

# **FREEHOLD REGIONAL HIGH SCHOOL DISTRICT**

## **OFFICE OF CURRICULUM AND INSTRUCTION**

### **CAREER-TECHNICAL EDUCATION/TECHNOLOGY EDUCATION DEPARTMENT**

# **COMPUTER AIDED DESIGN I**

#### **COURSE PHILOSOPHY**

Computer Aided Design is a constantly evolving field which affects the way everyday products are designed, prototyped, and manufactured. Students enrolled in CAD I become proficient with various CAD functions, terminology, and career opportunities in related fields. Each participant will demonstrate the safe operation of tools, computer equipment, and plotters in their quest to design and analyze solutions to real-world problems within time constraints. Students will create computer-generated single view, orthographic, isometric, and three-dimensional drawings in preparation for advanced high school and post-secondary education programs and/or industry.

#### **COURSE DESCRIPTION**

Grade Level: 9 - 12

Department: Career-Technical  
Education  
Technology Education

Course Title: Computer Aided Design I

Credits: 5

Course Code: 086400

**BOARD OF EDUCATION INITIAL ADOPTION DATE: AUGUST 30, 2010**

### **Course Philosophy**

In order to prepare students for the 21<sup>st</sup> century workforce it is important to impart the knowledge and skills students will require at an early stage. Computer Aided Design I will focus on providing students with the information they need to be productive members of the design and industrial world. Through the use of traditional methods and hands-on problem solving, students will be engaged in a host of real world problem solving activities. By immersing students in an experience that mimics industry, they will be better prepared to continue their education in this field and have an understanding for how the world around them is designed and produced.

### **Course Description**

Computer Aided Design I is a one year, five credit course designed for students who may be considering post secondary training in related areas, such as Mechanical Engineering, Product Design, or Industrial Design. The CAD courseware includes, but is not limited to, 2D and 3D design, parametric modeling, engineering drawings, as well as Computer Aided Manufacturing (CAM) technology. Students learn by creating computer-generated single view, orthographic, isometric, and 3D designs along with constructing models/prototypes. The CAD course will increase the students' awareness of various facets of engineering fields including manufacturing techniques, design trends, design styles, CAD functions, and creating prototypes for presentation to clients. Skills in communication, mathematics, science, leadership, teamwork, and problem solving are reinforced in this course.

**Freehold Regional High School District  
Curriculum Map**

**Computer Aided Design I**

Relevant Standards <sup>1</sup>	Enduring Understandings	Essential Questions	Assessments		
			Diagnostic (before)	Formative (during)	Summative (after)
9.1.12.F.1 9.3.12.C.1,2,5,6, 11-13 9.4.12.O.38-45	Self-management is a key to maximizing efficiency and preventing accidents.	<ul style="list-style-type: none"> <li>What are some organizational skills?</li> <li>How are organizational skills beneficial to an employee/employer relationship?</li> <li>Why is time management important?</li> <li>Why are safety precautions important in the workplace?</li> </ul>	Do Now  Ice Breaker  Pretest	Quizzes  Chapter Test  Written Assignments	Portfolios  Self and Peer Assessment  Performance Assessment
9.1.12.C.1-6; D.1-3; E.5; F.1 9.3.12.C.14-24 9.4.12.O.1,13-18, 22,29-33,36,46- 51,67,68	Working with other people is an important skill for life and the workplace.	<ul style="list-style-type: none"> <li>What characteristics are essential to a functional team?</li> <li>What are the benefits of working in a team environment as opposed to individually?</li> <li>How do inappropriate behaviors and characteristics affect productivity?</li> </ul>	Student Survey  Oral Questions/ Discussion	Oral Presentations  Observations	Mid Terms  Final Exam
8.1.A.12.1 8.1.12.F.2 9.4.12.O.58; O(1).9-10	Knowing how to create, save, retrieve, and produce electronic work is essential in the work place.	<ul style="list-style-type: none"> <li>How is work done on a computer created and stored?</li> <li>What is the benefit of a computer network?</li> <li>What is the purpose of various file types?</li> </ul>	Anticipatory Set Questions	Participatory Rubrics  Role Play	Projects Based Learning – Rubric Assessment
8.2.12.B.1-3; C.1-3; D.1; E.1 9.4.12.O(1).11-12	The design/engineering process is a series of steps taken in order to create a product or solve a problem.	<ul style="list-style-type: none"> <li>What are the components of the design/engineering process?</li> <li>How is the design/engineering process carried out, and what are the steps?</li> <li>How is a final product affected by the design/engineering process?</li> </ul>		Interviews  Journals  Research Assignments	
8.1.12.A.2 8.2.12.F.3 9.4.12.O(1).2,5,8-12	Proficiencies with various tools and menus of a computer program will greatly assist the efficiency of work.	<ul style="list-style-type: none"> <li>How do sketches play a role in creating a solid model?</li> <li>How does a CAD program help you create a design?</li> <li>What part of the CAD editing program helps you create the changes?</li> <li>How can one navigate through the various options of a CAD program?</li> </ul>			
9.4.12.B.6, 18, 24, 8.1.12.C.1, F.2; 8.2.12.G.1,	Innovation in digital tools and products are utilized to aid and simplify work.	<ul style="list-style-type: none"> <li>What is the difference between using your hand to drawn design as opposed to a computer?</li> <li>What is the difference between using your hand to alter a design as opposed to altering it digitally?</li> <li>Who is known as a major contributor in CAD?</li> <li>What are the benefits of digital CAD technology in product development?</li> </ul>			

Relevant Standards <sup>1</sup>	Enduring Understandings	Essential Questions	Assessments		
			Diagnostic (before)	Formative (during)	Summative (after)
8.2.12.F.1, 3, 9.4.12.B(1).9, 75, 5.1.12.B.2	CAD requires knowledge of proper technique.	<ul style="list-style-type: none"> <li>• What are the basic CAD terminologies for creating models?</li> <li>• What are some of the key features that should be understood when designing a product?</li> <li>• Why is it important to follow proper procedure in creating a model?</li> <li>• How does proper dimensioning affect a product?</li> <li>• How do various parts come together to form sub assemblies?</li> <li>• What are the key features in renderings?</li> <li>• Why is it important to know various file types?</li> </ul>	Do Now  Pretest  Student Survey  Oral Questions/ Discussion	Journals  Quizzes  Chapter Test  Observations  Participatory Rubrics	Portfolios  Projects Based Learning – Rubric Assessment  Self and Peer Assessment  Performance Assessment  Mid Terms  Final Exam
9.4.12.B(1).1, 2, 15; 9.1.12.D.3, 8.1.12.C.1, 8.2.12.B.1, 2	CAD programs allow products to be presented to clients prior to production.	<ul style="list-style-type: none"> <li>• Why are presentations important?</li> <li>• How is a product presentation conducted?</li> <li>• What are some ways in which CAD models can be presented to clients?</li> <li>• Why is solid model rendering important?</li> </ul>	Anticipatory Set Questions	Interviews  Written Assignments  Oral Presentations	
9.4.12.B(1).1, 9, 5.1.12.B.2, 8.2.12.A.1, B.1, 2	CAD programs are fundamental to the development of technological products.	<ul style="list-style-type: none"> <li>• How has the timeline of product development been affected by CAD technologies?</li> <li>• What is the difference between CAD and CAM?</li> <li>• Why is it important to know how to use CAD CAM Software together?</li> <li>• How is rapid prototyping used in the development of a product?</li> </ul>		Research Assignments	
9.4.12.B(1).7, 54-58, C.55, 9.1.8.E.4, 8.1.12.D.2	Use of various designs and information adheres to legal and ethical laws.	<ul style="list-style-type: none"> <li>• What are the consequences of copying and pasting other peoples work without permission?</li> <li>• What ethical guidelines need to be followed when producing ideas and designs?</li> <li>• Why are patents important in the development of technological products and systems?</li> </ul>			

