FREEHOLD REGIONAL HIGH SCHOOL DISTRICT

Technical Drawing I Curriculum
Course Code #080600

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Curriculum Writing Committee
Theodore Powoski
Sheryl Roses
Board of Education
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Debra Kozar
Dr. Meryl Norych
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Joseph Robinson
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Scenarios for Authentic Tasks

Build assessments anchored in authentic tasks using **GRASPS**:

- **G** - What is the **G**oal in the scenario?
- **R** - What is the **R**ole?
- **A** - Who is the **A**udience?
- **S** - What is your **S**ituation (context)?
- **P** - What is the **P**erformance challenge?
- **S** - By what **S**tandards will work be judged in the scenario?
Think of your obligations via

**W. H. E. R. E. T. O.**

**W** ▪ “**W**here are we headed?” *(the student’s Q!)*

**H** ▪ How will the student be ‘**H**ooked’?

**E** ▪ What opportunities will there be to be **E**quipped, and to **E**xperience and **E**xperience key ideas?

**R** ▪ What will provide opportunities to **R**ethink, **R**ehearse, **R**efine and **R**evise

**E** ▪ How will students **E**valuate their work?

**T** ▪ How will the work be **T**ailored to individual needs, interests, styles?

**O** ▪ How will the work be **O**rganized for maximal engagement and effectiveness?
Students enrolled in this course will demonstrate mastery of the following proficiency requirements as outlined in the curriculum guide and receive a passing grade in accordance with Board of Education policies on grading and attendance:

1. Demonstrate an understanding of basic skills in reading and mathematics, particularly as they relate to drafting terminology.
2. Know and apply appropriate shop safety rules and regulations prescribed by the New Jersey State laws and Board of Education policy.
3. Demonstrate the safe operation and use of various equipment, tools, and supplies, as outlined in the curriculum guide.
4. Demonstrate desirable work habits and attitudes, and the ability to work individually or in a group.
5. Demonstrate the ability to complete teacher assigned drawing projects accurately and within given time limitations.
6. Become familiar with career opportunities that utilize technical drawing and computer aided drawing skills.
7. Be able to describe how technical drawing is used in industry and in every day activities.
8. Demonstrate the ability to use basic sketching techniques to communicate ideas.
9. Demonstrate a competency in the reading and interpretation of plans and prints.
10. Demonstrate the ability to select the appropriate drawings to best represent a given object.
11. Demonstrate the ability to draw and understand single, multi-view and pictorial drawings and their transposition.
12. Demonstrate the ability to read and understand dimensions, and their application.
13. Demonstrate the ability to execute the American Standard style of lettering.
14. Demonstrate a competency in symbol and line recognition and execution.
15. Demonstrate the ability to do basic geometric construction.
16. Demonstrate insight in reading and interpreting drawings and apply this ability to other courses in Applied Technology.
17. Demonstrate the ability to utilize the design loop for solving technical problems.
18. Demonstrate the ability to follow the proper sequence of keyboard commands need to enter the CAD system, assign a part name, file a part for future use and exit the system.
19. Demonstrate the ability to give the commands needed to create basic lines, arcs, circles, points, and fillets using the CAD system.
20. Demonstrate the ability to set-up and use a high resolution pen plotter for plotting out drawings created on the screen.
21. Demonstrate an understanding of Computer Aided Design (CAD) by successfully completing various orientation exercises and specific drafting problem assignments.

To measure mastery in accordance with the grading policy, attendance policy and other policies of the Board of Education, the teacher will select appropriate evaluative methods as listed below:

Laboratory work _____  Final exam _____  Homework _____  
Quizzes _____  Unit test _____  Performance test _____  
Mid term _____  Notebook _____  Project _____  
Reports _____  Shop maintenance _____
Technical Drawing I offers the student an excellent foundation in drafting with “hands-on” experience in the development of individual projects which will include sketching, geometric construction, orthographic projection, isometrics, sectioning, and auxiliary drawings. Student assignments will be drawn manually using conventional drafting methods, and with computers using the latest technology available.

This five credit course is open to all students in grades 9 through 12 and meets daily for the entire year.
As most people know, every item that has been designed, built, assembled and manufactured had to first be drawn on paper in a universal language that can be read by all. The ability to understand and use this universal language known as technical drawing has become important for every person to learn. This course is based on present engineering practices and follows a step-by-step approach to the study of technical drawing and CAD skills and the mastery of special techniques that are necessary in order to produce clear and concise drawings.

All information in this course is considered by industry professionals to be fundamental knowledge for students moving to future education in related fields.
Technical Drawing I Curriculum

Unit 1:
Class and Self Management / Health & Safety

TIME FRAME:
1 week

ESTABLISHED GOALS: CORE CURRICULUM CONTENT STANDARDS
9.2B3, 9.2D3, 9.2F1, 9.2F2, 9.2F3, 9.2F4, 9.2F5

UNDERSTANDINGS: STUDENTS WILL UNDERSTAND THAT...
- Safety is a priority in all school settings.
- Students are obliged to follow all rules, policies and laws regarding safety set by the Board of Education (FRHSD), New Jersey and the Federal Government (OSHA and PEOSHA).
- Student self-management is key to preventing accidents and injuries.

ESSENTIAL QUESTIONS:
- What are the safety concerns to be considered when working in a lab setting in school or on the job?
- What hazards and dangers can Personal Protective Equipment (PPE) be used to protect against?
- What elements should an effective school/occupational safety and health program include in it?

KNOWLEDGE: STUDENTS WILL KNOW:
- The safety procedures to be followed in class including fire drill procedures.
- Where the PPE is stored and proper usage of each item.
- What action should be followed in the event of an accident or injury.
- Proper disposable of sharps (including Exacto knife blades).

