produces energy. Show how this energy is used to run your favorite portable device.

**Concepts**

In completing this activity students become engaged in the following concepts:

**Technology Education Concepts**
- How to apply problem-solving methods to construct a poster presentation.
- Demonstrate the steps of the design process.
- Understanding of how people use energy and power technology to make our world work.
- Explanation of why energy and power technology systems work the way they do.
- Description of the ways energy and power technology affects both people and our planet.

**Mathematics Concepts**
- Students demonstrate ability to use a ruler in achieving a balanced arrangement of items.

**Science Concepts**
- Researching, visually preparing, and verbally presenting this project promotes students’ understanding of how scientific concepts contribute to technological advances.

**Social Science Concepts**
- The project shows that students understand how technology relates to the development of societal needs.
- The students demonstrate an understanding of society’s role in the development of technologies.
- Students make reasonable judgments regarding the role of technology in society.

**Communication Concepts**
- Students demonstrate the use of language skills necessary to convey messages in brief headlines, explanations, and captions under items.
- of their posters to the class and on videotape.
Procedure
Students may draw, use pictures cut from magazines, or use newspaper articles or other artifacts that can be attached to their poster board. These posters will be displayed in the class for all to see.

Equipment/Supplies
• 22” x 17” white poster board
• Elmer’s glue
• Scissors
• Markers
• Magazine
• Newspaper
• Internet print-out

Method of Evaluation
1. Teacher observation
2. Poster presentation

Correlation to Standards

Georgia Academic Standards for Technology Education for 6th-8th
• Nature of Technology 1, 2, 3, 4, 5
• Human Ingenuity 3, 5, 6
• Technological Systems 1, 3, 5, 6
• Impact of Technology 2, 3, 5, 6, 7

Quality Core Curriculum for 6th-8th Grades
• TECHED: 6-8.1, 3, 6, 7, 8, 9, 10

National Standards for Technological Literacy for 6th-8th Grades
• Technology and Society – 4: D, E, F, G; 5: D, F; 6: E, F; 7: C, D
In grades 9-12, students gain a broader perspective of the importance of human innovation and ingenuity in refining existing technologies and developing new ones. They also continue to develop higher-order thinking skills, such as questioning, investigating, and researching. By the time they graduate, students should have developed an understanding of the scope of technology. This realization includes knowing what technology is and recognizing that it has an intellectual domain and content base of its own. (Standards for Technological Literacy, 2000, p. 30)

The goals of high school technology education in Georgia focus on enabling students to become more technologically literate through in-depth experiences geared to career preparation. Students develop deeper problem-solving skills leading to consumer awareness and personal enrichment as well as to occupational readiness. Technology education at the high school level strives to develop critical-thinking skills in such ways that students are more discriminating with regard to technology and its impact on society. Class projects are designed to expand the mental methods of inquiry that are used when solving technological problems. This is done through a combination of “hands-on” and “minds-on” experiences in the technology laboratory.

Modular instruction of technology topics is common in many Georgia technology education programs. In addition to technology modules, students are introduced to a wide variety of instructional methods that encourage them to connect their learning with real-world issues and problems. Instruction in technology education at the high school level is typically delivered through the following courses:

- Introduction to Technology I
- Introduction to Technology II
- Communication Technology
- Drafting Technology: Introduction
- Drafting Technology Mechanical
- Drafting Technology Architectural
- Graphic Arts Technology
- Materials and Processes Technology I
- Production Technology I
- Production Technology II
- Energy and Power Technology
- Electrical/Electronics Technology
- Research and Development
- Pre-Engineering Technology
- Engineering Applications
**Course:** Introduction to Technology I  
**Course number:** 21.425

**State Course Description**  
The Introduction to Technology I course introduces the three technology education clusters—energy and power, production, and communication—and emphasizes increased capability with a greater variety of tools, materials, processes, career awareness, and reinforcement of basic skills and core competencies. The course uses a modular delivery system for computer-aided drafting, computer-aided publishing, computer numerical control, robotics, fluidics, automation, lasers, and alternative energy. It includes individual, team, and group activities.

**Detailed Course Description**  
This course is designed to promote technology awareness in areas of environmental concerns, society issues, and industry standards. The class utilizes various teaching strategies and whole class, small group, paired, and individual activities to introduce contemporary workplace technologies and practices. Instruction is related to the major areas of communication, production, energy and power, transportation, and bio-related technologies.

**Objectives**  
The student will perform and/or demonstrate the following:

- How the technology lab operates and how to function successfully in that environment.
- How to function safely and ethically in the work environment.
- That technology is comprised of five areas and their contents.
- That a systems model is a widely used organizational tool and how it is applied.
- The function of a computer operating system and its uses.
- The evolution of technology and its social impact.
- The processes for solving problems and their application.
- How to express ideas in written, graphical, and oral forms.
- Designated assignments in a modular environment in a specified time frame.
- The ability to complete designated assignments in a group environment in a specified time frame.
- How to use the computer as a tool and a resource.
- Leadership, communication, and competitive skills through cocurricular vocational student organization activities.

**Georgia Academic Standards for Technology Education for 9th-12th Grades**

- Nature of Technology 1-10
- Human Ingenuity 1, 2, 4, 5
- Technological Systems 1, 3, 6, 10
- Impact of Technology 1, 2, 4, 7, 8, 9

**Quality Core Curriculum for 9th-12th Grades**

- TCCORE: 9-12.1 - 31
- TECHED: 9-12.32 - 45

**National Standards for Technological Literacy for 9th-12th Grades**


**Sample Instructional Activity**  
*All Bent Out of Shape*

**Description**  
In this activity the students design a new paper clip by using the problem-solving process. They market the product through the production of a short commercial. Through the use of questions and problems, they discover some of the things that affect profit and loss on the manufacturing side of the product.
Concepts
In completing this activity students become engaged in the following concepts:

**Technology Education Concepts**
- Technology Education Concepts
- How to produce thumbnail sketches.
- How to produce a dimensioned final sketch.
- How to use rulers.
- How to use the problem-solving process.
- How to market a product.
- How to evaluate profit and loss.

**Mathematics Concepts**
- Measurement
- Business math
- Spatial orientation
- Parallel and perpendicular lines

**Science Concepts**
- Testing the tensile strength of a given metal through the design of a product that must have a minimum holding capacity.
- Metal properties (e.g., malleability, strength).

**Social Science Concepts**
- Planning and organizing techniques used in design processes.

**Communication Concepts**
- Graphical representation of an animate object.
- Use of graphics as a language.
- Marketing of a product through commercials and flyers.

Procedure
1. Sketch as many different paper clip configurations (shapes) as possible on the scratch paper provided. BE CREATIVE.
2. When you have finished, circle the five designs that you think will work best.
3. Evaluate the five possibilities on the matrix provided. This process will rank your five possibilities. Identify the best choice on your scratch sheet.
4. Have your instructor approve your design. Upon approval he or she will give you a piece of wire.
5. Bend the wire into the final shape.
6. If it works as well as you thought it would, make a detailed dimensional drawing of it on the sheet provided. Obtain another piece of wire from your instructor and bend a second paper clip, using your design. You should now have two identical paper clips, one for each group member.
7. Now it is time to market your invention. It must have catchy name, a company name, company address, price, warranty, phone number, Web site, guarantee, and any other information that you feel the public should know.
8. Develop a commercial to sell your paper clip. BE CREATIVE. The commercial should last approximately 30 seconds.
9. As the other groups in the class give their commercials, use the evaluation matrix provided to evaluate them. Do not evaluate yourselves.
10. Answer the questions below.
11. Turn in all of your materials. The following list covers everything that should be turned in by each group member:
   A. Questions answered completely.
   B. Scratch paper showing all designs, with top five designated and top pick designated.
   C. Matrix with top five evaluated.
   D. Dimensional drawing of top pick, with the name that you chose included.
   E. Any notes and scripts used in planning the commercial.
   F. Evaluation matrix of the other commercials that were presented.
   G. The entire package must be held together by your paper clip.

Equipment/Supplies
- The All Bent Out of Shape student handout packet
- Large paper clips
- Needle-nose pliers
- Rulers
- Color pencils and paper
- Wire for paper clips

Method of Evaluation
1. Teacher observation.
2. Comparison of students’ drawings to drafting standards.
3. Written test.
Correlation to Standards

Georgia Academic Standards for Technology Education for 9th-12th Grades
- Nature of Technology 1, 2, 10
- Human Ingenuity 1, 3, 4, 5
- Technological Systems 2

Quality Core Curriculum for 9th-12th Grades
- TCCORE: 9-12.1, 3, 4, 5, 6, 7, 8, 9, 10, 13, 14, 15, 17, 18, 20, 21, 24, 28, 30, 31
- TECHED: 9-12.32, 33, 35, 36, 38, 40, 41, 45

National Standards for Technological Literacy for 9th-12th Grades
- Technology and Society – 6: I; 7: G
- Design – 8: H, I; 9: K; 10: J
- Abilities for a Technological World – 11: M, N, O, P, Q, R; 13: J
- The Designed World – 17: P

Course: Introduction to Technology II
Course number: 21.426

State Course Description
The Introduction to Technology II course enhances level-one skills and introduces additional materials, processes, and careers with continued reinforcement and application of basic skills and core competencies. The course includes additional modules and individual, team, and group activities.

Detailed Course Description
This course is designed to help students acquire more specialized skills in one area of technology. The students incorporate ideas from all modules to help develop better ideas, theories, and solutions for problems in the environment and society. This class utilizes various teaching strategies and whole class, small group, paired, and individual activities to introduce contemporary workplace technologies and practices. Instruction is related to the major areas of communication, production, energy and power, transportation, and bio-related technologies.

Objectives
The student will perform and/or demonstrate the following:
- How the technology lab operates and how to function successfully in that environment.
- How to function safely and ethically in the work environment.
- That technology is comprised of five areas and their contents.
- That a systems model is a widely used organizational tool and knowledge of how it is applied.
- The function of a computer operating system and its uses.
- The evolution of technology and its social impact.
- How to apply a problem-solving process.
- How to express ideas in written, oral, graphical, and electronic forms.
- How to apply skills in a culminating activity or problem.
- The functions and applications of a computer operating system.
• Designated assignments in a modular environment in a specified time frame.
• The ability to complete designated assignments in a group environment in a specified time frame.
• How to use the computer as a tool and a resource.
• Leadership, communication, and competitive skills through cocurricular vocational student organization activities.