**Freehold Regional High School District  
Course Proficiencies and Pacing**

**Computer Aided Design I**

Unit Title	Unit Understandings and Goals	Recommended Duration
Unit 1: Teamwork, Self Management, and Health & Safety	Self-management is a key to maximizing efficiency and preventing accidents. Working with other people is an important skill for life and the workplace. <ul style="list-style-type: none"> <li>• Students will be able to identify and implement proper safety in a work environment.</li> <li>• Students will also understand the importance of collaboration and effective teamwork skills.</li> </ul>	2 weeks
Unit 2: Introduction to Design	The design/engineering process is a series of steps taken in order to create a product or solve a problem. Innovation in digital tools and products are utilized to aid and simplify work. CAD programs are fundamental to the development of technological products. Use of various designs and information adheres to legal and ethical laws. <ul style="list-style-type: none"> <li>• Students will be able to demonstrate an understanding of the design/engineering process and put it into practice.</li> <li>• Students will be able to identify basic technical drawings and describe their importance to the design/engineering process.</li> <li>• Students will be able to identify the impact and use of computer technology in product development.</li> </ul>	2-3 weeks
Unit 3: Sketching and Drawing	The design process is a series of steps taken in order to create a product or solve a problem. Innovation in digital tools and products are utilized to aid and simplify work. CAD requires knowledge of proper technique. <ul style="list-style-type: none"> <li>• Students will be able to demonstrate an understanding of various sketching techniques as well as drawing types.</li> <li>• Students will develop an appreciation for the use of computers in drafting and design work.</li> <li>• Students will be able to identify the early influences in CAD technology.</li> </ul>	2-3 weeks
Unit 4: CAD - History and Introduction	Knowing how to create, save, retrieve, and produce electronic work is essential in the work place. Proficiencies with various tools and menus of a computer program will greatly assist the efficiency of work. Innovation in digital tools and products are utilized to aid and simplify work. <ul style="list-style-type: none"> <li>• Students will understand the historical background that lead to the innovation of CAD and how it was first used.</li> <li>• Student will be able to identify the various menus, toolbars, windows, and work areas of the CAD program.</li> <li>• Students will also understand how to create specific file types, save file, and format preferences.</li> </ul>	2 weeks
Unit 5: Creating a Simple Model.	Knowing how to create, save, retrieve, and produce electronic work is essential in the work place. The design process is a series of steps taken in order to create a product or solve a problem. Proficiencies with various tools and menus of a computer program will greatly assist the efficiency of work. Innovation in digital tools and products are utilized to aid and simplify work. <ul style="list-style-type: none"> <li>• Students will understand the need to have a valid sketch prior to creating a solid.</li> <li>• Students will understand the concept of parametric modeling and shape before size.</li> <li>• Students will understand the importance of selecting the appropriate drawing plane.</li> <li>• Students will understand the primary extrude feature. Students will be able to troubleshoot common errors.</li> </ul>	2 weeks
Unit 6: Dimensions and Constraints	Innovation in digital tools and products are utilized to aid and simplify work. Proficiencies with various tools and menus of a computer program will greatly assist the efficiency of work. CAD requires knowledge of proper technique. <ul style="list-style-type: none"> <li>• Students will describe the importance of dimensioning and tolerances</li> <li>• Students will understand the interaction between sketching dimensions and the resulting solid mode, as well as geometric and parametric relationships.</li> </ul>	3 weeks

Unit Title	Unit Understandings and Goals	Recommended Duration
Unit 7: Engineering Drawing	<p>Knowing how to create, save, retrieve, and produce electronic work is essential in the work place.            Innovation in digital tools and products are utilized to aid and simplify work.            Proficiencies with various tools and menus of a computer program will greatly assist the efficiency of work.            CAD requires knowledge of proper technique.            CAD programs allow products to be presented to clients prior to production.</p> <ul style="list-style-type: none"> <li>• Students will be producing engineering drawings based on 3D models and parts.</li> <li>• Students will be able to identify proper drawing styles and their individual components.</li> <li>• Students will understand the proper dimensioning techniques.</li> <li>• Students will understand how to create a title block and scale their drawing to specific.</li> </ul>	2 weeks
Unit 8: Drawing Output	<p>Knowing how to create, save, retrieve, and produce electronic work is essential in the workplace.            Proficiencies with various tools and menus of a computer program will greatly assist the efficiency of work.</p> <ul style="list-style-type: none"> <li>• Students will understand how to format their drawings and models for out put to an assortment of printers and plotters.</li> </ul>	1 weeks
Unit 9: Patterns and Copies	<p>Proficiencies with various tools and menus of a computer program will greatly assist the efficiency of work.</p> <ul style="list-style-type: none"> <li>• Students will be able to duplicate and mirror visual objects within their design to create patterns and several instances of the same shape.</li> </ul>	2 weeks
Unit 10: Revolve	<p>Proficiencies with various tools and menus of a computer program will greatly assist the efficiency of work.</p> <ul style="list-style-type: none"> <li>• Students will be able to understand the relationship between a profile and the axis it is rotated about using revolve or a similar feature.</li> </ul>	2 weeks
Unit 11: Sweep/Loft	<p>Proficiencies with various tools and menus of a computer program will greatly assist the efficiency of work.</p> <ul style="list-style-type: none"> <li>• Students will be able to project a profile along a given path to create a new solid object that may be of an irregular shape.</li> </ul>	4 weeks
Unit 12: Rendering	<p>CAD programs allow products to be presented to clients prior to production.</p> <ul style="list-style-type: none"> <li>• Students will be able to apply materials and textures to a designed product to give it a realistic appearance for presentation.</li> </ul>	2 weeks
Unit 13: Assemblies	<p>Innovation in digital tools and products are utilized to aid and simplify work.            The design process is a series of steps taken in order to create a product or solve a problem.</p> <ul style="list-style-type: none"> <li>• Students will be able to take multiple designed components and join them together within the program to make a complete final product.</li> </ul>	3 weeks
Unit 14: Rapid Prototyping	<p>Innovation in digital tools and products are utilized to aid and simplify work. CAD Programs are fundamental to the development of technological products.            The design process is a series of steps taken in order to create a product or solve a problem.</p> <ul style="list-style-type: none"> <li>• Students will be able to create a design and then use a rapid prototyping method to create a tangible 3D model.</li> </ul>	3 weeks
Unit 15: Careers and Professionalism	<p>Working with other people is an important skill for life and the workplace.            CAD programs allow products to be presented to clients prior to production.</p> <ul style="list-style-type: none"> <li>• Students will be able to create a final product using CAD/CAM software to quickly create a prototype of their ideas for presentation.</li> </ul>	2 weeks

**Freehold Regional High School District  
Computer Aided Design I**

**Unit #1: Teamwork, Self Management, and Health & Safety**

**Enduring Understandings:** Self-management is a key to maximizing efficiency and preventing accidents.  
Working with other people is an important skill for life and the workplace.

**Essential Questions:** What are some organizational skills? How are organizational skills beneficial to an employee/employer relationship?  
Why is time management important? Why are safety precautions important in the workplace?  
What characteristics are essential to a functional team? What are the benefits of working in a team environment as opposed to individually?  
How do inappropriate behaviors and characteristics affect productivity?

