GEORGIA | PEACH STATE PATHWAYS

Career, Technical, & Agricultural Education

ENGINEERING & TECHNOLOGY

PATHWAY: Manufacturing

COURSE: Robotics and Automated Systems

UNIT: 5.4 Design and Mechanics—Engineering Drawings

INTRODUCTION

Annotation:

In this unit students will learn the basics of engineering drawings, and how drafting is considered the language of industry. Students will explore tools, techniques, various types of drawings, as well as the role of CAD and careers available in the drawing industry.

Grade(s):

	9th
x	10th
x	11th
x	12th

Time: 25 hours

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Additional Author(s):

Students with Disabilities:

For students with disabilities, the instructor should refer to the student's IEP to be sure that the accommodations specified are being provided. Instructors should also familiarize themselves with the provisions of Behavior Intervention Plans that may be part of a student's IEP. Frequent consultation with a student's special education instructor will be beneficial in providing appropriate differentiation.

FOCUS STANDARDS

GPS Focus Standards:

ENGR-RAS-2. Students will identify and explain the major engineering tasks in organizing automated manufacturing.
ENGR-RAS-3. Students will discuss the systems and applications of automation including: AGV, PLC, CNC, CIM, CAD, CAM, and robotics as essential to succeeding globally in a manufacturing market.
ENGR-STEM-1. Students will recognize the systems, components, and processes of a technological system.
ENGR-STEM-3. Students will design technological problem solutions using scientific investigation, analysis and interpretation of data, innovation, invention, and fabrication while considering economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability constraints.
ENGR-STEM-4. Students will apply principles of science, technology, engineering, mathematics, interpersonal communication, and teamwork to the solution of technological problems.
ENGR-STEM-5. Students will select and demonstrate techniques, skills, tools, and understanding related to energy and power, bio-related, communication, transportation, manufacturing, and construction technologies.
ENGR-STEM-6. Students will enhance reading by developing vocabulary and comprehension skills associated with text materials, problem descriptions, and laboratory activities associated with engineering and technology education.

GPS Academic Standards:

ELAALRC2. The student participates in discussions related to curricular learning in all subject areas.
ELAALRC3. The student acquires new vocabulary in each content area and uses it correctly.
ELAALRC4. The student establishes a context for information acquired by reading across subject areas.

National / Local Standards / Industry / ISTE:

UNDERSTANDINGS & GOALS

Enduring Understandings

- Students will understand how important accurate drawings are to the production of any manufactured products.
- Students will be introduced to the tools, techniques, and types of drawings used in the manufacturing industry.

Essential Questions:

- What is a sketch?
- What drawings tools are available to create accurate drawings?
- What is a scale and how is it used?
- How are multi views developed?
- How are CAD programs like manual drafting?
- What are some career opportunities in the engineering drawing industry?

Knowledge from this Unit:

- Students will learn simple sketching techniques.
- Students will recognize manual drafting tools, and describe their correct use and functions.

Skills from this Unit:

- Students will be able to apply proper techniques in producing 2 –D drawings, and orthographic projections of various items.
- Students will produce various drawing types including pictorial, multi-view orthographic, sectional, and working drawings.
- Students will use CAD to produce various drawings.

ASSESSMENT(S)

Assessment Method Type: Select one or more of the following. Please consider the type(s) of differentiated instruction you will be using in the classroom.

- [x] Pre-test
- [x] Objective assessment - multiple-choice, true- false, etc.
  - [ ] Quizzes/Tests
  - [x] Unit test
- [ ] Group project
- [x] Individual project
- [x] Self-assessment - May include practice quizzes, games, simulations, checklists, etc.
  - [x] Self-check rubrics
  - [ ] Self-check during writing/planning process
  - [ ] Journal reflections on concepts, personal experiences and impact on one's life
  - [ ] Reflect on evaluations of work from teachers, business partners, and competition judges
  - [ ] Academic prompts
  - [ ] Practice quizzes/tests
- [ ] Subjective assessment/Informal observations
  - [ ] Essay tests
  - [ ] Observe students working with partners
  - [ ] Observe students role playing
- [ ] Peer-assessment
  - [ ] Peer editing & commentary of products/projects/presentations using rubrics
  - [ ] Peer editing and/or critiquing
- [x] Dialogue and Discussion
  - [x] Student/teacher conferences
  - [ ] Partner and small group discussions
  - [x] Whole group discussions
  - [ ] Interaction with/feedback from community members/speakers and business partners
- [x] Constructed Responses
  - [ ] Chart good reading/writing/listening/speaking habits
  - [x] Application of skills to real-life situations/scenarios
- [ ] Post-test