Georgia Academic Standards for Technology Education for 9th-12th Grades
• Nature of Technology 1-10
• Human Ingenuity 1, 2, 4, 5, 7, 8, 10
• Technological Systems 1, 2, 3, 4, 6, 10
• Impact of Technology 1, 2, 4, 6, 7, 8, 9

Quality Core Curriculum for 9th-12th Grades
• TCCORE: 9-12.1 - 31
• TECHED: 9-12.32 - 4

National Standards for Technological Literacy for 9th-12th Grades
• The Designed World – 14: K; 15: K, L; 16: J, M; 17: L, M, N, O, P, Q; 18: J

Sample Instructional Activity
Time Motion Studies

Description
We’ve all heard the saying, “Time is money.” During the process of developing any product, manufacturers become keenly aware of the time required to do each step in the production process. They carefully evaluate and revise their processes as necessary to improve production efficiency. Any time saved in the creation of their product can be directly translated into more products being made, a reduction in the cost of each item, or both. These improvements result in a bigger bottom line for producers.

Some companies have employees who specialize in time management. These personnel look for ways to simplify production, improve automation, save time, and reduce production costs. Manufacturing engineers and technicians are very important in turning ideas into reality. Students can be made aware of this challenging vocational field by participating in a simple activity that illustrates the idea of studying motion and time in the assembly of a simple product.

Concepts
In completing this activity students become engaged in the following concepts:

Technology Education Concepts
• How to use time as a technological resource.
• How to increase production through efficient use of time.
• How to evaluate assembly production methods.
• How to implement quality control.
• How to effectively cross-train the work force.

Mathematics Concepts
• Time measurement
• Averaging
• Basic math

Science Concepts
• Producing written reports (e.g., graphs) of observations.
• Making observations.
• Drawing conclusions based on observations.

Social Science Concepts
• Planning and organizing techniques used in assembly production.
• Management and labor relationships.
• Cooperative work groups.

Communication Concepts
• Graphical representation of a system or process.
• Use of graphics as a language.
• Generating and following directions.
• Evaluation and feedback.
• Documentation.
• Development of a portfolio.
**Procedure**

1. Divide the class into workgroups. The size of each workgroup will depend upon the number of parts in the particular item you are assembling. Designate one person to be the timer/recorder. Each person in the group must have an assigned task.

2. Explore linear assembly line production. Separate the retractable pen parts into parts bins/containers. Each bin should contain the entire quantity of a particular pen part. Form an assembly line on which each student adds the same part to each pen assembly. Assemble a number of pens completely and time the entire operation. The time to assemble each pen is determined by dividing the total time by the number of pens assembled. NOTE: Try this several times, varying the order in which the parts are added to the assembly. See if there are any differences in the production times that can be related to these changes in order of assembly.

3. Explore production team assembly. Form teams of students where there are several more parts than students (example: 7 parts, 3-4 students). Remember to include a timer/recorder. Let the team members decide who will assemble which parts and in what order the parts will be assembled. After these decisions are made, have the timer/recorder time the assembly of all the parts.

4. Explore individual production. Divide the class into pairs. One student will do the entire assembly of ten (10) units while his or her partner times their work. After disassembly, the partners swap places and repeat the process. Determine the class average assembly time for one unit and compare to assembly line and production team assembly times.

5. Discuss the concept of time as a technological resource. Discuss observations and recorded data with class. Discuss automation versus manual labor.

6. Draw flow charts and diagrams showing each of the assembly methods used. Compare groups and assembly methods, using mathematical graphs. Have students explain the positive and negative aspects of each assembly method.

7. Explain how motion/time studies would affect the profitability of a company.

**Equipment/Supplies**

You will need a product that can be disassembled into its individual parts, something such as a ballpoint pen that has at least five or six parts and may be purchased from an office supply store. Better yet, you may find a local business or advertiser who will donate these pens. Another product that may be used is a five- or six-piece wooden sphere or cube puzzle. Yet another idea is to assemble small Lego vehicle kits; these may be purchased at a department store such as Wal-Mart or a toy store such as Toys-R-Us.

This particular activity will use two types of ballpoint pens purchased from Office Max. You will need to purchase enough pens to enable several groups to work at the same time. Additionally, you will need to have enough stopwatches and clipboards to time each group and to record data. Pen parts are identified as follows:

**RETRACTABLE BALLPOINT PENS**

*Bic Clear Click (WCCM11CL)*

1. lower barrel
2. upper barrel (includes pocket clip)
3. decorative ring
4. spring
5. ink-filled ballpoint stick
6. upper extension/retraction lever
7. lower extension/retraction lever
8. metal lever cover barrel

*Bic Soft Feel (SCSM11)*

1. barrel
2. top (includes pocket clip)
3. tip
4. spring
5. ink-filled ballpoint stick
Method of Evaluation

1. Teacher observation.
2. Comparison of students’ drawings to drafting standards.
3. Written test.

Correlation to Standards

**Georgia Academic Standards for Technology Education for 9th-12th Grades**
- Nature of Technology 1, 2, 10
- Human Ingenuity 1, 3, 4, 5
- Technological Systems 2
- Impact of Technology

**Quality Core Curriculum for 9th-12th Grades**
- TCCORE: 9-12.9, 14, 30
- TECHED: 9-12.34, 40, 41

**National Standards for Technological Literacy for 9th-12th Grades**
- Technology and Society – 7: N, O
- Design – 8: I; 9: I, K
- Abilities for a Technological World – 11: M, N, Q, R; 12: L, P; 13: J
- The Designed World – 17: P

**Course: Communication Technology**

**Course number: 21.431**

**State Course Description**

The Communication Technology course presents communication technology capabilities through activities with graphic arts, photography, electronic communication, drafting, computer-aided design (CAD), and media as well as information, storage, and retrieval. The course emphasizes the concepts that underlie each application.

**Detailed Course Description**

This course is designed to further introduce the scope of contemporary workplace technologies and practices related to the graphic and electronic communication industries. Students will focus on modules and activities in graphic and electronic communications. This class utilizes various teaching strategies, including small group, paired, and individual activities, to enhance skills in computer-aided publishing, digital imaging, video editing, and television broadcasting. Emphasis will be placed on the role of electricity and electronics in modern communications. Additionally, skills in the use of the Internet and PowerPoint presentations will be further developed and incorporated throughout the course. Moral and ethical uses of communication technology will be discussed.

**Objectives**

The student will perform and/or demonstrate the following:

- How to express and integrate ideas in written, oral, graphical, and electronic forms.
- How to function safely and ethically in the work environment.
- The ability to follow the function of a communication system and to effectively apply the system.
- The evolution of communication technology and its social impact.
- How to use the computer as a tool, resource, and an effective research vehicle.
- How to apply video and audio resources.
- How to cooperatively apply skills in a major collaborative or team effort.
- The ability to complete designated assignments in a modular environment in a specified time frame.
• How to integrate written, oral, graphical, and electronic forms into a presentation for a diverse audience.
• The process of developing basic leadership qualities and characteristics.

**Georgia Academic Standards for Technology Education for 9th-12th Grades**
• Nature of Technology 2, 3, 4, 5
• Human Ingenuity 2, 4, 5, 8
• Technological Systems 1, 2, 3, 5, 6, 8, 10
• Impact of Technology 1, 2, 4, 5, 6, 7, 8, 9

**Quality Core Curriculum for 9th-12th Grades**
• TCCORE: 9-12.1 - 31
• TECHED: 9-12.32 - 45

**National Standards for Technological Literacy for 9th-12th Grades**
• Technology and Society – 4: H, J; 7: G, H, I, J, N,O
• The Designed World – 17: L, M, N, O, P, Q

**Sample Instructional Activity**

**Trifold Brochure**

**Description**
Students design and print a two-sided trifold brochure on either letter- or legal-sized paper, promoting a student organization or academic department in their school. This activity involves the application of computer skills, including document composition, layout and design, use of graphics, digital imaging, font and color management, production scheduling, cost management, and so on. The brochure is created using publishing software such as PageMaker or Microsoft Publisher.

**Concepts**
In completing this activity students become engaged in the following concepts:

**Technology Education Concepts**
• How to organize and lay out printed materials.
• How to choose appropriate fonts and font sizes.
• How to appropriately use headers, footers, and headlines.
• How to use color or gray scale appropriately.
• How to properly choose, insert, and size appropriate clipart or digital images.
• How to develop a production timeline and meet deadlines.
• How to calculate costs and figure profit/loss.
• How to use feedback to evaluate the final product against the desired/planned product.

**Mathematics Concepts**
• Measurement of margins, columns, gutters, headers, and footers.
• Parallel and perpendicular lines.
• Planning, calculating, measuring, and adjusting time factors.
• Calculating material and labor costs, profit margin, sales price, profit/loss.

**Science Concepts**
• Use of recycled paper to promote environmental awareness.

**Social Science Concepts**
• Planning and organizing techniques used in design processes.
• Teamwork, cooperative production groups.
• Management/labor issues.
• Ethical issues relating to copyright and libel.
• Workplace safety, OSHA guidelines.
• Personnel evaluation.

**Communication Concepts**
• Using printed materials to sell or inform.
• Proper use of language, including spelling, grammar, and choice of words.
• Target audience.
**Procedure**

1. Divide the class into production teams.
2. Have the production teams choose the student organization or academic department about which they will create the brochure.
3. Plan for production. Organize. Each group will determine necessary tasks, who will do each task, and draw up a chart itemizing these tasks and assignments. Additionally, the group must calculate the amount of time necessary to do each task and the entire assignment.
4. Research, collect, and organize the information to be used in the brochure.
5. Plan and sketch layout and design on a piece of letter- or legal-sized piece of paper.
6. Produce the printed document, being careful that folding leaves proper margins around text.
7. Calculate production workers’ hours, material costs, profit margin, and sales price.
8. Evaluate individual and group performances. Evaluate the finished product to see if it meets planned outcomes.
9. Document the group’s work in a portfolio; each participant will use this as a part of his or her individual student portfolio.

**Equipment/Supplies**

- Computer(s), color printer, laser printer, scanner, computer-aided publishing software, computer clipart
- Paper, legal- and letter-sized
- Pencils, pens, rulers, drawing tools
- Digital camera
- Floppy disks (if needed)
- Graphic arts textbook (for reference about industry standards and practice)

**Method of Evaluation**

1. Teacher observation.
2. Comparison of students’ brochures to publishing standards.
4. Student personal evaluations.
5. Teacher-made evaluation rubric.
6. Teacher-made test.

**Correlation to Standards**

**Georgia Academic Standards for Technology Education for 9th-12th**

- Nature of Technology 1, 2, 3, 10
- Human Ingenuity 1, 2, 4, 5
- Technological Systems 2, 3, 4, 5, 6

**Quality Core Curriculum for 9th-12th Grades**

- TCCORE: 9-12: 1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 20, 21, 22, 23, 24, 26, 28, 30, 31
- TECHED: 9-12: 32, 34, 35, 36, 38, 39, 40, 41

**National Standards for Technological Literacy for 9th-12th Grades**

- The Nature of Technology – 2: W, X, Y, Z; 3: J
- Technology and Society – 7: O
- Design – 8: H, I, J, K; 9: K
- The Designed World –17: L, M, N, O, P, Q
State Course Description
This course introduces a broad overview of drafting technology and covers sketching as well as mechanical, architectural, and computer-aided drafting.