SKILLS: STUDENTS WILL BE ABLE TO:
- Practice the safe use of tools and equipment.
- Implement safety procedures in the classroom.
- Identify safety signage and the hazard the symbol is warning against.
- Model methods for maximizing personal productivity in a safe environment.
- Maintain the equipment in safe operating condition.
SUGGESTED PERFORMANCE TASK:

- **G:** Students will select a part of the body that could be vulnerable to hazards / injuries in the classroom (eyes, face, head, feet, hands & arms, nose/lungs, ears) and identify available personal protective equipment available to prevent injuries to that area of the body.
- **R:** Student will develop a safety poster to the theme of “Safety Matters” that addresses the importance of Personal Protective Equipment and safety procedures in the classroom.
- **A:** The poster will be hung in the classroom for the year to remind all students of the importance of safety procedures and PPE.
- **S:** The poster must be on 11” X 17” paper and have a minimum of three colors. It can be created freehand using markers / colored pencils or digitally using software and clip art.
- **P:** The poster must be of high quality and depict the “Safety Matters” theme.
- **S:** [Rubric]

OTHER EVIDENCE: SUGGESTED ASSESSMENTS:

- Quiz on safety signage
- Signed safety contracts
- Student self-assessment of safety procedures
- Performance test to include safety scenarios and emergency situations.
- Informal, ongoing observations of students following safety procedures.

SUGGESTED LEARNING ACTIVITIES:

- **Ice breaker activity**
  - Divide class into 3 or 4 teams. Students will compete in a quiz bowl testing their safety sign/symbol knowledge. Use whatever is available to ring in (call bell, whistle etc.) Team with most correct answers receives extra credit reward. (H)
- **Lecture**
  - PowerPoint presentation on classroom and occupational safety procedures, PPE and hazardous signage. (E and T)
- **Research**
  - Use trade journals/magazines and websites to identify PPE and occupational safety procedures. (E and T)
- **Portfolio**
  - Begin a paper or electronic portfolio to follow yearly progress including copies of safety rules (SE and R)
- **Laboratory work**
  - Create a poster to the theme “Safety Matters”. (E and T)
Unit 2:  
Historical Significance and  
Technological Impacts  

TIME FRAME:  
2 weeks  

ESTABLISHED GOALS: CORE CURRICULUM CONTENT STANDARDS  
3.3D1, 3.3D2, 6.1A1, 8.1B12, 8.1A5, 8.2A1, 8.2A4, 8.2A5  

UNDERSTANDINGS: STUDENTS WILL UNDERSTAND THAT...  
- Technical drawing is a communication method.  
- Information is cumulative throughout time  
- Information advances exponentially up to the current day  
- Humans modify their world to meet human needs and wants.  

ESSENTIAL QUESTIONS:  
- Why is it important to study significant historical figures and time periods in technology?  
- What can we learn from the past?  
- How has the world changed and how might it change in the future?  

KNOWLEDGE: STUDENTS WILL KNOW:  
- The influence of technology on history  
- The cultural, social, economic, and political effects of technology  
- Civilization identification and their contributions  
- Throughout history, people have modified their world to meet human needs and conveniences.  

SKILLS: STUDENTS WILL BE ABLE TO:  
- Explain the cultural and societal effects resulting from the dramatic increases of knowledge and information available today.  
- Describe how the legacy of earlier societies and individuals influence subsequent generations.  
- Reflect on past innovators that have made significant contributions to society.
**SUGGESTED PERFORMANCE TASK:**
- **G:** Select and research a significant architect, inventor, engineer or designer
- **R:** The student will create and present a visual presentation relating the major contributions or works of their selected individual.
- **A:** The presentation will be made to the entire class.
- **S:** The presentation must be a minimum of 3 minutes and include at least one of the following: model, pictures or renderings, multimedia presentation, mobile, poster or a tri-fold.
- **P:** The project must be of high quality and accurately depict the significant contribution of the individual selected.
- **S:** [Rubric](#)

**OTHER EVIDENCE: SUGGESTED ASSESSMENTS:**
- Visual products
- Self and peer evaluation
- Quiz on civilization periods / ages
- Oral presentation

**SUGGESTED LEARNING ACTIVITIES:**
- Ice breaker activity
  - Distribute Leonardo Da Vinci sketches to half the class and real world photos of the comparable item to the other half. Allow the students to analyze their images and circulate the room to find their partner image. (H)
- Lecture
  - PowerPoint presentation on civilization periods / ages (E and T)
- Research
  - Use journals, industrial books/magazines, websites, photographs and museums (E and T)
- Portfolio
  - Begin a paper or electronic portfolio to follow yearly progress (SE and R)
- Laboratory work
  - Create a model, pictures or renderings, multimedia presentation, mobile, poster or a tri-fold to represent their selected inventor/designer/engineer/architect. (E and T)
UNIT 3:
Technical Sketching

TIME FRAME:
3 weeks

ESTABLISHED GOALS: CORE CURRICULUM CONTENT STANDARDS
8.1B11, 8.2B1, 8.2C2

UNDERSTANDINGS: STUDENTS WILL UNDERSTAND THAT...
- Almost everything designed is sketched first.
- Technical sketching is a freehand expression of the graphic language.
- Technical sketching is a valuable tool used as a means of communication for a designer or engineer.

ESSENTIAL QUESTIONS:
- What is the relationship between technical sketching and technical drawing?
- How is sketching said to be “worth a thousand words”?

KNOWLEDGE: STUDENTS WILL KNOW:
- Technical sketching is not artistic in nature.
- Technical ideas can be expressed quickly and effectively without the use of special equipment.
- Sketching allows an individual to visualize, refine, resolve and communicate ideas effectively.
- Sketching is an excellent method of analyzing an object because it forces them to notice details.
- Sketched shapes can be natural shapes, geometric shapes or free-form shapes.

