

CTE/ROP Introduction to Engineering Design 1/2

San Diego County Office of Education - Sweetwater Union High School District Pacing Guide/Course Description

Course Length: 2 Semesters	Classroom Instruction: 180 hours
SUHSD Course Number: 97243/97244	Grade Level: 9, 10, 11, 12
SDCOE Course Number: 578308	SDCOE Total Hours: 180 hours
CBEDS Number/Title: 5704/Civil-Structural Drafting	Year of Implementation: 2011
Course Pre-requisites: None	Articulation (school/credits): Southwestern College/Up to 3 Credits
CTE Industry Sector: Engineering and Design	CTE Pathway(s): Architectural and Structural Engineering, Engineering Design, Engineering Technology
Job Titles: Mechanical Drafter, Industrial Drafter, Mechanical Engineer, Industrial Engineers, Field Engineer, Civil Engineer, Manufacturer	
Credential Information: Preliminary or Clear Full-Time Designated Subjects CTE Teaching Credential in Engineering Design	
Required Textbooks: None	
Course Description: This course provides students exposure to design process, research and analysis, teamwork, communication methods, global and human impacts, engineering standards and technical documentation. Employment possibilities include Civil Engineering, Industrial Engineering, and Architecture. Instruction covers the following areas: Design process, introduction to technical sketching and drawing, measurement and statistics, design exercises, dimensions and tolerances, advance modeling skills, reverse engineering, visual analysis, functional and structural analysis, product improvement by design, engineering ethics and design teams. Students use equipment which includes: Computers, plotters and printers.	

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Semester 1

Unit A: Career Development

Unit 1: Design Process

- Lesson 1.1 Introduction to a Design Process
- Lesson 1.2 Introduction to Technical Sketching and Drawing
- Lesson 1.3 Measurement and Statistics
- Lesson 1.4 Puzzle Cube

Unit 2: Design Exercises

- Lesson 2.1 Geometric Shapes and Solids
- Lesson 2.2 Dimensions and Tolerances
- Lesson 2.3 Advanced Modeling Skills
- Lesson 2.4 Advanced Designs

Semester 2

Unit B: Career Development

Unit 3: Reverse Engineering

- Lesson 3.1 Visual Analysis
- Lesson 3.2 Functional Analysis
- Lesson 3.3 Structural Analysis
- Lesson 3.4 Product Improvement By Design

Unit 4: Open-Ended Design Problems

- Lesson 4.1 Engineering Design Ethics
- Lesson 4.2 Design Teams

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<u>Semester 1 - Unit A - Career Development (10 hours)</u>				
Competencies	Standards	Suggested Pacing	Essential Vocabulary	Resources/Materials
<p>A - Completes an appropriate resume and job application.</p> <p>B - Acquires job interview techniques.</p> <p>C - Attains awareness of advanced career and educational opportunities.</p>	<p><u>Career Technical Education:</u> *ED/CPM/ 3.1 Know the personal qualifications, interests, aptitudes, knowledge, and skills necessary to succeed in careers. 3.2 Understand the scope of career opportunities and know the requirements for education, training, and licensure. 3.6 Know important strategies for self-promotion in the hiring process, such as job applications, résumé writing, interviewing skills, and preparation of a portfolio.</p> <p><u>Core Academic:</u> *ED/A/1.4VPA/VA/ADV/G9-12/ (5.3) Prepare portfolios of their original works of art for a variety of purposes (e.g., review for postsecondary application, exhibition, job application, and personal collection). *ED/C/2.2W/WSA/G11-12/ (2.5) Write job applications and résumés: a. Provide clear and purposeful information and address the intended audience appropriately. b. Use varied levels, patterns, and types of language to achieve intended effects and aid comprehension. c. Modify the tone to fit the purpose and audience. d. Follow the conventional style for that type of document (e.g., résumé, memorandum) and use page formats,</p>	<p>A - 3 hours: Resume and 2 hours: Job Application</p> <p>B – 2.5 hours: Job interviews</p> <p>C - 2.5 hours: Career awareness</p>	<p>Career Characteristics Convicted Description Disability Extracurricular Interview skills Job Application Job Interview Labor Laws Limitations Objective Position Portfolio Previous/Former Reference Referred Resume Salary Skills Strengths</p>	<p><u>Teacher Resources:</u> Job Finder’s Guide</p> <p>Employability Skills Handbook (lesson plan examples) http://www.baldyviewrop.com/teachers_staff/lesson_plans.htm</p> <p><u>Student Resources:</u> Master Application Job Finder’s Guide www.snagajob.com www.monster.com http://www.ca.gov/Job/s/</p>