Detailed Course Description
This course is designed to introduce 2-D and 3-D sketching, geometric construction, multiview drawing, CAD, dimensioning, section drawing, and 3-D modeling. It introduces the student to processes involved in producing a manufactured part.

Objectives
The student will perform and/or demonstrate the following:
• How to sketch 2-D and 3-D drawings.
• How to use the concept of the six principles views in preparing drawings.
• How to use the ruler and scales.
• How to use the theory of orthographic projection in preparing multiview drawings.
• How to create basic isometric and oblique pictorial drawings.
• How to create and use basic section drawings.
• How to correctly apply line weights, symbols, and notes in mechanical drawings.
• How to correctly apply the rules of dimensioning in mechanical drawings.

Georgia Academic Standards for Technology Education for 9th-12th Grades
• Nature of Technology 1-10
• Human Ingenuity 1, 2, 3, 4, 5, 6, 10
• Technological Systems 1, 2
• Impact of Technology 2, 4, 6, 9

Quality Core Curriculum for 9th-12th Grades
• TCCORE: 9-12.1 – 31
• TECHED: 9-12.32 - 36, 38 - 41, 43 - 45

National Standards for Technological Literacy for 9th-12th Grades
• The Nature of Technology – 1: L; 3: G, J
• Technology and Society – 7: G, H, O
• Design – 8: H, I, J
• Abilities for a Technological World – 13: J
• The Designed World –17: L, O, P

Sample Instructional Activity
Pictorial representations (isometric and oblique)

Description
In this activity the students create images representing three-dimensional objects created in isometric and oblique projections. This activity may be accomplished on paper or using a computer-aided drafting software application.

Concepts
In completing this activity students become engaged in the following concepts:

Technology Education Concepts
• Technology Education Concepts
• How to sketch 2-D and 3-D drawings.
• How to use the concept of the six principles views in preparing drawings.
• How to use the rulers and scales.
• How to create isometric and oblique pictorial drawings.
• How to correctly apply the rules of dimensioning in mechanical drawing.

Mathematics Concepts
• Measurement
• Geometric construction
• Spatial orientation
• Parallel and perpendicular lines
• Common, irregular, acute, and obtuse angles
Science Concepts
- Vectors
- Use of symbols to represent objects

Social Science Concepts
- Planning and organizing techniques used in design processes.

Communication Concepts
- Graphical representation of an animate object.
- Use of a graphics as a language.

Procedure
This may be handled as a sketching unit or using the drafting tools or a CADD program.
1. Assign an appropriate unit in your textbook along with review questions and any worksheets that will help your students understand the concepts being presented.
2. Begin with a few basic 2-D drawings (flat sketches) to help the student visualize how to go from 2-D to 3-D.
3. Extrude the flat sketches into 3-D objects by teaching the correct axis with which to begin the drawing. Present the students with a step-by-step method to complete each type of drawing. This is important because some will not understand the concept immediately. They can succeed, however, by learning the method that you present.
4. Assign several of each type of drawing by giving the students a dimensioned drawing to get the necessary measurements. Be sure to cover when it is most appropriate to use each type of drawing and the differences in each type.

Equipment/Supplies
- Grid paper or drawing paper
- Drafting tools (if used)
- CADD software and computer (if used)
- Textbooks and handouts (if used)

Method of Evaluation
1. Teacher observation.
2. Comparison of students’ drawings to drafting standards.
3. Written test.

Correlation to Standards

Georgia Academic Standards for Technology Education for 9th-12th
- Nature of Technology 1, 2, 10
- Human Ingenuity 1, 3, 4, 5
- Technological Systems 2

Quality Core Curriculum for 9th-12th Grades
- TCCORE: 9-12.1, 3, 4, 6, 9, 10, 13, 17, 21, 22, 23, 24, 26, 28, 31
- TECHED: 9-12.32, 33, 34, 35, 36, 38, 40, 41

National Standards for Technological Literacy for 9th-12th Grades
- Technology and Society – 7: O
- Design – 8: I, J
- Abilities for a Technological World –13: J
- The Designed World –17: L, P
State Course Description
The Drafting Technology Mechanical course presents the international language of lines and symbols related to mechanical engineering and emphasizes basic drafting skills, sketching, orthographic projections, and pictorial drafting. The course uses board and electronic media for problem solving.

Detailed Course Description
This course is designed to introduce more in-depth studies of 2-D and 3-D sketching, multiview drawing, CAD, dimensioning, section drawing, and 3-D modeling. Students are also introduced to working drawings, assembly drawings, reading a micrometer, and the vernier caliper. Students use basic problem-solving techniques to achieve solutions to mechanical drafting-related problems. The course introduces students to advanced processes involved in producing a manufactured part.

Objectives
The student will perform and/or exhibit knowledge of the following:
• How to sketch detailed 2-D and 3-D drawings.
• How to use the concept of the six principles views in preparing drawings.
• How to use rulers, scales, a micrometer, and a vernier caliper.
• How to use the theory of orthographic projection in preparing multiview drawings.
• How to create advanced isometric and oblique pictorial drawings.
• How to create and use the common types of section drawings.
• How to correctly apply line weights, symbols, and notes in mechanical drawings.
• How to correctly apply the rules of dimensioning in mechanical drawings.
• How to create working drawings.

• How to create assembly drawings.
• How to use problem-solving techniques to achieve solutions to drafting-related problems.

Georgia Academic Standards for Technology Education for 9th-12th Grades
• Nature of Technology 1-10
• Human Ingenuity 1, 2, 3, 4, 5, 6, 10
• Technological Systems 1, 2
• Impact of Technology 2, 4, 6, 9

Quality Core Curriculum for 9th-12th Grades
• TCCORE: 9-12.1 - 31
• TECHED: 9-12.32 - 45

National Standards for Technological Literacy for 9th-12th Grades
• Technology and Society – 4: J; 5: H, I; 6: J; 7: G, H, N, O
• Design – 8: H, I, J, K; 9: K
• Abilities for a Technological World – 11: M, O; 13: J, K, L
• The Designed World –17: L, O, P, Q; 18: J; 19: M, N, P, R

Sample Instructional Activity
Assembly Drawings

Description
In this activity the students create images representing three-dimensional objects created in isometric projections. They will be assembly drawings. Assembly drawings show an object exploded apart so that all pieces of the object can be seen. The pieces must be arranged so that each part of the object is drawn in proper relationship to the other parts of the object such that the object could be pushed back together and the pieces would fit. To successfully accomplish this task, the student should have a working knowledge of the object in question. The more the student knows about how the object works and how its pieces fit together, the easier this process becomes. This activity may be accomplished on paper or using a computer-aided drafting software application.
Concepts
In completing this activity students become engaged in the following concepts:

Technology Education Concepts
• How to draw 3-D drawings.
• How to use the concept of the six principles views in preparing drawings.
• How to use rulers and scales.
• How to create isometric pictorial drawings.
• How to apply the concept of the assembly drawing.

Mathematics Concepts
• Measurement
• Geometric construction
• Spatial orientation
• Parallel and perpendicular lines
• Common, irregular, acute, and obtuse angles

Social Science Concepts
• Planning and organizing techniques used in design processes.

Communication Concepts
• Graphical representation of an animate object.
• Use of graphics as a language.

Procedure
This may be handled as a sketching unit or using the drafting tools or a CADD program.

1. Assign an appropriate unit in your textbook along with review questions and any worksheets that will help your students understand the concepts being presented.
2. Begin by assigning an object that the students can see fully assembled. Provide them with working drawings of the pieces of the object and any other written or drawn details of how the object is put together. Have them prepare the drawing.
3. Assign each student an object that he or she must take apart and then measure each part. Have the student prepare an assembly drawing from this data.

Equipment/Supplies
• Drawing paper
• Drafting tools (if used)
• CADD software and computer (if used)
• Textbooks and handouts (if used)

Method of Evaluation
1. Teacher observation.
2. Comparison of students’ drawings to drafting standards.
3. Written test.

Correlation to Standards

Georgia Academic Standards for Technology Education for 9th-12th
• Nature of Technology 1, 2, 10
• Human Ingenuity 1, 3, 4, 5
• Technological Systems 2

Quality Core Curriculum for 9th-12th Grades
• TCCORE: 9-12.1, 3, 4, 5, 6, 8, 9, 13, 17, 21, 22, 23, 24, 26, 28, 31
• TECHED: 9-12.32, 33, 34, 35, 36, 38, 39, 40, 41, 44, 45

National Standards for Technological Literacy for 9th-12th Grades
• The Nature of Technology – 1: J, K; 2: W, AA
• Abilities for a Technological World – 13: J
• The Designed World – 19: M, P
Course: Drafting Technology Architectural
Course number: 21.434

State Course Description
The Drafting Technology Architectural course presents the international language of lines and symbols related to architectural engineering and emphasizes print reading, design, floor plan development, perspective solutions, and rendering. The course uses board and electronic media for problem solving.

Detailed Course Description
This course is designed to introduce the basic aspects of residential architectural drafting. The student learns to produce all necessary industry-standard drawings to build a residential home.

Objectives
The student will perform and/or exhibit knowledge of the following:
• Common architectural styles and basic house design.
• How to correctly plan the location of the rooms of the house in relation to the three major areas of the house and traffic patterns.
• How to draw a plot plan.
• Basic concepts of footings and foundations and how to draw a foundation plan.
• How sills and floors are constructed and drawn.
• How walls and ceilings are constructed and drawn.
• How doors and windows are constructed and drawn.
• How stairs are constructed and drawn.
• How fireplaces and chimneys are constructed and drawn.
• How to draw and dimension a floor plan.
• How common roof designs are constructed and drawn.
• How to draw elevations.
• The electrical code and how to draw electrical plans.

Georgia Academic Standards for Technology Education for 9th-12th Grades
• Nature of Technology 1-10
• Human Ingenuity 1, 2, 3, 4, 5, 6, 10
• Technological Systems 1, 2
• Impact of Technology 2, 4, 6, 9

Quality Core Curriculum for 9th-12th Grades
• TCCORE: 9-12.1 - 31
• TECHED: 9-12.32 - 45

National Standards for Technological Literacy for 9th-12th Grades
• Design – 8: H, I, J, K; 9: K
• Abilities for a Technological World – 11: M, O, Q, R; 13: J, K, L, M
• The Designed World –17: L, O, P, Q; 20: J, K, L, M, N

Sample Instructional Activity
Wall Sections

Description
In this activity the students create wall section drawings to scale. In order to completely understand the wall sections, they must learn the basic construction techniques involved in a standard house from foundation to roof. Students also must learn the standard materials used in house construction from ceiling to floor. This unit may be completed with drafting tools or with a CADD system.
In completing this activity students become engaged in the following concepts:

**Technology Education Concepts**
- How to draw a full wall section.
- How to use the concept of cutting a full section of a house out on paper.
- How to use rulers and scales.
- How to correctly apply the rules of dimensioning in architectural drawing.