SKILLS: STUDENTS WILL BE ABLE TO:
- Freehand sketch various geometric and everyday objects found in the technical drawing lab.
- Sketch 3-D objects in oblique and isometric views.
- Sketch objects in one, two and three point perspective.
- Use color pencils to show shading and give objects a 3-D appearance.
- Utilize sketching techniques to achieve appearance of texture and material.
SUGGESTED PERFORMANCE TASK:
- G: In design teams, draw a 3-D sketch of a Rube Goldberg device that can cut or shred into strips 5 sheets of 8 1/2" x 11" 20lb paper individually with a shredder in 20 or more steps!
- R: Sketch each of the simple machines (lever, inclined plane, screw, wheel and axle, wedge, pulley) Include items associated with each, such as a lever is often shown with a fulcrum.
- A: The individual sketches will be presented to the design team and the final solution to the entire class.
- S: Your design team has entered the Rube Goldberg Machine Design Contest with its goal to win!
- P: The drawing must accurately depict the use of all 6 simple machines and document 20 steps or more.
- S: Rube Goldberg Machine Contest Judging Criteria

OTHER EVIDENCE: SUGGESTED ASSESSMENTS:
- Sketchbook as documented in paper journal/portfolio
- Self and peer evaluation of final solution to Rube Goldberg drawing
- Oral description of final drawing to class
- Practice sketching worksheets on 1 and 2 point perspective.

SUGGESTED LEARNING ACTIVITIES:
- Ice breaker activity
  - Students will analyze sketches of two Rube Goldberg devices and brainstorm as many simple machines as possible. [Link](http://stlouis.missouri.org/techteachers/2002%20Expo%20PDF%27s/Sketching%20Student.pdf) (H & T)
- Lecture
  - PowerPoint slide presentation of objects to be sketched. (E and T)
  - Demonstration one, two, three point perspective sketching. (E)
  - Demonstrations of 3-D sketching techniques including crating, material highlighting, and sketching textures. (E)
- Research
  - Rube Goldberg devices and uses of simple machines. (E and T)
- Portfolio
  - Continue sketching in portfolio. Add knowledge sheets on sketching techniques. (SE and R)
- Technical sketching practice
  - Create drawing of Rube Goldberg device to satisfy current year challenge. (E)
- Enrichment activity
  - Try building a model of your sketch with the help of a technology education teacher. (E)
Unit 4: Lettering

TIME FRAME:
2 weeks

ESTABLISHED GOALS: CORE CURRICULUM CONTENT STANDARDS
4.1, 5.4, 8.2

UNDERSTANDINGS: STUDENTS WILL UNDERSTAND THAT...
- Each lettering style has meaning
- National standards in letter configuration in words, decimals, fractions, and leader notes assure uniformity.

ESSENTIAL QUESTIONS:
- What is the relationship between gothic letter styles and single stroke engineering letters?
- How are lettering styles affected by the application of mechanicals compared to architectural drawings?

KNOWLEDGE: STUDENTS WILL KNOW:
- Uniformity in height, inclination, proportion, strength of lines and spacing of letters and words is essential.
- There are various tools and devices available for lettering including LeRoy lettering instruments, Ames lettering guides and CAD software.

SKILLS: STUDENTS WILL BE ABLE TO:
- Write letters, numbers, fractions and decimals in ANSI style, gothic, modern and italics styles.
- Use mechanical templates as devices
- Use CAD software to create layout and lettering.
- Annotate drawings with notes, labels and dimensions in various systems (Engineering scale, metric and US).
- To identify and select appropriate lettering styles for the drawing being done.
- Space words correctly using correct strokes in ANSI style lettering.
SUGGESTED PERFORMANCE TASK:
- **G**: Develop a collection of samples of lettering styles from magazines, trade journals or instruction manuals for a variety of pictorials, architectural drawings, mechanical and engineering drawings.
- **R**: Each student will be a judge as well as competitor in the lettering competition.
- **A**: The audience will be the judges (entire class).
- **S**: You were selected as a judge for the TSA technical drawing competition. Each drawing must be analyzed for effectiveness of lettering styles, readability and appropriateness.
- **P**: Arrange the collection of samples in an aesthetic manner on 11” X 17” paper. All lettering must be hand done and be accompanied by sample images no larger than 3” X 3”.
- **S**: Rubric

OTHER EVIDENCE: SUGGESTED ASSESSMENTS:
- Self and peer evaluations
- Performance Task Rubric
- Portfolio
- Word processed Quiz

SUGGESTED LEARNING ACTIVITIES:
- Ice breaker activity
  - Peruse LetraSet Lettering Gallery with your students either individually if a computer lab is available or with a projector and laptop. Then give the students sample copy of fonts and direct them to use the remainder of the period to design a personal monogram or logo using their initials that can be used on a master portfolio page for the remainder of year (H and T)
- Lecture
  - PowerPoint slide presentation of classifications of lettering styles, lettering uniformity, lettering tools and spacing. (E and T)
  - Teacher demonstration of lettering, numbering, hand positioning, using guidelines and left hand techniques. (E)
  - Teacher demonstrations of lettering tools including lettering guides, lettering triangles and Ames lettering guide. (E)
- Lettering Exercises
  - Exercise #1 (E and T)
  - Exercise #2 Creating a Title Block (E and T)
  - Exercise #3 Creating a Custom Title Block (E and T)
- Portfolio
  - Practice hand lettering in portfolio. Add knowledge sheets on lettering fonts, styles and rules of lettering. (SE and R)
TIME FRAME:
3 weeks

ESTABLISHED GOALS: CORE CURRICULUM CONTENT STANDARDS
4.2C1, 4.2C2, 4.2D1, 4.2D2, 4.2E1, 8.2B1, 8.2B6

UNDERSTANDINGS: STUDENTS WILL UNDERSTAND THAT...
- Precision is necessary with different types of measuring tools.
- Any object that is important can be measured.
- Measurements impact the way we live. Without measurement, humankind could not track time, mass produce items, make maps, pay for items with money, or develop musical, mathematical, navigational, commercial and administrative skills.