**Unit Goals:** Students will be able to identify and implement proper safety in a work environment.  
Students will also understand the importance of collaboration and effective teamwork skills.

**Duration of Unit:** 2 weeks

**NJCCCS:** 9.1.12.C.1-6, 9.1.12.D.1-3, 9.1.12.E.5, 9.1.12.F.1, 9.1.12.F.1, 9.3.12.C.1,2,5,6,11-13, 9.3.12.C.14-24, 9.4.12.O.1,13-18, 22,29-33,36,38-51,67,68

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
<p>What are common organizational skills needed in the workplace?</p> <p>How does time management affect productivity?</p>	<p>Proper record keeping is critical</p> <p>In order to meet goals, a timeline with objectives must be set.</p> <p>Model methods of organizing materials and resources for projects.</p>	<p>Desktop Computer</p> <p>Internet</p> <p>Study Guides/Handouts</p> <p>PowerPoint or SMART Notebook Presentations</p>	<p>Role playing of teachers and students. Teacher/ Students demonstrating good and bad organization.</p> <p>Discussions of class procedures and expectations</p>	<p>Written tests and quizzes</p> <p>Worksheets</p> <p>Notebook assessments</p> <p>Responses to discussion questions</p>
<p>What are the governing bodies that set safety laws?</p> <p>What is Personal Protective Equipment?</p>	<p>Implement safety procedures in the classroom.</p> <p>Identify safety signage and the hazard the symbol is warning against.</p> <p>Model methods for maximizing personal productivity in a safe environment.</p>	<p>Moodle</p> <p>Pacing Chart</p> <p>Class Expectations/Rules</p> <p>SMART responders</p>	<p>Presentation on classroom and occupational safety procedures, PPE and hazardous signage.</p> <p>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.) Winning team receives extra credit.</p>	<p>Journal assessments</p> <p>Threaded Discussion Groups</p> <p>Self and Peer assessments</p> <p>TSA Rubrics</p> <p>Midterm/Final Exam</p>
<p>What are some key characteristics and advantages of team work?</p>	<p>Model social characteristics that are beneficial to groups.</p>		<p>Presentation on appropriate characteristics for team work and collaboration.</p> <p>Review of articles on team work skill with a reflection provided by the students and shared with others.</p>	

**Suggestions on how to differentiate in this unit:**

- A hands-on approach to assignments and projects is recommended as the most effective method of learning. Students that fall behind may be teamed up with students whom excel in particular topics. Teacher should always adjust learning environment based on reluctant learners or special education needs.

# Freehold Regional High School District Computer Aided Design I

## Unit #2: Introduction to Design

**Enduring Understandings:** The design/engineering process is a series of steps taken in order to create a product or solve a problem.  
 Innovation in digital tools and products are utilized to aid and simplify work.  
 CAD programs are fundamental to the development of technological products.  
 Use of various media and information adheres to legal and ethical laws.

**Essential Questions:** What are the components of the design/engineering process? How is the design process carried out, and what are the steps?  
 How is a final product affected by the design process? What is the difference between using your hand to drawn design as opposed to a computer?  
 What is the difference between using your hand to alter a design as opposed to altering it digitally?  
 How has the timeline of product development been affected by CAD technologies? How is rapid prototyping used in the development of a product?  
 What are the consequences of copying and pasting other peoples work without permission? Why are patents important in the development of technological products and systems?

**Unit Goals:** Students will be able to demonstrate an understanding of the design/engineering process and put it into practice. Students will be able to identify basic technical drawings and describe e their importance to the design/engineering process. Students will be able to identify the impact and use of computer technology in product development.

**Duration of Unit:** 2-3 weeks

**NJCCCS:** 8.1.12.C.1, 8.1.12.D.2, 8.2.12.G.1, 8.1.12.F.2, 8.2.12.A.1, 8.2.12.B.1-3, 8.2.12.C. 1-3, 8.2.12.D.1, 8.2.12.E.1, 9.4.12.0(1).11-12, 9.4.12.B (1).1, 9.4.12.B (1).7, 9.4.12. B (1).9, 5.1.12.B.2, 9.4.12.B.6, 9.4.12.B.18, 9.4.12.B.24, 9.4.12.B.54, 9.4.12.B.55, 9.4.12.B.56, 9.4.12.B.57, 9.4.12.B.58, 9.4.12.C.55, 9.1.8.E.4,

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
How are products conceived?	<p>Definitions and examples of the design/engineering process.</p> <p>Utilize design/engineering process to complete an activity.</p>	<p>Classroom supplies for technological learning activities (TLA)</p> <p>Examples from industry (rendered drawings, floor plans, sectional drawings)</p> <p>Current textbook and resource binder</p> <p>PowerPoint/SMART Notebook Presentation</p>	<p>Students participate in simple Technological Learning Activity (TLA)</p> <p>Class discussion on process used in order to create solution for TLA</p> <p>Completion of Design/Engineering Process Handout/Power Point</p>	<p>Written tests and quizzes</p> <p>Worksheets</p> <p>Project assessments</p> <p>Article summaries</p>
What role do conceptual sketches and drawings have in product development?	<p>Definitions and examples of basic technical drawings. 2 Dimensional (2D), 3Dimensional (3D):</p> <p>Identify various technical drawings and categorize them as 2D or 3D. Identify them the purpose of the drawings in the design/engineering process.</p>	<p>Internet</p> <p>Product literature from manufactures.</p> <p>Sample products from manufactures, or classroom activities</p>	<p>Students share their sketches and drawings produced for previously competed TLA.</p> <p>Instructor shares drawings of student work such as CO2 Dragsters or Furniture design.</p> <p>Instructor facilitates a discussion as to how ideas for products such as cell phones, automobiles, and household furniture are developed.</p>	<p>Notebook assessments</p> <p>Responses to discussion questions</p> <p>Journal assessments</p>
How does computer technology influence product development?	<p>Definitions and examples of Computer Aided Design (CAD) and Computer Aided Manufacturing (CAM) technologies.</p> <p>Identify various CAD programs and CAM technologies such as AutoCAD, Pro ENGINEER, Phinocerous, CNC Mills/Routers, CNC Laser Cutter/Engravers, 3D Printers</p>		<p>Instructor present methods that are utilized in modern manufacturing process such as CAD and CAM. Identifying specific examples such as the use of CAD programs to operate CNC mills.</p> <p>Instructor facilitates a discussion as to how ideas for products such as cell phones, automobiles, and household furniture are influenced through the use of computer technology.</p>	<p>Threaded Discussion Groups</p> <p>Self and Peer assessments</p> <p>TSA Rubrics</p> <p>Midterm/Final Exam</p>

**Suggestions on how to differentiate in this unit:**

- Students with individual learning styles can be assisted through adjustments in assessment standards, one-to-one teacher support, additional testing time, and use of visual and auditory teaching methods
- A wide variety of assessments and strategies complement the individual learning experience.

**Freehold Regional High School District  
Computer Aided Design I**

**Unit #3: Sketching and Drawing**

**Enduring Understandings:** The design/engineering process is a series of steps taken in order to create a product or solve a problem.  
Innovation in digital tools and products are utilized to aid and simplify work.  
CAD requires knowledge of proper technique.

**Essential Questions:** How is the design/engineering process carried out, and what are the steps? What is the difference between using your hand to draw design as opposed to a computer? What is the difference between using your hand to alter a design as opposed to altering it digitally? Who is known as a major contributor in CAD? How does proper dimensioning affect a product?

**Unit Goals:** Students will be able to demonstrate an understanding of various sketching techniques as well as drawing types.  
Students will develop an appreciation for the use of computers in drafting and design work.  
Students will be able to identify the early influences in CAD technology.