**Mathematics Concepts**
- Measurement
- Geometric construction
- Spatial orientation
- Parallel and perpendicular lines
- Common, irregular, acute, and obtuse angles

**Science Concepts**
- Units of measurement.
- Characteristics and compositions of metals and woods.

**Social Science Concepts**
- Planning and organizing techniques used in design processes.

**Communication Concepts**
- Graphical representation of an animate object.
- Use of graphics as a language.

This project may be handled as a sketching unit or by using the drafting tools or a CADD program.

1. Assign an appropriate unit in your textbook along with review questions and any worksheets that will help your students understand the concepts being presented.
2. Begin with a well-organized section on building materials and standard construction techniques.
3. You can have the students complete the wall section after they have completed their research on the standard materials and techniques or let them work on their drawings in phases as they reach certain points in their research.
4. Assign a wall section that utilizes different building techniques from those used in the first one they completed.
5. Have the students compare the two and prepare a presentation on the strengths and weaknesses of each and when it is most appropriate to use each one.

**Equipment/Supplies**
- Drawing paper
- Drafting tools (if used)
- CADD software and computer (if used)
- Textbooks and handouts (if used)

**Method of Evaluation**
1. Teacher observation.
2. Comparison of students’ drawings to drafting standards.
3. Written test.

**Correlation to Standards**

**Georgia Academic Standards for Technology Education for 9th-12th**
- Nature of Technology 1, 2, 10
- Human Ingenuity 1, 3, 4, 5

**Quality Core Curriculum for 9th-12th Grades**
- TCCORE: 9-12.1, 3, 4, 5, 6, 8, 9, 13, 17, 21, 22, 23, 24, 26, 28, 31
- TECHED: 9-12.32, 34, 35, 36, 38, 39, 40, 41, 44, 45

**National Standards for Technological Literacy for 9th-12th Grades**
- The Nature of Technology – 1: J, K; 2: W, AA
- Technology and Society – 4: I
- Abilities for a Technological World – 11: Q, R; 13: J
- The Designed World – 20: J, K, L, M, N
Course: Graphic Arts Technology
Course number: 21.435

State Course Description
The Graphic Arts Technology course presents the tools, material, and processes involved in the mass production of photography and printing, such as intaglio, relief, piano-graphic, screen process printing, and thermography. The course includes using a camera and instruction in composition, imposition, press work, and computer-aided publishing.

Detailed Course Description
This course is designed to address the production of printed images such as newspapers, brochures, printed T-shirts, signs, photographs, letterhead, and business cards. Students design, plan, and reproduce products similar to those produced by today’s printing industry. Learners increase their knowledge of contemporary resources, process, and impacts of graphic arts enterprise and acquire related skills. Activities in this course may include graphic design, computerized image composition, screen printing, continuous tone and process photography, prepress production, image transfer, and finishing processes.

Objectives
The student will perform and/or exhibit knowledge of the following:

- The appropriate communication design processes and techniques to develop a variety of communication products that conform to industry standards.
- Management approaches by participating in the organization and operations of a real or simulated project.
- The skills needed to develop a budget and determine the most effective strategies to minimize costs.
- The integration of ideas in written, oral, graphical, and electronic forms to present to a real or simulated client.
- Ability to solve problems with technological resources using a systems approach, requiring higher-order thinking skills and collaborative ingenuity.
- Leadership, teamwork, career advancement, and honest work habits through cocurricular academic/vocational student organization activities.
- Safe, ethical, and desirable behavioral standards required in a competitive environment.

Georgia Academic Standards for Technology Education for 9th-12th Grades
- Nature of Technology 1, 3, 4, 6, 7, 10
- Human Ingenuity 1, 2, 4, 5, 8, 9
- Technological Systems 2-6, 10
- Impact of Technology 1-3, 5, 6, 9

Quality Core Curriculum for 9th-12th Grades
- TCCORE: 9-12.1 - 31
- TECHED: 9-12.32, 34, 35, 36, 38, 39, 40, 41, 42, 43, 44, 45

National Standards for Technological Literacy for 9th-12th Grades
- The Designed World –17: L, M, N, O, P, Q

Sample Instructional Activity
Trade Customs in the Printing Industry (record-keeping system for printing jobs)

Description
In this activity students learn the set of practices for business transactions in the printing industry. In management practices, students must understand and form a competence in organizing an accurate record-keeping document for customers. A knowledge of production scheduling and cost management is essential to understanding the printing industry.
Concepts
In completing this activity students become engaged in the following concepts:

Technology Education Concepts
• How to organize documentation for job efficiency.
• How to calculate costs.
• How to appropriate work with prospective customers.
• How to use materials and resources appropriately.
• How to schedule production components.
• How to develop a production timeline and meet deadlines.

Mathematics Concepts
• Planning, calculating, measuring, and adjusting time factors.
• Calculating material and labor costs, profit margin, sales price, profit/loss.

Social Science Concepts
• Planning and organizing techniques used in the workplace.
• Management/labor issues.
• Ethical issues relating to copyright and libel.

Communication Concepts
• Using documented materials to inform prospective customers.
• Proper use of language, including spelling, grammar, and choice of words.
• Target audience.
• Customer relations.

Procedure
Have students work individually.
1. Assign or have each student choose a product to complete from design to delivery of the final product to the customer.
2. Provide students with two copies of a job record-keeping form. This form should contain the following information: (1) for whom and where the job will be performed; (2) purchase order number; (3) job number and date; (4) job description; (5) job schedule; (6) job estimate given to customer; (7) in-house instructions; (8) outside purchases; (9) time records; (10) task designations; and (11) billing information.
3. Research, collect, and organize the information to be used on the record-keeping form before the job starts production.
4. Students may use reference books (e.g., customer, class textbook, Pocket Pal handbook, supply expense directory).
5. Students should attach the form to the job jacket that holds all camera-ready art, masking sheets, and plates.
6. As students work through the process of completing the product, they should keep track of the amount of time spent in each phase of the activity.
7. Have the students calculate production workers’ hours, material costs, profit margin, and sales price.
8. Evaluate individual performances. Evaluate the finished product to see if it meets planned outcomes.
9. Have students document the work and completed product in a student portfolio.

Equipment/Supplies
• Computer(s), color printer, laser printer, scanner, computer-aided publishing software, computer clipart
• Paper, ink, standard printing materials and chemicals
• Standard printing equipment (i.e., horizontal or vertical camera, light table, plate maker, printing press, and finishing equipment)
• Graphic arts reference books (for reference about industry standards and practice)
• Copy of the printing industry trade customs (contact local printer to obtain copy)

Method of Evaluation
1. Teacher observation.
2. Comparison of students’ products to publishing standards.
3. Customer evaluations.
4. Student personal evaluations.
5. Teacher-made evaluation rubric.
Correlation to Standards

Georgia Academic Standards for Technology Education for 9th-12th
• Nature of Technology 1, 3, 6
• Human Ingenuity 1, 4, 5, 9
• Technological Systems 3-6
• Impact of Technology 3, 9

Quality Core Curriculum for 9th-12th Grades
• TCCORE: 9-12.1 – 7, 9 - 13, 15 - 19, 21, 23 – 28, 30
• TECHED: 9-12.34, 36, 38, 39, 40, 41, 44, 45

National Standards for Technological Literacy for 9th-12th Grades
• The Nature of Technology – 1: M; 2: W, Y, Z, AA, DD, EE, FF; 3: J
• Technology and Society – 4: J; 6: J; 7: G, O
• Design – 10: L
• Abilities for a Technological World – 11: M, N, P, Q, R; 12: L, P; 13: J
• The Designed World –17: L, M, N, O, P, Q

Course: Materials and Processes Technology I
Course number: 21.441

State Course Description
The Materials and Processes Technology I course presents material and processes (separating, combining, forming, conditioning, and finishing) as a managed sequence of activities to convert an idea into a manufactured product or service.

Detailed Course Description
This course is designed to familiarize students with the materials and processes used to turn materials into useful products. The student will collaborate with the instructor to create individualized project plans. These plans will include separating, combining, forming, conditioning, and finishing materials in a managed sequence of activities to convert an idea into a manufactured product or a service. These activities can be individual or team based.

Objectives
The student will perform and/or exhibit knowledge of the following:
• The differences that exist among materials and an understanding of the nature of those differences.
• The differences that in materials are comprised of compatibility, composition, and testability.
• Awareness that industry standards exist for all materials used in production processes.
• The ability to use various tools and how they apply to industrial processes.
• The ability to develop critical, insightful points of view concerning personal preferences and career options available in the materials and processing areas of industry.
• The ability to complete designated assignments in a directed group environment in a specified time frame.
• How to express and integrate ideas in written, oral, graphical, and electronic forms.
• How to function safely and ethically in the work environment.
Georgia Academic Standards for Technology Education for 9th-12th Grades

- Nature of Technology 1-10
- Human Ingenuity 1-10
- Technological Systems 1-10
- Impact of Technology 1, 2, 4, 6, 7, 8, 9

Quality Core Curriculum for 9th-12th Grades

- TCCORE: 9-12: 1, 2, 3, 4, 6, 7, 8, 9, 10, 12, 13, 14, 15, 17, 18, 21, 22, 23, 24, 25, 26, 28, 31
- TECHED: 9-12: 32, 33, 34, 35, 36, 37, 38, 40, 41

National Standards for Technological Literacy for 9th-12th Grades

- Design – 8: H, I, J, K
- The Designed World – 19: L, M, N, O, P, Q, R

Sample Instructional Activity

Assembly in Manufacturing (nameplate)

Description

In this activity the students manufacture and assemble a product that is made from three different materials. These three different materials are fashioned or worked in three different manufacturing processes.

Concepts

In completing this activity students become engaged in the following concepts:

Technology Education Concepts

- How to produce technical drawings.
- How to use specifications and tolerances.
- How to manufacture a nameplate using a CNC milling machine.
- How to manufacture a base using traditional woodworking machinery.
- How to manufacture a decal using computer-aided publishing equipment.
- How to manufacture assembly jigs and fixtures.

Mathematics Concepts

- Linear measurement
- Polar coordinates
- Arcs, circles, and irregular curves
- Parallel and perpendicular lines
- Acute and right angles
- Duplication
- Repetition

Science Concepts

- Origin and properties of different materials. How are they processed or made?
- Observation of physical changes in matter.
- Human use of natural resources.