ESSENTIAL QUESTIONS:
- How are measurement and accuracy important in life?
- Why do we need standard units of measure?
- Why do we need an accurately drafted drawing of an object?

KNOWLEDGE: STUDENTS WILL KNOW:
- The rapid technological growth of worldwide commerce has fostered an international system of units (SI) and American system of units (ANSI) based on the meter and suitable for measurements in science and engineering.
- Drawings should be made to scale and indicated in the title block.
- The importance of dimensions on a drawing.

SKILLS: STUDENTS WILL BE ABLE TO:
- Identify and apply dimension lines, extension lines, and leaders.
- Select fractional, decimal and metric dimensions for various types of drawings.
- Place dimensions in a practical and effective method so they are all accurate and legible.
- Dimension geometric shapes including rectangles, circles, arc, fillets, cylinders, holes and miscellaneous shapes.
- Determine the necessary dimensions for a given drawing.
**SUGGESTED PERFORMANCE TASK:**
- **G:** Design and develop a dimensioned floor plan for your bedroom that incorporates your present furniture and an additional closet, computer station, entertainment system or other addition you would like to add.
- **R:** Using the Internet, catalogues or magazines research items to update your bedroom and make it more comfortable.
- **A:** Your parent/s will make the decision as to whether or not the modifications will be made.
- **S:** Your parents have agreed to allow you to update your bedroom.
- **P:** You must develop a dimensioned plan, bill of materials and stay within a budget of $1000.
- **S:** Rubric

**OTHER EVIDENCE: SUGGESTED ASSESSMENTS:**
- Self and peer evaluations
- Performance Task Rubric
- Portfolio
- Word processed Quiz

**SUGGESTED LEARNING ACTIVITIES:**
- Ice breaker activity
  - Each student should measure, calculate and draw a sketch of themselves in quarter inch scale. Dimension height, distance from ground to knee, from ground to fingertips, from ground to waist, from ground to elbow, and from ground to bottom of neck. (H)
- Lecture
  - Teacher demonstration of lines used in dimensioning, placement of dimension and extension lines, drawing arrowheads and leaders (E)
  - Teacher demonstrations of writing fractions, decimals and metric dimensions. (E)
- Activities
  - Create a poster to help students distinguish between extension lines, dimension lines, arrowheads, center line and leaders. (R)
- Dimensioning Exercises
  - Complete dimensioning exercises (sample exercise)
- Portfolio
  - Practice dimensioning in portfolio. Add knowledge sheets, geometric dimensioning sheet of symbols and dimensioning rules. (SE, T and R)
Unit 6: 
Geometry and Mathematical Formulas

TIME FRAME: 
1 week

ESTABLISHED GOALS: CORE CURRICULUM CONTENT STANDARDS 
4.2A1, 4.2E1, 4.2E2, 4.3B2, 8.1A3, 8.2B3

UNDERSTANDINGS: STUDENTS WILL UNDERSTAND THAT...
- Geometric figures and relationships can be represented numerically, graphically and with models.
- Math and mathematical formulas play a role in other disciplines and in life.
- Geometry and mathematical formulas are an integral part of graphic representation.

ESSENTIAL QUESTIONS:
- How do lines, measurements, basic shapes and geometric construction relate to developing mechanical drawings?
- Where is geometry used in the human designed and controlled world?
- Are mathematical formulas invented or discovered?
- How would your lifestyle be impacted without the knowledge of mathematics and mathematical formulas?

KNOWLEDGE: STUDENTS WILL KNOW:
- There are many different types of angles including right, acute, obtuse and complimentary.
- Various geometric shapes can be drawn using specific tools and equipment or by using mathematical methods.

SKILLS: STUDENTS WILL BE ABLE TO:
- Draw examples of various triangles, quadrilaterals, circles, arcs and polygons.
- Divide a line into equal parts or proportional parts.
- Draw specific angles using a triangle (tool) or the tangent, sine or chord method.
- Draw various geometric shapes from written descriptors.
- Apply various mathematical formulas in the drawing of geometric shapes.
SUGGESTED PERFORMANCE TASK:

- **G:** Using drawing instruments and mathematical formulas, draw a template to be printed on parchment paper to equally divide the following foods:
  - 14” diameter pizza into 8 equal slices
  - 12” x 22” pan of lasagna into 16 equal slices
  - 12” diameter calzone (half circle) into 3 equal pieces
  - 9” square pan of Torrone into 16 equal nougats

- **R:** The student will be the designer of a new product for an Italian restaurant.

- **A:** The product is designed for your boss (your instructor).

- **S:** As a new employee at an Italian restaurant, your boss finds out that you are in a technical drawing class at school. He asks that you help him develop a new product to help employees equally divide entrees.

- **P:** The template should be drawn on parchment (tracing vellum) which is normally used between the food and the plate. It should be printed on the reverse side away from food and be slightly 1/8” larger than the item to ensure visibility for the employee to divide foods equally.