**Duration of Unit:** 2-3 weeks

**NJCCCS:** 5.1.12.B.2, 8.1.12.C.1, 8.2.12.G.1, 8.1.12.F.2, 8.2.12.B.1-3, 8.2.12.C. 1-3, 8.2.12.D.1, 8.2.12.E.1, 8.2.12.F.1, 8.2.12.F.3, 9.4.12.0(1).11-12, 9.4.12.B (1).9, 9.4.12.B.6, 9.4.12. B.18, 9.4.12.B.24, 9.4.12.B.75

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
What purpose do sketches and drawings serve?	<p>Definitions of visual representations such as sketches, drawings, technical drawing, and rendering.</p> <p>Summarize the application of sketches, drawings, and renderings. Identify them the purpose of the drawings in the design/engineering process. Utilize basic techniques to produce sketches</p>	<p>Current textbook and resource binders</p> <p>Examples of visual representation: sketches, drawings, renderings.</p> <p>PowerPoint/SMART Notebook Presentations</p> <p>Paper</p> <p>Pencils</p>	<p>Display examples of sketches, drawings, and technical drawings. Engage students in a discussion that lists the similarities and differences. Have students brainstorm the purpose for the various types of visual representations.</p> <p>Students participate in teacher led exercise in sketching, including w=how to hold and use a pencil correctly, as well as techniques for using basic shapes to form more complicated designs.</p>	<p>Written tests and quizzes</p> <p>Worksheets</p> <p>Project assessments</p> <p>Article summaries</p> <p>Notebook assessments</p>
<p>How can technical drawings be categorized?</p> <p>What is the purpose of the various technical drawings?</p>	<p>Definitions and examples of technical drawings.</p> <p>Identify various technical drawings and categorize them as 2D or 3D.</p> <p>Summarize</p>		<p>Presentation on the various technical drawing types. Engage students by asking them what purpose each drawing serves and whom it might be for.</p> <p>Students participate in an activity where they must match a drawing to the correct name.</p>	<p>Self and Peer assessments</p> <p>TSA Rubrics</p> <p>Midterm/Final Exam</p>
What are some specific elements similar to all technical drawings?	<p>Definitions and examples of technical drawings elements.</p> <p>Produce technical drawings utilizing the appropriate line types and styles.</p>		<p>Students recreate drawings from handouts. Activity progresses by having students take a 3D drawing and creating a 2D drawing, or vice versa.</p>	

**Suggestions on how to differentiate in this unit:**

- Students with individual learning styles can be assisted through adjustments in assessment standards, one-to-one teacher support, additional testing time, and use of visual and auditory teaching methods
- A wide variety of assessments and strategies complement the individual learning experience.

# Freehold Regional High School District Computer Aided Design I

## Unit #4: CAD History and Introduction

**Enduring Understandings:** Knowing how to create, save, retrieve, and produce electronic work is essential in the work place.  
Proficiencies with various tools and menus of a computer program will greatly assist the efficiency of work.  
Innovation in digital tools and products are utilized to aid and simplify work.

**Essential Questions:** How is work done on a computer created and stored? What is the purpose of various file types?  
How does a CAD program help you create a design? What part of the CAD editing program helps you create the changes?  
How can one navigate through the various options of a CAD program? What is the difference between using your hand to drawn design as opposed to a computer? What is the difference between using your hand to alter a design as opposed to altering it digitally? Who is known as a major contributor in CAD?

**Unit Goals:** Students will understand the historical background that lead to the innovation of CAD and how it was first used.  
Students will be able to identify the various menus, toolbars, windows, and work areas of the CAD program.  
Students will also understand how to create specific file types, save file, and format preferences.

**Duration of Unit:** 2 weeks

**NJCCCS:** 8.1.A.12.1-1, 8.1.12.C.1, 8.1.12.F.2-3, 8.2.12.G.1, 9.4.12.B.6, 9.4.12.B.18, 9.4.12.B.24, 9.4.12.O.58, 9.4.12.O (1).2, 5, 8-12

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
What lead to the development of CAD?  How CAD was first utilized?	Early development of CAD was primarily for aerospace and automotive industries.  Types of models: wireframe, surface, solid and parametric.  Identify and describe early developmental drawbacks of CAD systems	Desktop Computer  Internet  CAD Software  Study Guides/Handouts  PowerPoint or SMART Notebook Presentations	PowerPoint Presentation on history of CAD, including early developers and usage.  Compare and contrast examples of various modeled parts and their drawings.	Written tests and quizzes  Worksheets  Project assessments  Article summaries
How files are initially created?  What is the purpose of various file types?	Define various file types such as part, sketch, and drawing.  File system architecture of program  Create, save and retrieve various file types such as part, sketch, and drawing. Describe appropriate file types.	Moodle  Texts similar to <i>Parametric Modeling with Pro/Engineer Wildfire 4.0</i> or <i>Designing with Pro/DESKTOP</i>	Demonstrate the various types of files and describe the purpose of each one.  Compare and discuss student responses to different topics relating to computer files.	Notebook assessments  Responses to discussion questions  Journal assessments  Threaded Discussion Groups
How does one navigate through a program?  What is the purpose of the user interface?	Identify various areas of program workspace, such as tool bar, main window, progress bar or similar features  Identify the purpose of the various navigation and display elements and describe how they are used in assisting usage of the program.		Compare and discuss student response to the similarities and differences between interface of CAD program and other computer programs.  Demonstrate the application of the various display areas and navigation menus.  Provide students with simple tutorials or guides to familiarizing them with interface.	Self and Peer assessments  TSA Rubrics  Midterm/Final Exam
How are features and drawings edited?	Define basic operations such as Sketch and Extrude Identify integral icons for the creation of sketches and parts.  Create, edit and save basic sketch or part file. Identify various icons and their functions.		Demonstrate the ease of use of the program be creating a simple part and identifying key features and icons, as well as possible problems.  Provide students with simple tutorials or guides to familiarizing them with interface. Students complete information as they move through the tutorial.	

**Suggestions on how to differentiate in this unit:**

- Students with individual learning styles can be assisted through adjustments in assessment standards, one-to-one teacher support, additional testing time, and use of visual and auditory teaching methods
- A wide variety of assessments and strategies complement the individual learning experience.

**Freehold Regional High School District  
Computer Aided Design I**

**Unit #5: Creating a Simple Model**

**Enduring Understandings:** Knowing how to create, save, retrieve, and produce electronic work is essential in the work place.  
Proficiencies with various tools and menus of a computer program will greatly assist the efficiency of work.  
Innovation in digital tools and products are utilized to aid and simplify work.

**Essential Questions:** How is work done on a computer created and stored? What is the benefit of a computer network? What is the purpose of various file types?  
How is a final product affected by the design/engineering process? How do sketches play a role in creating a solid model?  
What part of the CAD editing program helps you create the changes? What is the difference between using your hand to draw design as opposed to a computer? What is the difference between using your hand to alter a design as opposed to altering it digitally?

**Unit Goals:** Students will understand the need to have a valid sketch prior to creating a solid.  
Students will understand the concept of parametric modeling and shape before size.  
Students will understand the importance of selecting the appropriate drawing plane.  
Students will understand the primary extrude feature.  
Students will be able to troubleshoot common errors.