Social Science Concepts

- Planning and organizing techniques used in design processes.
- Cooperative work groups.
- Management and labor relationships.

Communication Concepts

- Graphical representation of an animate object.
- Use of graphics as a language.
- Generating and following directions.
- Evaluation and feedback.
- Documentation.
- Portfolio.

Procedure

1. Create a nameplate as one of the activities in the CNC mill module. Be sure that each nameplate has a customized name engraved on ?” Plexiglas of the desired dimensions.
2. Design a wooden base on which to mount the nameplate. Create technical drawings, specifications, and a parts list using computer-aided design software.
3. Design and produce jigs and fixtures to be used in manufacturing and assembly.
4. Design and produce a decal to be added to the wooden base. This decal can represent the school, student organization, or some special event or occasion.
5. Assemble the product, making sure that there are enough of them to fill the order or provide class-
6. Document every step in each operation. Use digital pictures or videotape.
7. Maintain quality control through the use of evaluation and feedback.
8. Prepare portfolio entries that can be used by each member of the operation.

**Equipment/Supplies**
- Computers, printers/plotter, computer clipart, CAD and CAP software
- Drawing paper
- Decal paper
- 1/8” Plexiglas cut into specified rectangular pieces
- Specified wood for base
- Liquid Nails adhesive
- Woodworking machinery
- Measuring tools

**Method of Evaluation**
1. Teacher observation.
2. Comparison of students’ drawings to drafting standards.
3. Student and teacher evaluation using teacher-made rubric.
4. Student portfolio.

**Correlation to Standards**

**Georgia Academic Standards for Technology Education for 9th-12th Grades**
- Nature of Technology 2, 4, 10
- Human Ingenuity 1, 2, 3, 4, 5, 9
- Technological Systems 1, 2, 3, 5,

**Quality Core Curriculum for 9th-12th Grades**
- TCCORE: 9-12: 1 - 4, 6, 7, 8, 9, 10, 12, 13, 14, 15, 17, 18, 21, 22, 23, 24, 28, 31
- TECHED: 9-12: 32, 33, 34, 35, 36, 38, 40, 41

**National Standards for Technological Literacy for 9th-12th Grades**
- Design – 8: H, I, J
- Abilities for a Technological World – 11: M, O; 13: J
- The Designed World – 19: L, M, N, O, P, Q, R

**Course: Production Technology I**

**Course number: 21.442**

**State Course Description**
The Production Technology I course presents manufacturing and construction activities in the production of products and covers management, research, development, marketing, and servicing as used by industries providing goods and services.

**Detailed Course Description**
This course is designed to provide an opportunity for students to organize and operate a manufacturing company to explore careers and work ethics typical of American industry’s free enterprise system. Students create products within the company while being exposed to the work of planners, designers, engineers, machine operators, personnel managers, and a variety of other manufacturing careers. Students study common manufacturing tools, machines, materials, and processes in the laboratory.

**Objectives**
The student will perform and/or exhibit knowledge of the following:
- Concerns about the historical perspective of manufacturing and the ability to distinguish between the advantages and disadvantages of manufacturing.
- The interrelationship between manufacturing and other technologies.
- The ability to categorize the parts of a manufacturing system model and apply the divisions of a manufacturing organization.
- Organize and participate in an assembly-line function of a classroom manufacturing company.
- How to make accurate measurements to the smallest gradations indicated on the measuring tool being used.
- Safe basic operations with power tools.
- The significance of manufacturing’s impact on the students’ lives and how manufacturing itself has been affected by society and the environment.

**Georgia Academic Standards for Technology Education for 9th-12th Grades**
- Nature of Technology 3, 4, 5, 7, 8,10
• Human Ingenuity 1, 2, 3, 5, 7, 8, 9, 10
• Technological Systems 1, 2, 3, 4, 6, 7, 10
• Impact of Technology 1, 2, 3, 7, 8, 9

Quality Core Curriculum for 9th-12th Grades
• TCCORE: 9-12: 1, 2, 3, 4, 6, 7, 8, 9, 10, 12, 13, 14, 15, 17, 18, 21, 22, 23, 24, 25, 26, 28, 31
• TECHED: 9-12: 32, 33, 34, 35, 36, 37, 38, 40, 41

National Standards for Technological Literacy for 9th-12th Grades
• Design – 8: H, I, J, K; 9: K
• The Designed World – 17: P, Q; 19: L, M, N, O, P, Q, R

Sample Instructional Activity

Playing the Game

Description
Assume that you live in a single-parent household with your mother and twin brothers. Because of this living arrangement and your older age, you are often asked to watch your eight-year-old twin brothers while your mother does the grocery shopping. While you appreciate the groceries, watching the twin brothers can become quite tiring. You have tried everything to entertain the boys. However, the twins usually end up trashing your room and going through your private things. Your family lives on a very tight budget so you are not able to buy new toys that might be used to entertain the twins.

You remember that the twins like board games. Your mother suggests that you and your friends design a board game that could be used to entertain the twins. While discussing the idea with friends and neighbors, you learn that the local educational store often buys locally made board games to sell. By creating an interesting game for the twins, you could also make a little extra spending money. Your task is to design a board game using only the materials listed in this activity.

The game should not resemble any games currently on the market since you can only sell original games to the educational store.

Concepts
In completing this activity students become engaged in the following concepts:

Technology Education Concepts
• Technology Education Concepts
• Write a description of the manufacturing process.
• Demonstrate tool and machine safety.
• Measure accurately with a ruler.
• Operate a band saw, drill press, router, and stationary belt and disc sander.
• Use manufacturing processes to determine quality assurance.
• Determine the kinds and uses of woods in manufacturing.
• Explain how manufacturing affects our lives.
• List some of the advantages and disadvantages of the manufacturing process.
• Identify and utilize specific job skills required in the manufacturing process.

Mathematics Concepts
• Measurement
• Geometric layout

Science Concepts
• Following instructions.
• Observing physical changes to materials.

Social Science Concepts
• Planning and organizing techniques used in design processes.
• Cooperative learning.

Communication Concepts
• Bill of material
• Brainstorming
• Technical writing

Procedure
1. Investigation procedures – Complete the following steps as you identify and refine ideas for your product:
   A. Locate the materials that are available for making the game.
   B. Discuss and brainstorm ideas for the design of the game.
C. Develop five to ten possible designs for your game, taking care to include the limitation set by the instructor.

D. Sketch your design ideas on the worksheet. The design sketches do not have to be perfect but should give you ideas to work with.

E. Select the best idea or combine several ideas to create the final design idea.

F. Develop a drawing of the final board game idea, using drafting materials, computer-aided drafting, or the worksheet provided.

G. Develop drawings of the package and logo/name that will be used for the final version of the board game, using the worksheet provided.

2. Developing your product – Complete the following steps as you create a three-dimensional prototype of your product:

A. Begin laying out, cutting, decorating, and assembling the board game. Note: Use the drawings you developed during the investigation phase of this activity.

B. While one member of your team is completing this first step, other members of your team could begin developing and word processing the directions for the board game.

C. Simultaneously other members of your team could begin developing the packaging name and logo materials that will be used on the board game and package.

D. When the board game, name and logo, directions, and package are complete, your team should complete the following assembly activities.

E. Affix the directions to the board game.

F. Prepare the package by attaching the board game name and logo as well as parental guidelines and any assemble instructions.

G. Complete the assembly by packaging the board game within the previously designed package.

**Equipment/Supplies**

- One 9” x 12” x 18” plywood base
- Miscellaneous cardboard
- One 1/8” x 12” x 12” sheet of acrylic
- One 9” x 12” wooden dowel rod
- 12 marbles
- Two ballpoint pen springs
- Four large rubber bands
- 12 tongue depressors
- 24” of cotton string
- One hot-glue gun
- One roll of masking tape
- Miscellaneous paint and brushes
- Miscellaneous woodworking tools
- Miscellaneous nails and screws
- Worksheets

**Method of Evaluation**

1. Teacher observation.
2. Inspection of the finished product.
3. Student presentation.

**Correlation to Standards**

*Georgia Academic Standards for Technology Education for 9th-12th*

- Nature of Technology 4, 5,10
- Human Ingenuity 1, 2, 3, 5, 7, 8, 9, 10
- Technological Systems 1, 2, 3, 4, 6, 7, 10
- Impact of Technology 3, 7, 8, 9

*Quality Core Curriculum for 9th-12th Grades*

- TCCORE: 9-12: 1, 2, 3, 4, 6, 7, 8, 13, 14, 15, 21, 22, 23, 24, 25, 28, 31
- TECHED: 9-12: 32, 35, 36, 37, 38, 40, 41

*National Standards for Technological Literacy for 9th-12th Grades*

- Technology and Society – 4: I, J; 5: K; 7: G, O
- Design – 8: H, I, J, K; 9: K
- The Designed World – 17: P, Q; 19: L, M, N, O, P, Q, R

**NOTE:** For a more detailed description of this activity, including drawings and directions for worksheets, see the 1997 International Technology Education Association “Product Design,” Senior Editor, Thomas Wright, DTE.
Course: Production Technology II  
Course number: 21.443

State Course Description
The Production Technology II course presents construction activities of the building industry and includes management, development, electrical wiring, framing, print reading, and other aspects of the structural engineering industry.

Detailed Course Description
This course is designed to introduce students to recent methods and materials used in the construction industry while they learn how to process information and manage resources. Students will enhance their problem-solving abilities and improve communication and whole-group skills by completing CAD architectural drawings. Students will design, build, and test scale-model structures, using common construction tools, machines, and processes.

Objectives
The student will perform and/or exhibit knowledge of the following:
- The importance of technological advancement in areas related to the construction industry.
- How the economy affects the construction industry.
- How to draw architectural plans and make models from those drawings.
- The proper way to safely execute the functions of cutting, sawing, and drilling with the appropriate tools.
- Accurate measurements to the smallest graduations indicated on the measuring tool being used.
- Safe basic operations with construction power tools.
- Construction of a model wall section with electrical, plumbing, and other fixtures placed correctly.
- The skills needed to develop an estimate of materials listing and determine the most effective strategies to minimize costs.

Georgia Academic Standards for Technology Education for 9th-12th Grades
- Nature of Technology 3, 4, 5, 6, 8, 10
- Human Ingenuity 1, 2, 3, 5, 8, 9
- Technological Systems 1, 2, 6, 7, 9, 10
- Impact of Technology 3, 7, 9

Quality Core Curriculum for 9th-12th Grades
- TCCORE: 9-12: 1 - 31
- TECHED: 9-12: 32 - 45

National Standards for Technological Literacy for 9th-12th Grades
- Design – 8: H, I, J, K; 9: K

Instructional Activities
Estimating Materials

Description
In this activity the students use three different methods to estimate the number of squares of shingles necessary to cover different styles of roofs.