- **S:** Rubric

OTHER EVIDENCE: SUGGESTED ASSESSMENTS:

- Visual products
- Student self assessment
- Quiz on use of drawing equipment and mathematical formulas.
- Portfolio

SUGGESTED LEARNING ACTIVITIES:

- Ice breaker activity
  - Students will be divided into 4 teams and teacher will direct students to analyze the class and record as many geometric shapes as they can in the classroom within 5 minutes. (H)

- Lecture
  - PowerPoint slide presentation of objects to be sketched. (E & T)
  - Review the “big inch” and “big centimeter” posters displayed. (E)

- Research
  - Mathematical formulas and methods used to divide objects. (E & T)

- Portfolio
  - Add products from performance task into portfolio. (SE and R)
**Unit 7: Projections and Views**

**TIME FRAME:**
8 weeks

**ESTABLISHED GOALS: CORE CURRICULUM CONTENT STANDARDS**
4.2A2, 4.2A3, 8.1B7, 8.2A3, 8.2B2, 8.2B6

**UNDERSTANDINGS: STUDENTS WILL UNDERSTAND THAT...**
- Many rules and accepted techniques for drawing orthographic projections have become industry standards.
- A projection or view is used to provide information about locating specific features such as holes or the intersection of planes.
- An orthographic projection is a means of representing a 3D object in 2D

**ESSENTIAL QUESTIONS:**
- Why is it necessary to illustrate 2 and 3 view drawings in proper placement to one another?
- Why are 2-D orthographic drawings used to show true size and appearance of a 3-D object?
- How is the visual language of design used to communicate a solution to solve a problem?

**KNOWLEDGE: STUDENTS WILL KNOW:**
- Drawings that use three basic views of an object (such as front, top, and side views) are orthographic projections.
- What a working drawing is and how it is used.

**SKILLS: STUDENTS WILL BE ABLE TO:**
- Determine the necessary views to correctly represent a 3D object.
- Develop and draw an orthographic projection.
- Identify and create a sectional drawing.
- Identify and create an auxiliary drawing.
- Identify and create an assembly drawing.
- Project a third view from a 2 view drawing.
- Describe the purpose of specifications for a design
- Explain the concept of a stakeholder as applied to the process of product design.
SUGGESTED PERFORMANCE TASK:

- **G:** Design children’s building blocks that can be made from recycled rubber bumpers.
- **R:** You own a design company and have been contacted by a rubber manufacturer to come up with ideas for a children’s toy to be used on a playground.
- **A:** The stakeholders are as follows: Schools and Parks Departments (purchasers), client (teacher for grading purposes) who manufactures and markets the new product you design, and general public (tax payers and citizens) who will use the toys.
- **S:** A company who currently manufactures rubber components for the automobile industry wishes to diversify but make use of the existing production equipment, namely their injection molding facility.
- **P:** The product should be safe, fun, easy to produce, modular and profitable. They should be able to fit together easily, store easily and be weather-proof.
- **S:** Rubric

OTHER EVIDENCE: SUGGESTED ASSESSMENTS:

- Orthographic projections of several products including the performance task using multiple views.
- Produce detailed specifications and constraints of your design.
- Student self assessment
- Portfolio

SUGGESTED LEARNING ACTIVITIES:

- **Ice breaker activity**
  - Have several orthographic projections taped to the white board or project digitally and one at a time, hold up the products they represent. Have students try to figure out which drawing is the companion to which product. (H)
- **Lecture**
  - Describe the concept of draft on a mold using digital images. (E & T)
  - Review positioning of views on an orthographic projection. (E)
- **Research**
  - Research on the Internet what makes a product safe for children 3 to 7 years old. (E & T)
  - Research capabilities, resources and costs of a manufacturing plant molding automobile bumpers. (E & T)
- **Portfolio**
  - Add drawings from performance task into portfolio. (SE & R)
  - Complete a self evaluation of the orthographic projections completed. (SE & T)
## Unit 8: Pictorials and Renderings

### TIME FRAME:
8 weeks

### ESTABLISHED GOALS: CORE CURRICULUM CONTENT STANDARDS
4.2A2, 4.2A3, 8.2A3, 8.2B2, 8.2B6

### UNDERSTANDINGS: STUDENTS WILL UNDERSTAND THAT...
- A pictorial drawing is one in which the object is viewed in such a position that several faces appear in a single view.
- Two or more views of an object can convey an idea of shape and form to people who are familiar with this type of drawing.

### ESSENTIAL QUESTIONS:
- Why would an engineer use a pictorial drawing to model a design?
- What is the relationship between an oblique, perspective and isometric drawing?

### KNOWLEDGE: STUDENTS WILL KNOW:
- The steps to producing a isometric drawing.
- When each type of pictorial drawing is applied.
- Right triangle theory 30/60/90.
- The difference between oblique, perspective and isometric pictorials.
- Isometric drawing is the most commonly used method of pictorial drawing.
- How to identify and select isometric, oblique, diametric, trimetric and planometric pictorial drawings to solve a given technological problem.

### SKILLS: STUDENTS WILL BE ABLE TO:
- Draw angles, circles and arcs in isometric.
- Produce an isometric section drawing.
- Identify X, Y and Z axis.
- Develop a technological solution to a given problem using pictorial drawings and given constraints.
SUGGESTED PERFORMANCE TASK:
- G: Students will design, draw in pictorial view and manufacture a hovercraft type vehicle that travels further than any other vehicle powered only by one balloon full of air.
- R: The student will be the designer of a new hovercraft vehicle that can be used by the military.
- A: The general (teacher) will be the judge of the new hovercraft’s design qualities and effectiveness.
- S: The U.S. military wants to commission private contractors to design and build a prototype of a hovercraft vehicle that goes the distance!
- P: The only materials that can be used are cardstock, paper plates, plastic film canisters, thread spool, hot glue and masking tape. The hovercraft can only be powered by one balloon full of air.
- S: The drawings will be judged on accuracy, neatness, and technical detail. The vehicle will be evaluated on the longest distance it travels.