Assessment(s) Title:

Assessment(s) Description/Directions:

Attachments for Assessment(s):

LEARNING EXPERIENCES

Sequence of Instruction

1. **Identify the Standards. Standards should be posted in the classroom for each lesson.**
2. **Review Essential Questions.**
3. **Identify and review the unit vocabulary.**
4. **Assessment Activity.**

Step 1:
Discuss the importance of engineering drawings in the manufacturing process.

Step 2:
Introduce students to graphic language and lettering using the correlating PowerPoint. Allow students to practice their technique. *(see Graphic Language and Lettering.ppt)*

Step 3:
Have students sketch, manually draft, and or produce CAD drawings based on lab equipment availability. *(see: Sketching.ppt; Multiviews.ppt; & Parametric Modeling.ppt)*

Step 4:
Work with students in reading and comprehending the various scales used in engineering drawings *(see: Scales.ppt & USFA engineering – architect scale worksheet)*

Step 5:
Assign various drawings, working with students to perfect their drafting techniques *(See local drafting resources and documents.)*

Attachments for Learning Experiences:

Notes & Reflections:

Teachers have various interests, favorite drawings, textbooks, etc. These allow for the tailoring of programs to play to a system's equipment strengths. A wide variety of drawing types is recommended, but too much time can be spent attempting to teach a drafting class instead of a drafting unit within a manufacturing focus. Be careful not to over do it.

An introduction of calipers and micrometers is recommended if your system has sufficient equipment to teach with.

The glass box concept used in teaching the multiple orthographic projected views is one that is timeless. If you have some Plexiglas, I recommend building a cube in which you can put an object. Use hinges or duct tape to hold the box together in such a way as to allow it to fold out showing the proper views in their appropriate locations. By using a whiteboard marker, you can draw each side of an object placed in the box, and then fold it out to show your students where the proper locations for each view are.

CULMINATING PERFORMANCE TASK (Optional)

Culminating Unit Performance Task Title:

Engineering Drawings (various)

Culminating Unit Performance Task Description/Directions/Differentiated Instruction:

Students will produce a variety of engineering drawings, sketches and CAD constructions as assigned by the instructor.

Attachments for Culminating Performance Task:

Various drawing assignments exist for instructors to chose from. Drafting texts cover a wide variety of subjects.

UNIT RESOURCES

Web Resources:

ORTHOGRAPHIC PROJECTION:
http://www.cbu.edu/~gmcginni/classes/CE%20111%20Engineering%20Design%20Graphics/
http://www2.arts.ubc.ca/TheatreDesign/crslib/drft_1/orthint.htm
http://www.engineering-ed.org/documents/Orthographic%20Projection.ppt
http://www.colorado.edu/MCEN/MCEN1025/lecture%20PDF/4-Orthographic%20projection-WWW.pdf
http://feh.eng.ohio-state.edu/Lectures/191au04/09-28%20Orthographic%20Projections.ppt
http://www.geneng.mtu.edu/courses/1100/current/eng1100.6a_ortho.pdf
https://mail.nvnet.org/~martin_s/TAD1/linx/ortho.html

Attachment(s):

Materials & Equipment:

What 21st Century Technology was used in this unit?

☐ Slide Show Software	☐ Graphing Software	☐ Audio File(s)
☐ Interactive Whiteboard	☐ Calculator	☐ Graphic Organizer
☐ Student Response System	☐ Desktop Publishing	☐ Image File(s)
☐ Web Design Software	☐ Blog	☐ Video
☐ Animation Software	☐ Wiki	☐ Electronic Game or Puzzle Maker
☐ Email	☐ Website	