Concepts
In completing this activity students become engaged in the following concepts:

Technology Education Concepts
- Determine the total area of a roof from a plan when the roof slope is given.
- Calculate the number of squares of shingles needed to cover a hip roof and a gable roof.
- Fill out a cost estimation report.
- Calculate labor for installing a roof.

Mathematics Concepts
- Measurement
- Geometry
- Calculating area using a standard formula.
- Basic multiplication and division
- Estimating

Science Concepts
- Comparing data to determine best method.
Procedure
To determine the number of shingles needed, the total area to be covered must be figured first. To figure the roof area without actually getting on the roof to measure the roofline, use the chart in figure 1. When the roof slope is known, this chart may be used to figure the roof area from the plan. The plan area of the roofline (including the overhang) should be multiplied by the factor shown in the table opposite the rise of the roof, which is given in inches per horizontal foot. The result will be the total roof area.

For example, if a home is 70’ long and 30’ wide including the overhang, the area is 2,100 square feet. If the rise of the roof is 5 7⁄8”, multiply the area by 1.100 for a total roof area of 2,310 square feet. Use this total roof area for figuring the amounts of roofing materials such as the felt underlayment or shingles that will be needed.

One square of shingles covers 100 square feet of roof surface. To determine the number of squares needed to cover the roof, divide the total area by 100.

\[ \frac{2310}{100} = 23.1 \text{ squares of shingles} \]

A 10 percent waste and cutting factor must be added to this amount.

\[ 23.1 \times 1.10 = 25.41 \]

2.31 + 2.31 = 25 squares of shingles

1. Determine the number of square feet of shingles needed to cover a roof that is 140’ x 80’ with a rise of 8”. What is the amount of waste?

Another method of figuring the area of a plain gable roof is to multiply the length of the ridge by the length of the rafter. This will give you one-half the roof area. Multiply by 2 to obtain the total square feet of roof surface.

A similar method may be used to find the area of a hip roof. Multiply the length of the eaves by one-half the length of the common rafter at the end. Multiply this by 2 to obtain the area of both ends. To find the area of the sides, add the length of the eave to the length of the common rafter and divide by 2. Multiply this by 2 to find the number of square feet on both sides of the roof. Add this to the area of the two ends and divide the total area by 100 to get the number of squares.

The area of a plain hip roof running to a point at the top is obtained by multiplying the length of the eaves at one end by one-half the length of the rafter. This gives the area of one side of the roof. Multiply by 2 to find the number of square feet on both sides of the roof. Add this to the area of the two ends and divide the total area by 100 to get the number of squares.

1. Determine the area of a plain hip roof that has a 4’ common rafter at the end and a 12’ eave.

2. By multiplying the length of the ridge of a 140’ x 96’ roof by the length of a rafter, determine the number of squares.
total square feet of the roof. How many squares of shingles will be needed to cover the roof? How much waste will there be?

To figure the labor for installing the roof in the above problems, refer to figure 2. Read down the column headed “Labor Hours per Square” to the line “3 Tab Square-Butt on New Deck.” Each square requires 1.5 hours. Twenty-five squares would require 37.5 hours.

25 (squares to be laid) x 1.5 (hours per square) = 37.5 hours

Figure 2: Nails Requirements for Asphalt Roofing Products

<table>
<thead>
<tr>
<th>Type of Roofing</th>
<th>Shingles per Square</th>
<th>Nails per Shingle</th>
<th>Length of Nail</th>
<th>Nails per Square</th>
<th>Pounds per Square</th>
<th>Labor Hours per Square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roll Roofing on New Deck</td>
<td>1”</td>
<td>252**</td>
<td>1”</td>
<td>0.73</td>
<td>1.12</td>
<td>1</td>
</tr>
<tr>
<td>Roll Roofing over Old Roofing</td>
<td>1 3/4”</td>
<td>252**</td>
<td>1 3/4”</td>
<td>1.13</td>
<td>1.78</td>
<td>1 1/2</td>
</tr>
<tr>
<td>19” Selvage over Old Shingles</td>
<td>1 3/4”</td>
<td>181</td>
<td>1 3/4”</td>
<td>0.83</td>
<td>1.07</td>
<td>1</td>
</tr>
<tr>
<td>3 Tab Sq. Butt on New Deck</td>
<td>80</td>
<td>4</td>
<td>1 3/4”</td>
<td>336</td>
<td>1.22</td>
<td>1 1/2</td>
</tr>
<tr>
<td>3 Tab Sq. Butt Reroofing</td>
<td>80</td>
<td>4</td>
<td>1 3/4”</td>
<td>504</td>
<td>2.38</td>
<td>1 5/6</td>
</tr>
<tr>
<td>Hex Strip on New Deck</td>
<td>86</td>
<td>4</td>
<td>1 1/4”</td>
<td>361</td>
<td>1.28</td>
<td>1 1/2</td>
</tr>
<tr>
<td>Hex Strip Reroofing</td>
<td>86</td>
<td>4</td>
<td>1 3/4”</td>
<td>361</td>
<td>1.65</td>
<td>2</td>
</tr>
<tr>
<td>Giant Amer.</td>
<td>226</td>
<td>2</td>
<td>1 1/4”</td>
<td>479</td>
<td>1.79</td>
<td>2 1/2</td>
</tr>
<tr>
<td>Giant Dutch Lap</td>
<td>113</td>
<td>2</td>
<td>1 1/4”</td>
<td>236</td>
<td>1.07</td>
<td>1 1/2</td>
</tr>
<tr>
<td>Individ. Hex</td>
<td>82</td>
<td>2</td>
<td>1 3/4”</td>
<td>172</td>
<td>0.79</td>
<td>1 1/2</td>
</tr>
</tbody>
</table>

(**) The number of nails required when spaced 2” apart.
To figure the labor for laying wood shingles, use the information from the chart in figure 3.

**Figure 3: Estimating Wood Shingles**

<table>
<thead>
<tr>
<th>Wood Shingles</th>
<th>Materials</th>
<th>Nails</th>
<th>Labor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Per 100 Square Feet of Surface</td>
<td>Per 100 Square Feet</td>
<td>Per 100 Square Ft.</td>
</tr>
<tr>
<td>Laid To Weather Shingles per 100 Sq. Ft.</td>
<td>Waste</td>
<td>Shingles per 100 Sq. Ft. with Waste</td>
<td>3d Nails</td>
</tr>
<tr>
<td>4”</td>
<td>900</td>
<td>10%</td>
<td>990</td>
</tr>
<tr>
<td>5”</td>
<td>720</td>
<td>10%</td>
<td>792</td>
</tr>
<tr>
<td>6”</td>
<td>600</td>
<td>10%</td>
<td>660</td>
</tr>
</tbody>
</table>

**Note:** Nails based on using 2 nails per shingle. Increase time factor 25 percent for hip roofs

1. Determine the labor cost to lay 100 squares in two hours.
2. How much would it cost to lay 900 wood shingles in three hours?

**Equipment/Supplies**
- Calculators
- Carpentry and building construction textbook
- Cost estimation software
- IBM-compatible computer
- Blueprints
- Roof plans
- A mockup of wall and roof section
- Shingles
- Felt
- Hammer
- Nails
- Flashing

**Method of Evaluation**
1. Teacher observation.
2. Inspection of the finished product.
3. Written test.
4. Cost estimation work sheets.

**Correlation to Standards**

*Georgia Academic Standards for Technology Education for 9th-12th*
- Nature of Technology 1, 2, 10
- Human Ingenuity 1, 3, 4, 5
- Technological Systems 2

*Quality Core Curriculum for 9th-12th Grades*
- TCCORE: 9-12: 1, 2, 3, 4, 6, 7, 8, 9, 10, 12, 13, 15, 21, 22, 23, 24, 25, 28, 31
- TECHED: 9-12: 32, 34, 35, 36, 38, 39, 40, 41, 44, 45

*National Standards for Technological Literacy for 9th-12th Grades*
- The Nature of Technology – 2: W, Z; 3: J
- Technology and Society – 7: N
- Abilities for a Technological World – 12: P
Course: Energy and Power Technology
Course number: 21.451

State Course Description
The Energy and Power Technology course presents sources, measurements, control, and applications of electrical energy and devices used in heating, power, illumination, and communication. The course includes experiments with designing, constructing, and testing electrical devices; alternative energy systems; and non-traditional energy sources characteristics and applications and emphasizes environment impact.

Detailed Course Description
This course is designed to introduce the concepts and application of energy technology, including their present and future applications, as well as the advantages and disadvantages of the technical, economic, and environmental aspects of each system. Students focus on the characteristics, generation, storage, distribution, and application of energy and power and design, construct, test, and apply devices for alternative energy systems.

Objectives
The student will perform and/or exhibit knowledge of the following:
- The identification of energy supplies and resources.
- An explanation of energy supply and demand.
- Proper use of energy terminology.
- The ability to perform mathematical computations related to energy.
- The identification of nonrenewable resources.
- The identification of renewable and nondepletable resources.
- Energy conversion, storage, and conservation.

Georgia Academic Standards for Technology Education for 9th-12th Grades
- Nature of Technology 4,6
- Human Ingenuity 1-5, 8, 10
- Technological Systems 2-6, 8, 9
- Impact of Technology 3, 6, 7

Quality Core Curriculum for 9th-12th Grades
- TCCORE: 9-12.1, 4, 6, 7, 8, 9, 11, 14, 21, 22
- TECHED: 9-32, 35, 38, 40, 41, 42

National Standards for Technological Literacy for 9th-12th Grades
- Design – 8: H, I, J, K; 9: K, L
- The Designed World – 16: J,K, L, M, N; 17: L, M, N, O, P, Q

Sample Instructional Activity
Solar Cooker

Description
Students build a device that uses the sun to cook a hot-dog.

Concepts
In completing this activity students become engaged in the following concepts:

Technology Education Concepts
- Identify the basic principles of energy.
- Understand the principles of solar energy.
- Utilize an alternative form of energy to solve a problem.

Mathematics Concepts
- Parabolas and conic shapes

Science Concepts
- Use of solar power.
- Energy units: calorie, watt.
- Trace flow of energy from source to sink (i.e., sun to hotdog to human).
- Explore ways to improve environment.

Social Science Concepts
- Identify the history of the use of solar energy as a natural resource.

Communication Concepts
- Cooperative learning skills.
- Brainstorming.
Procedure

1. Provide groups of three to four students with the materials listed in the equipment/supplies section.
2. Discuss possible solutions to the problem.
3. Allow students time to construct and test various design solutions.
4. Test all solar cookers created by allowing students to place hotdogs in cookers for approximately 15 minutes. (Marshmallows may be used in place of hotdogs.)
5. Discuss the characteristics of the more efficient cookers.