OTHER EVIDENCE: SUGGESTED ASSESSMENTS:
- Sample pictorial drawings on assigned objects and hovercraft vehicle.
- Recorded distance hovercraft travels.
- Student self assessment
- Portfolio

SUGGESTED LEARNING ACTIVITIES:
- Ice breaker activity
  - Images of a hovercraft and other experimental military vehicles can be shown to the class either digitally or in 2D. Have students try to explain what it is, how it functions, and brainstorm some unique uses for the vehicle. (H)
- Lecture
  - Teacher demonstration of how to draw an isometric, pictorial view. (E)
  - Teacher explanation of technology learning activity (performance task). (E)
- Activities
  - Students will research how a hovercraft works. (R)
  - Students will research and sketch simple hovercraft design into their portfolio (R)
  - Students will individually develop a new hovercraft design in and draw it in an isometric, pictorial view. (E and R)
- Portfolio
  - Include all research, drawings, sketches, test results and self evaluation in portfolio. (SE, T and R)
Unit 9:  
Problem Solving and Real World Applications

TIME FRAME:  
10 weeks

ESTABLISHED GOALS: CORE CURRICULUM CONTENT STANDARDS  
4.5A1, 4.5A2, 4.5C3, 4.5C4, 8.1A3, 8.2B3, 8.2B6, 9.1B4, 9.1B5, 9.2B2 9.2F4

UNDERSTANDINGS: STUDENTS WILL UNDERSTAND THAT...  
- Rapid societal changes in technology and communication have increased the need for students to be able to identify and solve real problems, use appropriate tools, reason effectively and think critically.  
- Design and engineering processes are effected by design constraints and specific limitations.

ESSENTIAL QUESTIONS:  
- What is the value of working as a team to develop a product?  
- How are hands-on, real world applications of abstract mathematical concepts tied into the success of a technology education project?  
- What are the negative and positive societal, environmental and economic impacts of designing a technological system?

KNOWLEDGE: STUDENTS WILL KNOW:  
- Various methods for creating possible solutions, modeling and testing of solutions, and modifying proposed design in the solution of a technological problem.  
- The steps of the design process in order to solve a given problem.  
- Geometric and mathematical concepts in order to solve the given problem.

SKILLS: STUDENTS WILL BE ABLE TO:  
- Select and safely use tools, products and systems solve the specific real world challenged posed to them.  
- Use computers and calculators in various applications of problem solving.  
- Document processes and procedures and communicate them to different audiences using appropriate oral and written techniques.  
- Design forecasting techniques to evaluate the results of altering natural systems and the long term effects on the environment.
SUGGESTED PERFORMANCE TASK:

- **G:** Working as a member of an architectural team, you are competing against other companies to win the contract to design a recreational facility for members of the community on a given site purchased by the town.
- **R:** Students will work in no more than teams of 4 members. Each team must have a Project Manager and define a Team Operating Agreement, signed by each team member. In the event a member is fired in accordance with the Team Operating Agreement, he/she will work the remaining time on an independent project assigned by the teacher.
- **A:** Your final solution will be presented to a group of local architects and the township planning board.
- **S:** Your town has agreed to purchase a large tract of land under open space appropriations (approximately 90 acres) in the center of your town to develop into a recreational area for all members of the community. It must include softball fields to find a permanent home for the girls’ softball program in town.
- **P:** Your design must meet the needs of the town you reside in, making use of the natural benefits of the chosen site, while preserving any wetlands.
- **S:** Instructional Rubric for Teamwork. Project assessment points will be awarded as follows: 200 points for Scale model, site plan, floor plan/s, perspective drawings (by teacher). Professional architect sample rubric. 200 points for presentation, architectural plan, overall site use and the degree of accountability including environmental impact and cost estimate. (by professional architects and planning board.) 100 points for assessing yourselves and your teammates on teamwork skills. (by student).

OTHER EVIDENCE: SUGGESTED ASSESSMENTS:

- Scale model of solution
- Site plan drawn to scale
- Floor plan/s
- Perspective drawings
- Cost estimate of proposed solution
- Written proposal
- Design file and portfolio including building and site sketches with brief notes on rejected ideas, notes from team meetings, rough drafts of written proposal and oral presentation as well as a self evaluation.
- Final presentation to community based architects and township planning board.
SUGGESTED LEARNING ACTIVITIES:

- **Ice breaker activity**
  - Conduct an informal interview of the student sitting next to you to figure out what recreational and environmental needs are not being met in the township you reside in. (H)

- **Lecture**
  - Teacher explanation of the real world technology design challenge (E)
  - Architects and township planning board members participate in a question and answer period (E)

- **Activities**
  - Students will visit or research the site that the project will be built upon. (R)
  - Students will conduct a survey to decide the community needs that can be fulfilled on the given site. (R)
  - Students will develop a site plan based upon the results of the survey and personal ideas of the team. (E and R)
  - Students will develop floor plans of all structures on the property. (E)
  - Students will create a perspective or pictorial drawing of the final design solution. (E)
  - Students will calculate and devise a written **cost estimate** of the final design solution. (E and T)
  - Student teams will generate a written proposal to be presented to the planning board for consideration. (E and T)
  - Student teams will make a presentation of their design solution to the township planning board in order to win the contract.
  - Debrief, reflect and evaluate teamwork skills. (SE and T)
  - Define and sign a **Team Operating Agreement** that will define what is expected of each team member and what should if a team member is not participating in the group. (E)
  - Build a scale model of the final design facility that you will be presenting to the planning board. (E)

- **Portfolio**
  - Include all working drawings, notes, group contacts, Team Operating Agreement, perspective drawing, **cost estimate** and written proposal. (SE, T and R)

- **Field trips (if available)**
  - To local architects and town hall to visit with the township planning board (R)
Unit 10: Careers

TIME FRAME:
2 weeks

ESTABLISHED GOALS: CORE CURRICULUM CONTENT STANDARDS
8.1A2, 9.1A1, 9.1A2, 9.1A3, 9.1A5, 9.1B1, 9.1B3, 9.1B4, 9.1B5, 9.2F5

UNDERSTANDINGS: STUDENTS WILL UNDERSTAND THAT...
- Technical Drawing I can prepare them for a variety of technology related careers.
- To be competitive in the global, information based society we live in, they must continue to use and apply life and career skills learned in technology education courses like this one.