**Duration of Unit:** 2 weeks

**NJCCCS:** 8.1.12.A.2, 8.1.12.C.1, 8.2.12.B.1-3, 8.2.12.C. 1-3, 8.2.12.D.1, 8.2.12.E.1, 8.2.12.G.1, 8.1.12.F.2-3, 9.4.12.B.6, 9.4.12.B.18, 9.4.12.B.24, 9.4.12.O.58, 9.4.12.O (1).2, 5, 8-12

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
What type of sketch is needed to produce a 3D part?	Editing multiple shapes into a valid sketch.  Create a valid 2D sketch that can be used for extrusion.	Desktop Computer  Internet  CAD Software	Demonstration on how to create a valid sketch.  Discussion of what constitutes a valid sketch profile.  Presentation on valid sketches and common errors	Written tests and quizzes  Project assessments  Article summaries
Is it important to know the size of an object prior to designing?	Constraints Rough Dimensions	PowerPoint or SMART Notebook Presentations  Moodle	Demonstration of digital readout of size.  Demonstration of using dimension tools.	Journal assessments  Threaded Discussion Groups
What are the three planes of a 3D part?	Lateral; Frontal; Base	LCD projector  Texts similar to <i>Parametric Modeling with Pro Engineer Wildfire 4.0</i> or <i>Designing with Pro/DESKTOP</i>	Lecture describing the concept of planes; PowerPoint presentation on various planes.  Discussion on relating planes to the planes in an orthographic projection.	Self and Peer assessments  TSA Rubrics
How do you create a 3D object from a 2D drawing?	Features; Extruding; Projecting		Discussion of how features work within a CAD program.  Demonstration of Extruding and Projection features; lecture describing the relation of extrusion and projection to actual manufacturing techniques.	Midterm/Final Exam

**Suggestions on how to differentiate in this unit:**

- Students with individual learning styles can be assisted through adjustments in assessment standards, one-to-one teacher support, additional testing time, and use of visual and auditory teaching methods
- A wide variety of assessments and strategies complement the individual learning experience.

**Freehold Regional High School District  
Computer Aided Design I**

**Unit #6: Dimensions and Constraints**

**Enduring Understandings:** Innovation in digital tools and products are utilized to aid and simplify work.  
Proficiencies with various tools and menus of a computer program will greatly assist the efficiency of work.  
CAD requires knowledge of proper technique.

**Essential Questions:** What is the difference between using your hand to draw design as opposed to a computer? What is the difference between using your hand to alter a design as opposed to altering it digitally? What part of the CAD editing program helps you create the changes?  
How can one navigate through the various options of a CAD program? What are some of the key features that should be understood when designing a product? How does proper dimensioning affect a product? Why is it important to know various file types?

**Unit Goals:** Students will be able to describe the importance of dimensioning and tolerances  
Students will understand the interaction between sketching dimensions and the resulting solid model, as well as geometric and parametric relationships.

**Duration of Unit:** 3 weeks

**NJCCCS:** 5.1.12.B.2, 8.1.12.A.2, 8.1.12.C.1, 8.2.12.G.1, 8.1.12.F.1-3, 9.4.12.B.6, 9.4.12.B.18, 9.4.12.B.24, 9.4.12.B.75, 9.4.12.B (1).9, 9.4.12.O (1).2, 5, 8-12

<b>Guiding / Topical Questions</b>	<b>Content, Themes, Concepts, and Skills</b>	<b>Instructional Resources and Materials</b>	<b>Teaching Strategies</b>	<b>Assessment Strategies</b>
What role do constraints play in a parametric model?	Constraints determine how big or small a part is when compared to a given value or proportion. They include dimensional, geometric, or parametric. Identify and describe what constraints regulate the look and size of a part.	Desktop Computer  Internet  CAD Software  Study Guides/Handouts	Compare and discuss student responses to their description of constraints.  Presentation on various CAD constraints such as dimensional, geometric and parametric.	Written tests and quizzes  Project assessments  Article summaries  Notebook assessments
What role do dimensions play in drawings?  How are dimensions created in CAD?	Parts can be constrained by using a specific dimensional value.  Apply appropriate dimensions.	PowerPoint or SMART Notebook Presentations	Provide students with simple tutorials or guides to familiarizing them with the dimension constraints of sketches and features.	Responses to discussion questions  Journal assessments
What types of geometric constraints can be placed on a feature or sketch?	Parts can be constrained by using various geometric constraints.  Apply appropriate geometric constraints.	Moodle  Texts similar to <i>Parametric Modeling with Pro Engineer Wildfire 4.0</i> or <i>Designing with Pro/DESKTOP</i>	Provide students with simple tutorials or guides to familiarizing them with the geometric constraints of sketches and features.	Threaded Discussion Groups  Self and Peer assessments
What types of parametric constraints can be placed on a feature or sketch?	Parts can be constrained by using proportional constraints so that when value is changed several others change because of their parametric constraint.  Apply appropriate parametric constraints.		Provide students with simple tutorials or guides to familiarizing them with the parametric constraints of sketches and features.	TSA Rubrics

**Suggestions on how to differentiate in this unit:**

- Students with individual learning styles can be assisted through adjustments in assessment standards, one-to-one teacher support, additional testing time, and use of visual and auditory teaching methods
- A wide variety of assessments and strategies complement the individual learning experience.

**Freehold Regional High School District  
Computer Aided Design I**

**Unit #7: Engineering Drawing**

**Enduring Understandings:** Proficiencies with various tools and menus of a computer program will greatly assist the efficiency of work.  
CAD requires knowledge of proper technique.  
CAD programs allow products to be presented to clients prior to production.

**Essential Questions:** What is the difference between using your hand to drawn design as opposed to a computer? What is the difference between using your hand to alter an design as opposed to altering it digitally? Who is known as a major contributor in CAD?

**Unit Goals:** Students will be producing engineering drawings based on 3D models and parts.  
Students will be able to identify proper drawing styles and their individual components. ]  
Students will understand the proper dimensioning techniques.  
Students will understand how to create a title block and scale their drawing to specific.

**Duration of Unit:** 2 weeks

**NJCCCS:** 9.4.12.B.6, 9.4.12.B.18, 9.4.12.B.24, 8.1.12.C.1, 8.2.12.G.1, 8.1.12.F.2

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
<p>What is the purpose of a technical drawing?</p> <p>What are the various forms of technical drawings?</p>	<p>Technical drawings are used to represent objects in a host of various methods, each having its own advantage and disadvantage.</p> <p>Identify and describe the various types of technical drawings and the purpose</p>	<p>Desktop Computer</p> <p>Internet</p> <p>CAD Software</p> <p>Study Guides/Handouts</p>	<p>Presentation of various technical drawings and their purpose and usage of technical drawings.</p> <p>Compare and discuss student responses to the various technical drawings.</p>	<p>Written tests and quizzes</p> <p>Worksheets</p> <p>Project assessments</p>
<p>Why are dimensioning standards important?</p> <p>What are the dimensions on a drawing used for?</p> <p>How do dimensions affect the overall presentation of the drawing?</p>	<p>Placement of dimensions is important and creates a more effective and accurate representation.</p> <p>Properly place dimensions on a part drawing.</p>	<p>PowerPoint or SMART Notebook Presentations</p> <p>Moodle</p> <p>Texts similar to <i>Parametric Modeling with Pro   Engineer Wildfire 4.0</i> or <i>Designing with Pro/DESKTOP</i></p>	<p>Demonstration of dimension placement.</p> <p>PowerPoint on dimensioning standards/ dimensioning conventions.</p> <p>Lecture on importance of accurate dimensioning.</p> <p>Self guided tutorial</p>	<p>Self and Peer assessments</p> <p>TSA Rubrics</p> <p>Midterm/Final Exam</p>
<p>What is the purpose of a title block?</p> <p>What information should be included on a title block?</p>	<p>Title blocks communicate key information about a drawing as well as provide a neat and organized means of presentation.</p> <p>Produce a title block with space for such key information, but not limited to: scale, creator, date and revision</p>		<p>Design activity in which students create their own title block to utilize throughout the year.</p>	
<p><b>Suggestions on how to differentiate in this unit:</b></p> <ul style="list-style-type: none"> <li>Students with individual learning styles can be assisted through adjustments in assessment standards, one-to-one teacher support, additional testing time, and use of visual and auditory teaching methods</li> <li>A wide variety of assessments and strategies complement the individual learning experience.</li> </ul>				

**Freehold Regional High School District  
Computer Aided Design I**

**Unit #8: Drawing Output**

**Enduring Understandings:** Knowing how to create, save, retrieve, and produce electronic work is essential in the workplace.  
Proficiencies with various tools and menus of a computer program will greatly assist the efficiency of work.

