Unit 16: Engineering Graphics

Content Area: **Applied Technology**
Course(s):
Time Period: **Marking Period 1**
Length: **2 Weeks**
Status: **Published**

Brief Summary of Unit

Students will develop their knowledge and skills in engineering graphics.

Standards

LA.RI.11-12.2	Determine two or more central ideas of a text, and analyze their development and how they interact to provide a complex analysis; provide an objective summary of the text.
LA.RI.11-12.3	Analyze a complex set of ideas or sequence of events and explain how specific individuals, ideas, or events interact and develop over the course of the text.
LA.RI.11-12.4	Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text (e.g., how Madison defines faction in Federalist No. 10).
LA.RI.11-12.10b	By the end of grade 12, read and comprehend literary nonfiction at grade level text-complexity or above.
MA.N-Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
MA.N-Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.
SCI.HS-ESS3-2	Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
SCI.HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
TECH.8.1.12.A.1	Create a personal digital portfolio which reflects personal and academic interests, achievements, and career aspirations by using a variety of digital tools and resources.
TECH.8.1.12.A.2	Produce and edit a multi-page digital document for a commercial or professional audience and present it to peers and/or professionals in that related area for review.
TECH.8.1.12.D.3	Compare and contrast policies on filtering and censorship both locally and globally.
TECH.8.1.12.D.5	Analyze the capabilities and limitations of current and emerging technology resources and assess their potential to address personal, social, lifelong learning, and career needs.
TECH.8.2.12.A.1	Propose an innovation to meet future demands supported by an analysis of the potential full costs, benefits, trade-offs and risks, related to the use of the innovation.
TECH.8.2.12.A.2	Analyze a current technology and the resources used, to identify the trade-offs in terms of availability, cost, desirability and waste.
TECH.8.2.12.B.1	Research and analyze the impact of the design constraints (specifications and limits) for a product or technology driven by a cultural, social, economic or political need and publish for review.

TECH.8.2.12.B.4	Investigate a technology used in a given period of history, e.g., stone age, industrial revolution or information age, and identify their impact and how they may have changed to meet human needs and wants.
TECH.8.2.12.C.4	Explain and identify interdependent systems and their functions.
TECH.8.2.12.C.5	Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.
TECH.8.2.12.C.6	Research an existing product, reverse engineer and redesign it to improve form and function.
TECH.8.2.12.D.1	Design and create a prototype to solve a real world problem using a design process, identify constraints addressed during the creation of the prototype, identify trade-offs made, and present the solution for peer review.
TECH.8.2.12.D.3	Determine and use the appropriate resources (e.g., CNC (Computer Numerical Control) equipment, 3D printers, CAD software) in the design, development and creation of a technological product or system.
TECH.8.2.12.D.5	Explain how material processing impacts the quality of engineered and fabricated products.
TECH.8.2.12.E.4	Use appropriate terms in conversation (e.g., troubleshooting, peripherals, diagnostic software, GUI, abstraction, variables, data types and conditional statements).

Transfer

Essential Questions

- • How do engineers communicate?
- • How do engineers solve problems?

Essential Understandings

- • CADD (Computer-aided Design and Drafting) is a convenient way to make and edit drawings.
- • dimensions relate to fabrication processes.
- • graphic conventions are a common symbolic visual language.
- • that the design loop is used to solve engineering problems.
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- • the solutions to mechanical engineering problems often include drawings.
- • units for drawings are trade specific.

Students Will Know

- • auxiliary view projection theory and practice.
- • conventions are commonly established ways to communicate. They are used in graphic, and

computer communications.

- conventions for lines, freehand sketching techniques, coordinate space, classification of geometric elements.
- how to dimension: size and location dimensions, detail dimensions & dimensioning techniques.
- how to draw objects with holes, chamfer, round etc.
- how to draw revolved protrusions, mirror copies.
- how to make multi-view drawings that include isometric, oblique and perspective views.
- how to modify, suppress, resume and insert features.
- how to view a selection; fundamental views of edges and planes for visualization.
- key terms: isometric, perspective, oblique, tolerance, maximum material condition, scale, detail.
- pictorial projections types including axonometric projections, oblique and perspective projections.
- the design loop.
- tolerance for interchangeability.
- what ANSI (American National Standards Institute) standards for multi-view drawings and sketches.
- what mechanical engineers do.
- working drawings: part lists, basic concepts.

Students Will Be Skilled At

Evidence/Performance Tasks

- complete writing prompts. Examples: (a) 3-D views or objects are useful in communicating assemblies because… (b) Tolerancing in a mechanical drawing tells a story about manufacture and interchangeable parts. For example… There are drawing conventions because…
- demonstrate the ability to utilize the design loop as a problem solving tool.
- demonstrate understanding on written quizzes and tests about subject materials.
- develop a digital portfolio that logs student activities throughout the year. The portfolio will be graded using a rubric
- invent the solution to a mechanical engineering problem and provide a solution with drawings, and prototypes as practical. Use unit vocabulary.
- meaningfully address the essential and guiding questions of this unit of study.
- meaningfully participate in guided question and answer sessions, group and individual discussions, show an understanding of the purpose of the unit lesson(s) and their key terms and concepts.
- provide evidence of CADD skills.

Learning Plan

- Conduct formative assessments throughout the process using class discussion, student writing and practice quizzes.
- Preview the essential questions and connect to learning throughout the unit.
- Provide guidance and rubrics for the development of a digital portfolio.
- Provide lecture and opportunities for discussion about guiding questions.
- Students and teacher will score summative assessment using a rubric specific to the design problem.
- Students will complete a writing prompt.
- Students will complete unit test or quiz.
- Students will research careers and evaluate their personal interest.
- Teacher will demonstrate and involve students in presentation techniques using SMART technology and PowerPoint.
- Teacher will demonstrate how CADD drawings are made in AutoCAD. Lecture and investigation about units that are used in different disciplines and why. Concepts of how dimensioning and tolerance are related.

Materials

- CAD (Computer-aided Design) and other software programs
- DVDs
- Email and e-board
- Robotics lab equipped with MATLAB, PSpice, power supplies, logic testers, various electrical components, drill press and tools.
- SmartBoard use for presentation and interactive lessons
- Virtual Field Trips
- Web sites

Suggested Strategies for Modifications

- additional time on task
- alternative outcome options
- assessment based on individual development in the area of study
- audio tape of instruction
- cooperative learning groups
- handouts of notes, procedures, processes, diagrams, etc.
- images and visual aids
- one-to-one instruction and assistance
- preferential seating
- reading material modified to student level
- revised techniques, use of tools and media in hands-on activity
- study partners

- testing materials appropriate to student level