ESSENTIAL QUESTIONS:
- How will understanding myself assist me in making good career choices?
- What different types of education are required for the various occupational clusters?
- What careers interest me? What careers am I suited for?
- How can I communicate effectively in a job interview?

KNOWLEDGE: STUDENTS WILL KNOW:
- How to obtain information on specific careers using the Occupational Outlook Handbook.
- Their own personal qualities and education that are needed to obtain and retain a specific job related to technical drawing.

SKILLS: STUDENTS WILL BE ABLE TO:
- Research three careers related to technical drawing and career and technical education and gain enough understanding to allow them to answer job-specific questions.
- Develop a resume and cover letter for one of the three careers researched.
- Complete a job application properly demonstrating knowledge of the position
- Prepare themselves and undergo a mock interview acting as both a job applicant and an interviewer.
SUGGESTED PERFORMANCE TASK:
- **G:** Each student will document in their portfolio research of three different careers related to technical drawing. Prepare a resume and cover letter for the one career you feel most suited and complete a job application.
- **R:** The role of the student will be to participate as both an applicant and interviewer in a mock interview. Sample questions can be found on [www.echoices.com](http://www.echoices.com). (See guidance department for access code.)
- **A:** The class is the audience. Each student will have the opportunity to be the interviewer as well as the job applicant.
- **S:** You have graduated from high school and have the appropriate level of training/education that is required for successful employment in your selected career.
- **P:** The research on the 3 areas related to technical drawing should provide supporting information including brief description of each career, training/education, the job outlook and average starting salary.
- **S:** Rubric

OTHER EVIDENCE: SUGGESTED ASSESSMENTS:
- Resume and cover letter
- Completed job application
- Documentation of career research in their portfolio
- Mock interview

SUGGESTED LEARNING ACTIVITIES:
- Ice breaker activity
  - Complete a [career interest survey](#) to see what types of careers they are suited for and have an interest. (H)
  - Powerpoint that lists the top 10 careers technical careers and the average starting salary (E and T)
- Portfolio
  - Include all research, resume, cover letter, completed job application and self evaluation after the mock interview. (SE, T and R)
- Lecture
  - Conduct a class discuss that discusses preparation for the mock interview including how to shake hands, introductions, confidence, personal appearance and grammar. (E and SE)
- Activities
  - Complete a job application neatly in blue or black ink using correct spelling and punctuation. (E)
  - Research and select questions students will use in their mock interview (E and R)
  - Obtain sample resumes and cover letters to compare and contrast them. (E and R)
Rubrics and Resources by Unit

Unit One
Performance Task Rubric

Unit Two
Performance Task Rubric

Unit Three
Rube Goldberg Contest Details
Rube Goldberg Machine Contest Judging Criteria
Perspective Drawing Worksheet
Icebreaker Activity

Unit Four
LetraSet Lettering Gallery

Assessment Quiz
Directions: Using full sentences, answer the questions in a Microsoft Word document. After being graded, please insert into your portfolio.

• Why is it important for "drafters", "architects", "engineers", "designers", and "technicians" to have skill in "freehand" lettering?
• Why is "lettering" needed on a "technical drawing"?
• The "standard style of lettering" used on "technical drawings" is called ________
• What are "guide lines" and how are they used?
• Should "lower case letters" be used on a "technical drawing"? WHY?
• Lettering for "dimensions & notes" on a "technical drawing" should be _______ of an inch high.
• Lettering for "titles" on a "technical drawing" should be _____ of an inch high.
• The "guide lines" for "fractions" on a "technical drawing" should be _______ of an inch high.
• How should the "fraction bar" be drawn on a "technical drawing"? Why?
• What does "composition" mean in reference to "lettering" on a "technical drawing"?
• What "weight of drawing lead" is recommended for "freehand lettering"?
• What "weight of drawing lead" is recommended for "guide lines"?
• How does "architectural lettering" differ from the "standard style of lettering"?
• What type of "mechanical lettering" is done on clear tape and stuck on a drawing?
• Letter an example of each letter of the alphabet and the numerals 0 thru 9.
Unit Four
Performance Task Rubric

“TSA Technical Drawing Lettering Competition Official Rating Form”

<table>
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<th>Technical Details 20 points</th>
<th>Effectiveness 20 points</th>
<th>Appropriateness 20 points</th>
<th>Readability 20 points</th>
<th>Aesthetics 20 points</th>
<th>Total points earned</th>
<th>Rank</th>
<th>Evaluator's Comments and Notes</th>
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Unit Five

Assessment Quiz

Directions: Using full sentences, answer the questions in a Microsoft Word document. After being graded, please insert into your portfolio.

- Define the term "size description"?
- Why is it important to use extreme care in the selection and placement of dimension and notes?
- List the four criteria that must be followed when adding dimensions and specifications to a drawing:
- List two "standards" that are used to provide uniformity between all engineering groups in the application of dimensions:
- Describe the difference between the "unidirectional" and "aligned" systems for placing dimensions on a dimension line:
- What note should be placed on a drawing to indicate the unit of measurement being used on the drawing?
- List the four components of a dimension and draw an example:
- Describe the difference between "size" and "location" dimensions:
- What is a "leader" and how is it used?
- What is a "datum" and how is it used?
- Describe a "detail drawing"?
- What information is usually included as part of the "specifications" on a detail drawing?
- List the steps to follow for placing dimensions on a drawing:
- Which view on a multiview drawing usually has the majority of the dimensions? Explain?
- What amounts of spacing are used when placing extension and dimension lines on a view?
- Should dimensions be repeated on a drawing? Explain?
- What features on a view should be avoided when placing extension and dimension lines?
- Most dimension lines should be placed between the views and not within the views. Explain why this is true?
- Name the six (6) ways of forming holes in objects, sketch an example of each, and show the proper symbol:
- What is the difference between "baseline" and "chain" dimensioning and when should each be used?
Dimensioning Rules

Please keep a copy in your portfolio.