**Essential Questions:** How is work done on a computer created and stored? What is the benefit of a computer network?  
What is the purpose of various file types? How do sketches play a role in creating a solid model?  
How does a CAD program help you create a design? What part of the CAD editing program helps you create changes?  
How can one navigate through the various options of a CAD program?

**Unit Goal:** Students will understand how to format their drawings and models for output to an assortment of printers and plotters.

**Duration of Unit:** 1 week

**NJCCCS:** 8.1.A.12.1, 8.1.12.F.2, 9.4.12.O.58, 9.4.12.O(1).9-108.1.12.A.2, 8.2.12.F.3, 9.4.12.O(1),(2),(5), 9.4.12.O(8)-(12)

<b>Guiding / Topical Questions</b>	<b>Content, Themes, Concepts, and Skills</b>	<b>Instructional Resources and Materials</b>	<b>Teaching Strategies</b>	<b>Assessment Strategies</b>
<p>What are some common output types of drawings?</p> <p>What factors affect the quality of the output?</p> <p>What are standard paper sizes?</p>	<p>Identify and describe the various methods of outputting designs and part such as:</p> <p>Digital PDF Plot Full Color Render</p> <p>Identify and describe purpose of various paper sizes.</p> <p>Standard Sizes ANSI</p> <p>Skill: Produce an appropriate sized drawing of efficient quality and detail.</p>	<p>Desktop Computer</p> <p>Internet</p> <p>CAD Software</p> <p>Study Guides/Handouts</p> <p>PowerPoint or SMART Notebook Presentations</p> <p>Moodle</p> <p>Texts similar to <i>Parametric Modeling with Pro/Engineer Wildfire 4.0</i> or <i>Designing with Pro/DESKTOP</i></p> <p>Output device such as HP Design Jet 510</p>	<p>Demonstration of print command and preparation of drawing/part file to output device.</p> <p>Compare and discuss student responses to examples of printed and plotted part files.</p> <p>Self guided tutorial</p>	<p>Written tests and quizzes</p> <p>Worksheets</p> <p>Project assessments</p> <p>Self and Peer assessments</p> <p>Midterm/Final Exam</p>

**Suggestions on how to differentiate in this unit:**

- Students with individual learning styles can be assisted through adjustments in assessment standards, one-to-one teacher support, additional testing time, and use of visual and auditory teaching methods
- A wide variety of assessments and strategies complement the individual learning experience.

**Freehold Regional High School District  
Computer Aided Design I**

**Unit #9: Patterns and Copies**

**Enduring Understanding:** Proficiencies with various tools and menus of a computer program will greatly assist the efficiency of work.

**Essential Questions:** How do sketches play a role in creating a solid model? How does a CAD program help you create a design?

What part of the CAD editing program helps you create changes? How can one navigate through the various options of a CAD program?

**Unit Goal:** Students will be able to duplicate and mirror visual objects within their design to create patterns and several instances of the same shape.

**Duration of Unit:** 2 weeks

**NJCCCS:** 8.1.12.A.2, 8.2.12.F.3, 9.4.12.O (1), (2), (5), 9.4.12.O (8)-(12)

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
<p>How can we replicate a drawing or feature in a CAD program?</p> <p>What is the difference between mirroring and duplicating something?</p>	<p>Methods of duplicating features and sketches differ among CAD programs, desired outcome, and methodologies.</p> <p>Pattern Duplicate Mirror</p> <p>Identify and describe the various tools and commands used to replicate features and sketches.</p>	<p>Desktop Computer</p> <p>Internet</p> <p>CAD Software</p> <p>Study Guides/Handouts</p> <p>PowerPoint or SMART Notebook Presentations</p> <p>Moodle</p>	<p>Demonstrate various methods of duplicating features and sketches in CAD program. Identify key commands and steps needed to reach required effect.</p> <p>Compare and discuss student responses to the Revolve command</p> <p>Self guided tutorial</p> <p>Design activity in which feature needs to be utilized.</p>	<p>Written tests and quizzes</p> <p>Worksheets</p> <p>Project assessments</p> <p>Self and Peer assessments</p> <p>TSA Rubrics</p>
<p>How do you duplicate a shape?</p>	<p><i>Pattern</i> (or similar) command and how it is used to duplicate a feature or drawing.</p> <p>Replicate a feature by creating a pattern or copy in a linear or radial format.</p>	<p>Texts similar to <i>Parametric Modeling with Pro/Engineer Wildfire 4.0</i> or <i>Designing with Pro/DESKTOP</i></p>	<p>Self guided tutorial</p> <p>Design activity in which feature needs to be utilized.</p>	<p>Midterm/Final Exams</p>
<p>How do you mirror a shape?</p>	<p><i>Mirror</i> (or similar) command and how it is used to duplicate a feature or drawing.</p> <p>Replicate a feature by creating a pattern or copy in a linear or radial format.</p>			
<p><b>Suggestions on how to differentiate in this unit:</b></p> <ul style="list-style-type: none"> <li>• Students with individual learning styles can be assisted through adjustments in assessment standards, one-to-one teacher support, additional testing time, and use of visual and auditory teaching methods</li> <li>• A wide variety of assessments and strategies complement the individual learning experience.</li> </ul>				

**Freehold Regional High School District  
Computer Aided Design I**

**Unit #10: Revolve**

**Enduring Understanding:** Proficiencies with various tools and menus of a computer program will greatly assist the efficiency of work.

**Essential Questions:** How do sketches play a role in creating a solid model? How does a CAD program help you create a design?

What part of the CAD editing program helps you create changes? How can one navigate through the various options of a CAD program?

**Unit Goal:** Students will be able to understand the relationship between a profile and the axis it is rotated about using revolve or a similar feature.

**Duration of Unit:** 2 weeks

**NJCCCS:** 8.1.12.A.2, 8.2.12.F.3, 9.4.12.O (1), (2), (5), 9.4.12.O (8)-(12)

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
<p>How does a sketch need to be designed if it is going to be revolved?</p> <p>When is using a revolve function an appropriate choice?</p>	<p><i>Revolve</i> command is a method of creating a 3D feature using a 2D sketch and a rotational point, commonly known as a center line.</p> <p>Profile Revolve Centerline</p> <p>Produce a <i>Revolve</i> feature by producing a valid sketch and centerline. Then inputting the number of degrees to revolve the sketch around the centerline.</p>	<p>Desktop Computer</p> <p>Internet</p> <p>CAD Software</p> <p>Study Guides/Handouts</p> <p>PowerPoint or SMART Notebook Presentations</p> <p>Moodle</p> <p>Texts similar to <i>Parametric Modeling with Pro/Engineer Wildfire 4.0</i> or <i>Designing with Pro/DESKTOP</i></p>	<p>Demonstrate the method of revolving a profile around a center line. Identify key commands and steps needed to reach required effect.</p> <p>Compare and discuss student responses to the Revolve command</p> <p>Self guided tutorial</p> <p>Design activity in which feature needs to be utilized.</p>	<p>Written tests and quizzes</p> <p>Worksheets</p> <p>Project assessments</p> <p>Self and Peer assessments</p> <p>TSA Rubrics</p> <p>Midterm/Final Exams</p>

**Suggestions on how to differentiate in this unit:**

- Students with individual learning styles can be assisted through adjustments in assessment standards, one-to-one teacher support, additional testing time, and use of visual and auditory teaching methods
- A wide variety of assessments and strategies complement the individual learning experience.