Equipment/Supplies

- Small cardboard box
- Aluminum foil
- Paper
- Wire coat hanger
- Glue
- Scissors
- Hotdogs (or marshmallows)

Method of Evaluation

1. Teacher observation of brainstorming and construction.
2. Cookers can be evaluated based on how hot the hotdogs (or marshmallows) are after the 15-minute testing period.

Correlation to Standards

Georgia Academic Standards for Technology Education for 9th-12th
- Nature of Technology 3, 6, 10
- Human Ingenuity 1, 3, 4, 9, 10
- Technological Systems 1, 2, 3, 5, 9
- Impact of Technology 1, 2, 6, 7

Quality Core Curriculum for 9th-12th Grades
- Quality Core Curriculum for 9th-12th Grades
- TCCORE: 9-12.1, 4, 6, 7, 8, 9, 11, 14, 21, 22
- TECHED: 9-32, 35, 38, 40, 41, 42

National Standards for Technological Literacy for 9th-12th Grades
- Design – 8: H, I, J, K; 9: K, L
- Abilities for a Technological World – 11: M, N, O, P Q, R; 13: J
- The Designed World – 16: J, M, N
Course: Electricity/Electronics Technology

Course number: 21.452

State Course Description
The Electricity/Electronics Technology course presents electronic circuits and how they control industrial equipment and process and covers applications of semi-conductors, photoelectric devices, relays, servomechanisms, and electronic heating together with digital principles and applications. The course includes experiments and practical product work such as robotic interfacing with computers.

Detailed Course Description
This course is designed to introduce the concepts and application of electricity and electronics as a component of energy technology. Students focus on the characteristics, generation, storage, distribution, and application of electrical energy. The students apply these concepts through designing, testing, troubleshooting, and utilizing electronic devices and circuits.

Objectives
The student will perform and/or exhibit knowledge of the following:

- Discuss available careers related to electricity/electronics and the education and training requirements in these fields.
- The general safety rules, practices, and potential dangers of electricity/electronics.
- The phenomena, terms, and concepts associated with the basic electron theory.
- Distinguish between the various types of circuits and solve problems related to each.
- Identify various electronic components and demonstrate their usage by constructing circuits using the components.
- How to recognize electronic component schematics and use these to construct circuits.
- The explanation of various methods of producing electricity including chemical cells, generators, and aspects of the electric power industry.
- The practice of testing and how to troubleshoot electronic circuits using multimeters, oscilloscopes, and signal generators.

Georgia Academic Standards for Technology Education for 9th-12th Grades
- Nature of Technology 4, 6
- Human Ingenuity 1-5, 8, 10
- Technological Systems 2-6, 8, 9
- Impact of Technology 3, 6, 7

Quality Core Curriculum for 9th-12th Grades
- TCCORE: 9-12: 1, 2, 3, 4, 6, 7, 8, 9, 10, 12, 13, 14, 15, 17, 18, 21, 22, 23, 24, 25, 26, 28, 31
- TECHED: 9-12: 32, 33, 34, 35, 36, 37, 38, 40, 41, 45

National Standards for Technological Literacy for 9th-12th Grades
- Design – 8: H, I, J, K
- The Designed World – 17: L, O, P, Q

Sample Instructional Activity
Resistor Tolerance

Description
Students develop a chart comparing the resistor color code value of several resistors with the measured value of the resistors. Students are given several resistors of various resistances. Students should record the value of the resistor based on the color bands of the resistor as well as the tolerance of the component. Students use a multimeter or ohmmeter to measure the actual resistance of the components and record this number in the chart. Students then compare the numbers in the chart to determine if resistors are within tolerance.
Concepts
In completing this activity students become engaged in the following concepts:

**Technology Education Concepts**
- How to use the resistor color code.
- How to use a multimeter to determine resistance.
- How to determine tolerance of a resistor.

**Mathematics Concepts**
- Exponents
- Percentages

**Science Concepts**
- Resistance, current, and voltage.
- Use of ohmmeter.
- Use of chart.
- Understanding of how voltage travels through materials.
- Ohm’s law: \( V = IR \).
- Understanding of the SI unit: W (ohm)

**Communication Concepts**
- Creating charts for information.

Procedure
1. Provide students with 20 resistors of varying resistances.
2. Ask students to identify the value of the resistor, using the resistor color code.
3. Have students calculate the maximum and minimum resistance of the resistor in order for it to be within tolerance (either +/- 5% or +/-10%) and record the information on the chart.
4. Students should use a multimeter or ohmmeter to measure the actual value of the resistor and record the information in the chart.
5. Students compare the measured value to the numbers calculated in the tolerance columns to determine if the resistor is within tolerance.

**Equipment/Supplies**
- 20 Resistors of varying resistance
- Multimeter or ohmmeter
- Calculator
- Chart

**Method of Evaluation**
1. Information on the chart (can be graded objectively).
2. Teacher observation of use of multimeter/ohmmeter.

**Correlation to Standards**

*Georgia Academic Standards for Technology Education for 9th-12th*
- Nature of Technology 6
- Human Ingenuity 4, 5, 10
- Technological Systems 8

*Quality Core Curriculum for 9th-12th Grades*
- TCCORE: 9-12.1, 2, 3, 6, 9, 13, 22, 23
- TECHED: 9-12.34, 35, 36, 40, 41

*National Standards for Technological Literacy for 9th-12th Grades*
- The Nature of Technology – 2: Y
- Abilities for a Technological World – 11: M, Q; 12: N, O, P
Course: Research and Development  
Course number: 21.461

State Course Description
The Research and Development course develops technological analysis and synthesis skills and permits independent work in investigating the theory and practice of a significant facet of technology. The course offers opportunities to experiment in, research, and develop any single facet of technology in the technology education cluster areas and includes model building, written reports, and oral presentations.

Detailed Course Description
This course is designed to develop interest in technical problem-solving activities. It provides students with opportunities to research, design, and experiment in one or more of the technology systems (i.e., communication, energy and power, transportation, production, and bio-related technologies). Considerable independent work is involved as students investigate appropriate solutions to technological problems, utilizing research, data collection, design, prototype development, and working models.

Objectives
The student will perform and/or demonstrate the following:
• The capability of identifying a technological problem.
• An understanding of the R & D procedure, demonstrated by stating the hypothesis, collecting data, analyzing data, testing the hypothesis, and making recommendations.
• The use of appropriate technology resources, including tools, machines, and materials, in performing technological processes
• The use of the computer as a tool, a resource, and an effective research vehicle.
• The integration of ideas in written, oral, graphical, and electronic forms.
• Leadership, communication, and competitive skills through cocurricular vocational student organization activities.
• Safe, ethical, and desirable behavioral standards required in a competitive environment.

Georgia Academic Standards for Technology Education for 9th-12th Grades
• Nature of Technology 1, 3, 5-7, 9, 10
• Human Ingenuity 1, 3-7, 9, 10
• Technological Systems 1-5, 7-10
• Impact of Technology 2-4, 6-9

Quality Core Curriculum for 9th-12th Grades
• TCCORE: 9-12.1 - 31
• TECHED: 9-12.32 - 45

National Standards for Technological Literacy for 9th-12th Grades

Sample Instructional Activity
Manufacturing Prototype

Description
Students design and manufacture a prototype of a product and produce ancillary materials, including a description of the product, an advertisement, various design efforts (including sketches, pictures, magazine clippings, etc.), working drawings, material list, tool and machine list, production plans, and appropriate charts, graphs, and illustrations.
Concepts
In completing this activity students become engaged in the following concepts:

**Technology Education Concepts**
- Sketching.
- Creation of a prototype.
- How to create working drawings.
- How to use computer-aided publishing software.
- How to generate word-processed documents, charts, and graphs.
- How to use production equipment.

**Mathematics Concepts**
- Measurement.
- Reading and creating charts and graphs.

**Science Concepts**
- Observe physical changes to materials.

**Social Science Concepts**
- Planning and organizing techniques used in design processes.

**Communication Concepts**
- Graphical representation of an animate object.
- Use of graphics as a language.
- Creation of persuasive materials.

Procedure
1. Divide the class into groups of four to five students.
2. Explain to the groups the materials that will be available to them for their prototype.
3. Groups should brainstorm for ideas for a prototype.
4. Sketches should be generated.
5. Either a computer-aided drafting system or traditional board drafting should be used to create detailed drawings of the item to be created.
6. The group may work together to create the prototype, or part of the group may construct the prototype while other group members work on ancillary materials.
7. Students should create a written description of the product describing how the product is used.
8. Students should use computer-aided publishing software to develop an advertisement for the prototype.
9. The students should create a list of materials used in the prototype as well as a list of all the tools and machines used in the production.
10. Following this activity, groups should make a presentation to the class about the prototype.

**Equipment/Supplies**
- Computer systems with word processing, computer-aided publishing, and computer-aided drafting capabilities (traditional board drafting equipment may replace the CAD equipment).
- Paper and pencils.
- Materials for a prototype (may vary but can include wood, plastic, clock parts, nails, screws, wood glue, paint, stain, etc.).
- Equipment for material processing (will vary depending on materials used but may include bandsaw, radial arm saw, table saw, joiner, sander, etc.).

**Method of Evaluation**
1. Teacher observation of group activity.
2. Students may be evaluated based on the documentation provided with the prototype as well as on the craftsmanship and function of the product created.

**Correlation to Standards**

**Georgia Academic Standards for Technology Education for 9th-12th**
- Nature of Technology 6
- Human Ingenuity 1, 3, 4, 5, 9
- Technological Systems 1, 2, 3, 4
- Impact of Technology

**Quality Core Curriculum for 9th-12th Grades**
- TCCORE: 9-12.1, 2, 3, 6, 7, 9, 11, 14, 15, 21, 23, 24
- TECHED: 9-12.32, 34, 35, 38, 40, 41, 45

**National Standards for Technological Literacy for 9th-12th Grades**
- Technology and Society – 5: H, L; 6: J
- The Designed World – 17: L, M, N, O, P, Q; 19: L, M, N, O, P, Q, R; 20: J
State Course Description
The Pre-Engineering Technology course integrates technology-oriented application of mathematics and science into pre-engineering activities and covers material science, processes enterprises, and career exploration. The course provides occupational skills and information for aspiring craftspersons, technicians, technologists, or consumers.

Detailed Course Description
This course is designed to introduce students to the concepts and practices of engineering technology and engineering careers. Students explore engineering problem solving with the integration of mathematics, science, and technology in pre-engineering activities. Students should have a well-rounded base of knowledge in as many areas of technology as possible and have an area of specialized interest in which they have done extensive work. This class continues to utilize various teaching strategies along with small group, paired, and individual activities to further introduce the scope of contemporary workplace technologies and practices.