- Place dimensions on orthographic views, not on isometric (pictorial) views. You can begin to see why we use orthographic views as you try to interpret the isometric presentation of the problems.
- Leave enough room between dimensions to add another dimension without moving the existing dimensions. Crowded work can be very hard to read.
- Place your dimensions outside the outline of the object.
- Don’t cross dimension text or dimension lines with other text or extension lines.
- Completely dimension all the features of the object in your drawing (watch out for and try to avoid double dimensioned features. Too many dimensions can be as confusing as too few. Use reference dimensions only when they can clarify a feature. For instance: if you have chain dimensioned an object you may provide a ref dimension to give the overall dimension of the chain.
- Leaders defining radius and diameter should point at the center of the circle or arc.
- Dimension extension lines and leaders should not cross dimension lines.
- Ordinate dimensions should have their text .75” from the object envelope when printed.
- Centerlines should be used to couple multiple object features (holes, projections, and groups of features).
- The term (n)X should be used after the dimension text to indicate the text is used to define multiple objects. (n) is the number of times that the text applies. Example for a hole leader text “Ø .25 5X”.
- Text should be within the extension lines if possible, if not then arrowheads should be within the extension lines with the text removed, only if there is not room for the arrowheads, may both the arrowheads and text be outside the extension lines.
- Extension lines should be .06 inches from an object when drawn.
- Arrowheads should be closed filled unless otherwise specified.
- Circles should have centerlines which extend .12 inches beyond the circle when printed.
- Radii should not have centerlines or center marks unless the mark is being used to locate the radius.
- Leading zeros shall not be found on inch dimensions. Leading zeros shall be used with metric dimensions.
- To determine the dimension precision (the number of digits or zeros to the right of the decimal point), use the problem example. You may also ask me if this isn’t clear for a specific problem.
- Tolerance text should be the same size as the dimension.
- Dimensions given as fractions should be stacked.
Dimension Activity Sheet

Directions:

Dimension the part shown below using Geometric Dimensioning and Tolerance procedure so the following functional requirements are met:

- The datum surfaces A and B must be flat within a tolerance zone of 0.02mm
- The surface C must be parallel to datum surfaces A and B within 0.08 mm
- The large bore must be perpendicular to datum surfaces A and B within 0.08 mm
- The sides of the 4X8 keyway must be machined.
- The large hub must be circular within a tolerance zone of 0.02.
- Indicate the datum surfaces.
**Unit Six**

Performance Task Rubric

**Unit Seven**

Performance Task Rubric

**Unit Eight**

Manufacture a Hovercraft Type Vehicle  
Creating a High School Hovercraft Curriculum

**Unit Nine**

Team Operating Agreement

**Unit Ten**

[www.echoices.com](http://www.echoices.com)  
[www.monster.com](http://www.monster.com)  
Occupational Outlook Handbook  
Career interest survey  
Sample cover letters
### Career Comparisons Evaluation Rubric

**Name of Evaluator** _____________________________ **Period** ___________

**Date** ______________________  **Teacher**

<table>
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<th>Student ID#</th>
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#### Evaluative Criteria

**Research (25 points)**
- Evidence of Research of 3 Careers..........15 pts.
- Other supporting information ................. 5 pts.
- Neatness, format, spelling, punctuation... 5 pts.

**Resume and Cover Letter (25 points)**
- Organization ...........................................5 pts.
- Content (clear, concise, pertinent).........10 pts.
- Neatness .................................................. 5 pts.
- Format, spelling, punctuation ..............5 pts.

**Job Application (20 points)**
- Completeness ........................................ 5 pts.
- Neatness and spelling ............................ 5 pts.
- Knowledge of position ............................ 10 pts.

**Interview (30 points)**
- Introduction
- Content of answers
- Confidence, maturity, enthusiasm
- Personal appearance (poise, posture,
  Eye contact, attire)
- Voice / Language (grammar/clarity)

#### Total Points Earned

#### Evaluator’s Comments & Notes
Supplemental Resources

WebQuests
Solar Energy Designs for Architectural Drafting and Design
http://curry.edschool.virginia.edu/go/edis771/fall99webquests/student/sellsworthweaver/home.html

Building Bridges
http://www.alt.wcboe.k12.md.us/mainfold/technolog/techsat/web01/Shank/BUILDI%7E1.HTM

Perspective
http://montblanc.pausd.palo-alto.ca.us/~lpapanicolaou/perspective-webquest/perspective-webquest.html

Rethinking Your Environment: A Team Approach
http://www.burke.k12.nc.us/Instructionaltech/webquests/drafting/

Geographic Information Systems WebQuest
http://coe.west.asu.edu/students/jjenkin/webquest/webquest.htm

Drafting Careers
http://www.epcc.edu/programs/drafting/specialties.html
http://www.ohp.k12.oh.us/hs-amd.php

Activities
http://www.boiseschools.org/schools/lesbois/teachers/johns/links.htm#drawing
http://www.gritsonline.org/archa.htm
http://www.princetonol.com/groups/iod/lessons/middle/Donnalyn-hands.htm
http://www.adrianbruce.com/Symmetry/wsheet.htm
http://www.olejarz.com/arted/perspective/tools.html (interactive)