**Freehold Regional High School District  
Computer Aided Design I**

**Unit #11: Sweep/Loft**

**Enduring Understanding:** Proficiencies with various tools and menus of a computer program will greatly assist the efficiency of work.

**Essential Questions:** How do sketches play a role in creating a solid model? How does a CAD program help you create a design?

What part of the CAD editing program helps you create changes? How can one navigate through the various options of a CAD program?

**Unit Goal:** Students will be able to project a profile along a given path to create a new solid object that may be of an irregular shape.

**Duration of Unit:** 4 weeks

**NJCCCS:** 8.1.12.A.2, 8.2.12.F.3, 9.4.12.O (1), (2), (5), 9.4.12.O (8)-(12)

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
<p>How can one use a 2D drawing to create a 3D feature along a path?</p> <p>When would it be useful to sweep a profile along a path to aide in your design?</p>	<p>Identify the method of using two 2D sketches to form a <i>sweep</i> feature. Profile Sweep</p> <p>Skills: Sweeping a profile along a path to create complex shapes</p>	<p>Desktop Computer</p> <p>Internet</p> <p>CAD Software</p> <p>Study Guides/Handouts</p> <p>PowerPoint or SMART Notebook Presentations</p>	<p>Presentation on the various methods of taking two or more 2D sketches and creating a 3D feature. Identify key commands and steps needed to reach required effect.</p> <p>Compare and contrast the similarities and differences of a <i>Sweep</i> and <i>Loft</i>, while identifying appropriate uses of each command.</p> <p>Self guided tutorial</p>	<p>Written tests and quizzes</p> <p>Worksheets</p> <p>Project assessments</p> <p>Self and Peer assessments</p>
<p>When is appropriate to loft two features together?</p>	<p>The method of creating a 3D feature from 2D sketches on varying planes is known as a <i>Loft</i></p> <p>Profile Loft</p> <p>Utilize dissimilar 2D shapes create a complex irregular 3D feature.</p>	<p>Moodle</p> <p>Texts similar to <i>Parametric Modeling with Pro/Engineer Wildfire 4.0</i> or <i>Designing with Pro/DESKTOP</i></p>	<p>Design activity in which feature needs to be utilized.</p>	<p>TSA Rubrics</p> <p>Midterm/Final Exams</p>

**Suggestions on how to differentiate in this unit:**

- Students with individual learning styles can be assisted through adjustments in assessment standards, one-to-one teacher support, additional testing time, and use of visual and auditory teaching methods
- A wide variety of assessments and strategies complement the individual learning experience.

**Freehold Regional High School District  
Computer Aided Design I**

**Unit #12: Rendering**

**Enduring Understanding:** CAD programs allow products to be presented to clients prior to production.

**Essential Questions:** Why are presentations important? How is a product presentation conducted? What are some ways in which CAD models can be presented to clients?  
Why is solid model rendering important?

**Unit Goal:** Students will be able to apply materials and textures to a designed product to give it a realistic appearance for presentation.

**Duration of Unit:** 2 weeks

**NJCCCS:** 9.4.12.B (1).1, 9.4.12.B (1).2, 9.1.12.D.3, 8.1.12.C.1, 9.4.12.B.15, 8.2.12.B.1, 8.2.12.B.2

<b>Guiding / Topical Questions</b>	<b>Content, Themes, Concepts, and Skills</b>	<b>Instructional Resources and Materials</b>	<b>Teaching Strategies</b>	<b>Assessment Strategies</b>
How can virtual parts be realistically represented?  How do you render an object within a CAD program?  What textures and materials can be applied to give a product a realistic appearance?	Rendering is the production realistic models and images in CAD.  Coloring Surface texturing Bump Mapping Lighting Shading  Create realistic rendering of parts using available feature within CAD and through third party software.	Desktop Computer  Internet  CAD Software  Study Guides/Handouts  PowerPoint or SMART Notebook Presentations  Moodle	Presentation on the various rendering methodologies and their advantages and disadvantages.  Discuss necessary steps in completing a renderings.  Compare and discuss student responses to various rendered parts.  Self guided tutorial	Written tests and quizzes  Worksheets  Project assessments  Product Presentations  Self and Peer assessments
What are the benefits of high quality renderings?	There are many benefits of having images when used in presentations.  Create realistic rendering of parts using available feature within CAD and through third party software.	Texts similar to <i>Parametric Modeling with Pro/Engineer Wildfire 4.0</i> or <i>Designing with Pro/DESKTOP</i>  Community Resources  Printer/Plotter  Streaming Videos	Facilitate the creation of a rendering for a given target audience by using a stock part file.  Students work in small collaborative groups to identify desired textures, coloring, and shading to have the greatest impact.	TSA Rubrics

**Suggestions on how to differentiate in this unit:**

- Students with individual learning styles can be assisted through adjustments in assessment standards, one-to-one teacher support, additional testing time, and use of visual and auditory teaching methods
- A wide variety of assessments and strategies complement the individual learning experience.

**Freehold Regional High School District  
Computer Aided Design I**

**Unit #13: Assemblies**

**Enduring Understanding:** Innovation in digital tools and products are utilized to aid and simplify work.

**Essential Questions:** What is the difference between using your hand to draw a design as opposed to a computer?

What is the difference between using your hand to alter a design as opposed to altering it digitally?

Who is known as a major contributor in CAD? What are the benefits of digital CAD technology in product development?

**Unit Goal:** Students will be able to take multiple designed components and join them together within the program to make a complete final product.