Objectives
The student will perform and/or exhibit knowledge of the following:
• How to express and integrate ideas in written, oral, graphical, and electronic forms.
• How to function safely and ethically in the work environment.
• The ability to complete designated assignments in a directed modular environment in a specified time frame.
• The ability to complete designated assignments in a directed group environment in a specified time frame.
• How to apply skills in a culminating activity or problem.
• How to use the computer as a tool, a resource, and an effective research vehicle.
• An understanding of the nature of technology and the relationships among technological achievement, the environment, advancement of science, the individual, and society and the impacts they have on one another.
• How to integrate written, oral, graphical, and electronic forms into a presentation for a diverse audience.
• Develop basic leadership qualities and characteristics.

Georgia Academic Standards for Technology Education for 9th-12th Grades
• Nature of Technology 1-10
• Human Ingenuity 1-10
• Technological Systems 1-8, 10
• Impact of Technology 1-9

Quality Core Curriculum for 9th-12th Grades
• TCCORE: 9-12.1 - .31
• TECHED: 9-12.32 – .45

National Standards for Technological Literacy for 9th-12th Grades
• Abilities for a Technological World – 11: M, N, O, P, Q, R; 13: J, K, L, M

Sample Instructional Activity
Water-Powered 2-Liter Rocket

Description
Students design, construct, test, and evaluate water-powered rockets constructed from 2-liter soft drink bottles. This activity involves the application of numerous mathematical skills and physical science properties while developing engineering skills. This activity is ideal for individuals or student pairs. The whole class is involved in the launch and altitude measurement. Construction methods and materials,
aerodynamics, weight and balance, propulsion systems, range safety, and documentation and evaluation are some of the aspects emphasized during the unit. This activity may be jointly taught with a physical science or physics teacher.

Concepts
In completing this activity students become engaged in the following concepts:

Technology Education Concepts
• How to solve a problem, using the technology systems model.
• How to employ safety in the workplace.
• How to use different technological resources in problem solving.
• How to apply academic and workplace skills in problem solving.

Mathematics Concepts
• Geometric shapes and their construction.
• Spatial orientation.
• Parallel and perpendicular lines.
• Angles, arcs, circles.
• Radius, diameter, and circumference.
• Using measurement tools for layout and design.
• Drawing parallel lines.
• Dividing the circumference into three or four equal parts.
• Drawing and cutting out triangular fins.
• Drawing, cutting out, and forming a nose cone.
• Making a cylinder
• Joining a cone (rocket nose) and a cylinder (rocket body).
• Measuring air pressure in pounds per square inch (psi), using a gauge.
• Converting English units to metric units.
• Calculating altitude, using the length of one side of a triangle and its adjacent angle.

Science Concepts
• Identifying, demonstrating, and measuring the effects of Newton’s laws of motion.
• Demonstrating the use of pressure in a fluid as a force-like quantity that causes fluid movement.
• Predicting rate of fall based on design choice.
• Identifying forces working on bottle (e.g., gravity).
• Conservation of energy (from kinetic to potential).
• Effects of weight on velocity.
• Acceleration due to gravity.
• Collecting data from experiments and drawing conclusions.

Social Science Concepts
• Planning and organizing techniques used in design processes.
• Working cooperatively with a partner.
• Evaluation of self and partner performance.

Communication Concepts
• Use of graphics as a language.
• Interpreting drawings.
• Following oral and written directions.
• Writing a summary report of the activity, including principles learned, the rocket construction process, success or failure of the test flight, reasons for success or failure, and recommendations for activity improvement.

Procedure
1. Gather materials for construction. Have students bring empty 2-liter bottles (small mouth, not wide mouth).
2. Prepare workstations where students/teams will form cylinders, cut out nose cone, assemble rocket body, and attach fins.
3. Demonstrate how to mark the bottle for exact three- or four-fin placement.
4. Form and attach cylinder to extend rocket body.
5. Insert ballast material in upper part of cylinder.
6. Attach nose cone.
7. Attach fins.
8. Paint/decorate as desired.
9. Carefully fill 2-liter bottle about half full with water. Place on launcher.
10. Launch rockets, using a purchased or constructed launcher.
11. Calculate altitude achieved.
12. Evaluate rocket performance versus design.
13. Write a summary report of the activity, including principles learned, the rocket construction process, success or failure of the test flight, reasons for success or failure, and recommendations for activity improvement.
Equipment/Supplies

• 2-liter soft drink bottles (must be small-mouthed bottles; wide-mouthed bottles will not work).
• Manila file folders (for construction of body cylinders and nose cones).
• Plastic packaging tape.
• Cool-melt glue guns and cool-melt glue slugs. (Hot melt distorts the plastic bottle.)
• Show board or illustration board (about three times as thick as poster board) for fins.
• Nontoxic paint and/or markers for decoration.
• Water source.
• Launcher with air pump (may be teacher-made or purchased from Pitsco or Kelvin).
• Camcorder for videotaping.
• Device to measure angle of rocket at its flight apex.

Method of Evaluation

1. Teacher observation.
2. Comparison of students’ rockets to teacher-made rubric.
3. Student flight summary.
4. Student’s written evaluation.
5. Student portfolio.

Correlation to Standards

Georgia Academic Standards for Technology Education for 9th-12th

• Nature of Technology 1, 2, 6, 10
• Human Ingenuity 1, 2, 3, 4, 5
• Technological Systems 1, 2, 5,
• Impact of Technology 7, 8

Quality Core Curriculum for 9th-12th Grades

• TCCORE: 9-12.1 - 4, 6, 8, 9, 10, 12, 13, 14, 15, 17, 21, 22, 23, 24, 26, 28, and 31
• TECHED: 9-12.32, 33, 34, 35, 36, 37, 38, 40, 41, and 42

National Standards for Technological Literacy for 9th-12th Grades

• The Nature of Technology – 1: J; 2: W, AA; 3: G, J
• Abilities for a Technological World – 11: M, O, P, Q, R; 13: J
• The Designed World – 15: L; 16: N; 18: J

NOTE: For a more detailed description of this activity, including drawings and directions for launcher construction, see the 1999 Technology Education Advanced Workshop materials published by the Georgia Department of Education.
State Course Description

The Engineering Applications course presents hydraulics, pneumatics, mechanisms, computer interfacing, robotics, computer-aided design, computer numerical control, and electronics and demands higher-order thinking skills for solutions to teacher-and-student generated problems.

Detailed Course Description

This course is designed to address three tenets that apply to candidates for any engineering program:

- Students should have a well-rounded base of knowledge in as many areas of technology as possible.
- Students should have an area of specialized interest in which they have done extensive work.
- Students should have exceptional communication skills and be able to make presentations to their peers.

This class continues to utilize various teaching strategies along with small group, paired, and individual activities to further introduce the scope of contemporary workplace technologies and practices. Students will complete any module rotations required to finish the full scope and sequence begun in Pre-Engineering Technology. Students will then propose, plan, develop, and execute a significant specialization project each semester and make a presentation to the class upon its completion. Students will also lead in a culminating class activity.

Objectives

- The student will perform and/or exhibit knowledge of the following:
- How to function safely and ethically in the work environment.
- The ability to complete designated assignments in a directed modular environment in a specified time frame.
- The ability to complete designated assignments in a directed group environment in a specified time frame.
- How to apply skills in a culminating activity or problem.
- How to use the computer as a tool, a resource, and an effective research vehicle.
- An understanding of the nature of technology and the relationships among technological achievement, the environment, advancement of science, the individual, and society and their impacts on one another.
- How to integrate written, oral, graphical, and electronic forms into a presentation for a diverse audience.
- Basic leadership qualities and characteristics.

Georgia Academic Standards for Technology Education for 9th-12th Grades

- Nature of Technology 1-10
- Human Ingenuity 1-10
- Technological Systems 1-3, 5-8, 10
- Impact of Technology 1-9

Quality Core Curriculum for 9th-12th Grades

- TCCORE: 9-12.1 - .31
- TECHED: 9-12.32 – .45

National Standards for Technological Literacy for 9th-12th Grades


Sample Instructional Activity

Module Jeopardy

Description

Students develop a nonlinear PowerPoint activity about the technological area in which they have done their specialization. This activity is in the form of the game show Jeopardy. The presentation includes the use of hyperlinks, sounds, and imported graphics and pictures. The game board has six categories with five
clues/answers in each category. This game is presented to and played by members of the class.

**Concepts**

In completing this activity students become engaged in the following concepts:

**Technology Education Concepts**
- How to solve problems, using the technology systems approach.
- How to use technological resources in problem solving.
- How to develop leadership and communication skills.

**Mathematics Concepts**
- Basic math skills in scoring.
- Math skills related to specialization project, if any.

**Science Concepts**
- Science skills related to specialization project, if any.

**Social Science Concepts**
- Planning and organizing techniques used in design processes.
- Group game competition.

**Communication Concepts**
- Graphical representation of specialization project elements.
- Use of graphics as a language.
- Games as an instructional tool.
- Communication skills related to specialization project, if any.

**Procedure**

1. Upon completion of student specialization project, review materials to formulate the answers to thirty questions. Include questions about career choices and the technological evolution of the specialization project area.
2. On paper, design a game board and name the game (example: “CNC Manufacturing Jeopardy”).
3. Make a storyboard and plan each slide before beginning the PowerPoint presentation. Make notes about the hyperlinks required for each slide. Detailed planning eliminates many problems in game construction.
4. Construct the game.
5. Test and evaluate thoroughly.
6. Divide class into two or three groups. Have them play the game, using Jeopardy rules. Provide “prizes” for the winning team.
7. Evaluate the game and student play. Correct errors, improve weak points, and construct a student questionnaire for player evaluation.
8. Document construction and evaluation for the student portfolio.

**Equipment/Supplies**
- Computer, PowerPoint, computer clipart, sound files
- Digital camera
- Internet access
- Large-screen TV with scan converter for classroom presentation

**Method of Evaluation**
1. Teacher observation.
2. Student and teacher evaluation of game.
3. Portfolio entry.

**Correlation to Standards**

**Georgia Academic Standards for Technology Education for 9th-12th**
- Nature of Technology 2, 4, 8, 10
- Human Ingenuity 1, 2, 3, 4, 5, 8
- Technological Systems 1, 2, 6, 10
- Impact of Technology 1

**Quality Core Curriculum for 9th-12th Grades**
- TCCORE: 9-12.1, 2, 3, 4, 5, 6, 7, 9, 11, 13, 15, 17, 18, 21, 22, 23, 24, 26, 28, 31
- TECHED: 9-12.32, 33, 34, 35, 36, 37, 38, 40, 41

**National Standards for Technological Literacy for 9th-12th Grades**
- Technology and Society – 6: H, I; 7: O
- The Designed World – 16: M, N; 17: M, N, O, P, Q
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