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	<p>fonts, and spacing that contribute to the readability and impact of the document.</p> <p>*ED/C/2.3WO/ELC/G11-12/ (1.2) Produce legible work that shows accurate spelling and correct punctuation and capitalization.</p> <p>*ED/C/2.2W/WSA/G11-12/ (1.6) Develop presentations by using clear research questions and creative and critical research strategies (e.g., field studies, oral histories, interviews, experiments, electronic sources).</p>		
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Suggestions/Assessments:

Resume/Job Application/Letters

- Have students start by writing a Personal Statement (See Job Finder’s Guide)
- Have students properly request a job application in person, and/or print one from the Internet. Students should fill out and complete the application. Also have students complete an online job application for a company.
- Use technology to show students exemplary and poor-quality examples of resumes, cover letters, and follow-up letters. Identify the components of business letters and a resume. Have students identify errors in the examples.
- Show Resume PowerPoint presentation and have students fill out a Resume Worksheet with all the information they will need to type in their Resume in order to best prepare and complete the Resume Document.
- Have students prepare a Cover Letter Document, References Document, and Thank you letter Document.

Job Interviews

- Have students type up responses to interview questions. Have students practice with a partner, then present in front of the class.
- Have students participate in mock interviews.

Career Awareness

- Have students visit selected college and university Web sites to discover what courses are taught and what majors are offered in the field of information technology.
- Have students share their findings with the class using electronic presentation software.
- Have students use the online *Occupational Outlook Handbook* (<http://www.bls.gov/oco/>) to select an area of occupational interest. Have them research salary and educational requirements for the chosen career and then prepare a one-page summary of the information using word processing software or do a multimedia presentation using presentation software, such as Microsoft PowerPoint.
- Have students understand:
 - Keeping informed of the job market will ensure that you have every opportunity to obtain the best jobs available.
 - Well-prepared job candidates perform much better in the job application and interview process and are more likely to be hired for desirable positions.
- Have students conduct a job search.
- Guest Speakers: College representatives, Professional in the Industry

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- The teacher will assess the Resume, Cover Letter, References Page and Thank you letter documents, and mock interviews.

Comments:

- At the beginning of the unit, use the **KWL Chart** to determine what students Know and what they Want to know about careers and emerging technologies in the industry. At the end of the unit, use K-W-L to review by having students recall what they have learned.

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<u>Semester 1 - Unit 1 - Introduction to Design (49 hours)</u>				
Competencies	Standards	Suggested Pacing	Essential Vocabulary	Resources/Materials
<p>1A - Understands many design processes that guide professionals in developing solutions to problems.</p> <p>1B - Identifies design processes including brainstorming, defining a problem, researching, identifying requirements, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing, refining, making, and communicating results.</p> <p>1C - Is able to design in teams using brainstorming techniques to generate large numbers of ideas in short time periods.</p> <p>1D - Understands the use of an engineer's notebook to chronologically document all aspects of a design project.</p>	<p><u>Career Technical Education:</u> *ED/PSCT/ 5.1 Apply appropriate problem-solving strategies and critical thinking skills to work-related issues and tasks. *ED/EDP/ C1.2 Understand the development of graphic language in relation to engineering design. *ED/ETP/ D5.1 Understand the steps in the design process. <u>Core Academic:</u> *ED/A/1.2S/IE/G9-12 (1.1) Analyze situations and solve problems that require combining and applying concepts from more than one area of science.</p>	<p>Lesson 1.1 – 11 hours: Introduction to a Design Process</p>	<p>Assessment</p> <p>Brainstorming</p> <p>Client</p> <p>Constraint</p> <p>Design</p> <p>Design Brief</p> <p>Design Process</p> <p>Designer</p> <p>Engineer</p> <p>Engineer's Notebook</p> <p>Evolution</p> <p>Innovation</p> <p>Invention</p> <p>Iterative</p> <p>Problem Identification</p> <p>Process</p> <p>Product</p> <p>Research</p> <p>Sequential</p> <p>Solution</p> <p>Standard</p> <p>Target Consumer</p> <p>Time Line Chart</p>	<p><u>Teacher Resources:</u> Refer to Suggestions/ Assessments section.</p> <p><u>Student Resources:</u> Refer to Suggestions/ Assessments section.</p>

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Suggestions/Assessments:

Lesson 1.1

Section 1 (1 hour)