**Duration of Unit:** 3 weeks

**NJCCCS:** 9.4.12.B.6, 9.4.12.B.18, 9.4.12.B.24, 8.1.12.C.1, 8.2.12.G.1, 8.1.12.F.2

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
<p>What is an assembly?</p> <p>How are assembly drawings used in manufacturing?</p>	<p>Placing parts together to create more complex parts is known as an <i>Assembly</i>. There are various methods of doing this.</p> <p>Assembly Files Mating Constraints Assembly Drawings</p> <p>Identify and describe the various methods of assembly as well as the constraints that regulate how they are made.</p>	<p>Desktop Computer</p> <p>Internet</p> <p>CAD Software</p> <p>Study Guides/Handouts</p> <p>PowerPoint or SMART Notebook Presentations</p> <p>Moodle</p>	<p>Presentation on the various assembly methodologies and their advantages and disadvantages.</p> <p>Discuss necessary components of an assembly drawing.</p> <p>Compare and discuss student responses to various assembly drawings from engineering drawings to assembly instructions from household items such as IKEA furniture.</p>	<p>Written tests and quizzes</p> <p>Worksheets</p> <p>Project assessments</p> <p>Self and Peer assessments</p> <p>TSA Rubrics</p>
<p>How are parts of an assembly placed together?</p> <p>How is an assembly drawing created?</p>	<p>Placement and alignment of parts in an assembly rely on constraints they are: Mate, Mate Offset, Align, Align Offset, Insert, Orient</p> <p>Define and describe key components for assembly drawings and the information that they contain.</p> <p>Create an assembly using pre made parts and various placement constraints.</p>	<p>Texts similar to <i>Parametric Modeling with Pro   Engineer Wildfire 4.0</i> or <i>Designing with Pro/DESKTOP</i></p> <p>Community Resources</p> <p>Printer/Plotter</p> <p>Streaming Videos</p> <p>3D printer(optional)</p> <p>CNC Router(optional)</p>	<p>Demonstration of various assembly constraints to allow students to create definitions and descriptions of each.</p> <p>Handout of matching various assembly constraints with graphic representations of constraints.</p> <p>Demonstration of how CAD drawings are used in manufacturing operations.</p> <p>Design and model a product that uses multiple parts and multiple saved drawings for assembling together.</p>	<p>Midterm/Final Exams</p>
<p><b>Suggestions on how to differentiate in this unit:</b></p> <ul style="list-style-type: none"> <li>Students with individual learning styles can be assisted through adjustments in assessment standards, one-to-one teacher support, additional testing time, and use of visual and auditory teaching methods</li> <li>A wide variety of assessments and strategies complement the individual learning experience.</li> </ul>				

**Freehold Regional High School District  
Computer Aided Design I**

**Unit #14: Rapid Prototyping**

**Enduring Understanding:** Innovation in digital tools and products are utilized to aid and simplify work.

**Essential Questions:** How has the timeline of product development been affected by CAD technologies?

What is the difference between CAD and CAM? Why is it important to know how to use CAD CAM Software together?

How is rapid prototyping used in the development of a product?

**Unit Goal:** Students will be able to create a final product using CAD/CAM software to quickly create a prototype of their ideas for presentation to client.

**Duration of Unit:** 3 weeks

**NJCCCS:** 9.4.12.B (1).1, 9.4.12.B (1).9, 5.1.12.B.2, 8.2.12.A.1, 8.2.12.B.1, 8.2.12.B.2,

<b>Guiding / Topical Questions</b>	<b>Content, Themes, Concepts, and Skills</b>	<b>Instructional Resources and Materials</b>	<b>Teaching Strategies</b>	<b>Assessment Strategies</b>
What is rapid prototyping?  What equipment or software is necessary to create prototypes?	Identify and describe various methods of rapid prototyping used in industry and education. Selective Laser Sintering (SLS) Fused Deposition Modeling (FDM) Stereo lithography (SLA) Laminated Object Manufacturing (LOM) Electron Beam Melting (EBM) 3D printing (3DP) CNC Router CNC milling machine	Desktop Computer; Internet  CAD Software  Study Guides/Handouts  PowerPoint or SMART Notebook Presentations  Moodle  Texts similar to <i>Parametric Modeling with Pro Engineer Wildfire 4.0</i> or <i>Designing with Pro/DESKTOP</i>	Definitions of various types of rapid prototyping.  Sample of various technologies such as 3D printing or Laminated Object Manufacturing.  Description of current equipment available for use.	Written tests and quizzes  Worksheets  Project Rubrics  Self and Peer assessments  TSA Rubrics
What are the benefits of rapid prototyping versus traditional methods?	The process of presentation of prototypes and models over the years has varied and evolved.  Identify and describe various methods of prototype presentations throughout history.	Printer/Plotter  Streaming Videos	Creation of comparison chart between various technologies highlighting each strengths and weaknesses.  Student design and create a product for rapid prototyping.	Midterm/Final Exams
How is rapid prototyping performed?	The process of preparing part files for prototyping consists of assorted software and hardware.  CAD/CAM Post Processing Output files, such as STL Changing of tooling and material  Create a part using one of the methods of rapid prototyping.	3D printer(optional)  CNC Router(optional)	Design and model a product for consumer manufacture.  Create a presentation for a product of your design that will persuade investors to back the product.	

**Suggestions on how to differentiate in this unit:**

- Students with individual learning styles can be assisted through adjustments in assessment standards, one-to-one teacher support, additional testing time, and use of visual and auditory teaching methods
- A wide variety of assessments and strategies complement the individual learning experience.

## Freehold Regional High School District Computer Aided Design I

### Unit #15: Careers and Professionalism

**Enduring Understandings:** Working with other people is an important skill for life and the workplace.

CAD programs allow products to be presented to clients prior to production.

**Essential Questions:** What characteristics are essential to a functional team? What are the benefits of working in a team environment as opposed to individually?

How do inappropriate behaviors and characteristics affect productivity? Why are presentations important?

How is a product presentation conducted? What are some ways in which CAD models can be presented to clients?

Why is solid model rendering important?

**Unit Goal:** Students will be able to create a final product using CAD/CAM software to quickly create a prototype of their ideas for presentation to client.

**Duration of Unit:** 2 weeks

**NJCCCS:** 9.1.12.C.1-6, 9.1.12.D.1-3, 9.1.12.E.5, 9.1.12.F.1, 9.3.12.C.14-24, 9.4.12.O.1, 9.3.12.C.13-18, 9.3.12.C.22, 9.3.12.C.29-33, 9.3.12.C.36, 9.3.12.C.46-51, 9.3.12.C.67, 68, 9.4.12.B (1).1-2, 9.1.12.D.3, 8.1.12.C.1, 9.4.12.B.15, 8.2.12.B.1, 8.2.12.B.2

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
<p>What opportunities are available in the field of Computer Aided Design?</p> <p>What qualities do employers look for in job candidates?</p>	<p>Various careers exist that rely heavily on CAD knowledge and usage. Identify these CAD related careers and the requirements for these positions.</p>	<p>Desktop Computer</p> <p>Internet</p> <p>CAD Software</p>	<p>Research career opportunities in the area of CAD. Utilize database and resources such as Occupational Outlook Handbook and local professionals. Create a presentation on a career topic in CAD and presentation to peers.</p>	<p>Written tests and quizzes</p> <p>Project assessments</p>
<p>What are the characteristics of a successful team?</p> <p>How is productivity affected by a team member who acts inappropriately?</p>	<p>Identify and compare various traits and characteristics of team members and how they affect the outcome.</p> <p>Identify and describe the outcomes of collaboration.</p>	<p>Study Guides/Handouts</p> <p>PowerPoint or SMART Notebook Presentations</p>	<p>Work in groups of peers to cooperatively design a product using computer aided design.</p> <p>Demonstrate a cooperative, collegiate atmosphere when developing a product.</p>	<p>Article summaries</p> <p>Responses to discussion questions</p> <p>Journal assessments</p>
<p>What steps need to be taken to create an effective product presentation?</p>	<p>Create an interesting presentation which would be beneficial and impressive to a client.</p>	<p>Moodle</p> <p>Community Resources</p>	<p>Design and model a product for consumer manufacture.</p> <p>Create a presentation for a product of your design that will persuade investors to back the product.</p>	<p>Self and Peer assessments</p> <p>TSA Rubrics</p>
<p>How should a professional speak to a client?</p> <p>What things should a professional do to keep a client satisfied?</p>	<p>Provide a client with a rendered CAD drawing to give them an accurate depiction of the final product.</p>	<p>LCD Projector</p>	<p>Participate in a mock business meeting whereby the professional is trying to sell a product to a client.</p>	<p>Midterm/Final Exams</p>

**Suggestions on how to differentiate in this unit:**

- Students with individual learning styles can be assisted through adjustments in assessment standards, one-to-one teacher support, additional testing time, and use of visual and auditory teaching methods
- A wide variety of assessments and strategies complement the individual learning experience.