- The teacher will present [Concepts](#), [Key Terms](#), and [Essential Questions](#), in order to provide a lesson overview.
- The teacher will present [Engineers.ppt](#).
- The teacher will distribute an engineer's notebook to each student or have students create their own.
- **Note:** The teacher will determine whether students will record their notes in a daily journal, portfolio, or their engineer's notebook. For purposes of written directions in the day-by-day for each lesson in this course, it will be assumed students will record their notes in a journal. The journal may be a three-ring binder, spiral bound notebook, or an electronic document.
- The teacher will distribute [Sample Engineer's Notebook Entries](#) to each student and discuss what constitutes acceptable and unacceptable entries.
- The teacher will present Engineer's Notebook.ppt.
- **Note:** The teacher may want to present the extended version of this PowerPoint. The extended version is located in the Instructional Resources at the end of this lesson.
- Students will take notes in their journals while the teacher makes the presentation.
- Students will be advised to keep work for the creation of portfolios. Portfolios will be discussed in Lesson 1.4.

Sections 2 - 3 (2 hours)

- Students will participate in a teacher-led discussion on how society has changed because of a product or technology.
- The teacher will identify two or three major inventions that have made life easier, such as the automobile and telephone, to stimulate class discussion.
- The teacher will distribute and introduce [Activity 1.1.1 Beverage Container](#).
- The teacher will present the [Rules for Brainstorming.ppt](#).
- Students will begin work on Activity 1.1.1 Beverage Container.
- **Note:** The teacher may have other common objects to show that will offer students different experiences in learning about the parts of the design process in an impromptu way.
- The teacher may want to provide graph paper for the sketching located in the [Teacher Guidelines](#) located at the end of this lesson.
- The teacher will serve as a facilitator and keep students on task by offering cues and reiterating the problem statement.
- Students will present Activity 1.1.1 Beverage Container ideas to the class.
- The teacher will lead a discussion using the steps in the design process and possible constraints that would have to be addressed when redesigning the item. Refer to the [Teacher Notes](#) for a detailed explanation.

Sections 4 - 6 (3 hours)

- The teacher will present the [Evolution of Product Design.ppt](#).

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- Students will take notes in their journals.
- The teacher will introduce and distribute [Activity 1.1.2 Product Evolution](#) and [Activity 1.1.2 Product Evolution Rubric](#).
- **Optional:** The teacher may want to present [Introduction to Research.ppt](#) even though the design of this lesson is to assess students' knowledge and ability without additional instruction or guidance.
- The teacher and students will discuss the expectations of the activity and how the rubric will be used to assess the activity.
- Students will begin work on Activity 1.1.2 Product Evolution using an approved product from their hobby or interest.

Sections 7 - 8 (2 hours)

- Students will deliver their PowerPoint presentations to the class.
- **Note:** The teacher may want to invite an administrator, counselor, or member from the partnership team to view presentations.
- The teacher will assess the presentations using the Activity 1.1.2 Product Evolution Rubric.

Sections 9 – 11 (3 hours)

- The teacher will distribute [Example Design Process](#).
- The teacher will present the [Design Process Overview.ppt](#).
- Students will take notes in their journals.
- The teacher will distribute [Activity 1.1.3 Gossamer Condor](#).
- The teacher will show *The Flight of the Gossamer Condor*.
- **Note:** The teacher may wish to use another video from his or her past experiences that covers the design process. However, the teacher will need to create a working document to accompany the video of choice.
- Students will watch the film and complete Activity 1.1.3 Gossamer Condor.
- The teacher will review Activity 1.1.3 Gossamer Condor Design and lead the class in a discussion on the iterative nature, the use of a design process, and the way it will be used throughout the remainder of the course.
- The teacher will assess the students using [Activity 1.1.3 Gossamer Condor Answer Key](#)

Comments:

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<u>Semester 1 - Unit 1 - Introduction to Design</u>				
Competencies	Standards	Suggested Pacing	Essential Vocabulary	Resources/Materials
<p>1E - Creates sketches to quickly record, communicate, and investigate ideas.</p> <p>1F - Uses pictorials and tonal shading techniques in combination to give sketched objects a realistic look.</p> <p>1G - Uses isometric, oblique, perspective, and multiview sketching to maintain an object's visual proportions.</p> <p>1H - Produces multiview projections as a method of communicating the shape and size of an object that is intended for manufacture.</p>	<p><u>Career Technical Education:</u> *ED/EDP/ C4.4 Use the concepts of geometric construction in the development of design drawings. C7.2 Use a sectional view and appropriate cutting planes to clarify hidden features of an object. C10.1 Understand the process of producing proportional two- and three-dimensional sketches and designs. C10.3 Use freehand graphic communication skills to represent conceptual ideas, analysis, and design concepts.</p>	<p>Lesson 1.2 – 11 hours: Introduction to Technical Sketching</p>	<p>Construction Line</p> <p>Depth</p> <p>Documentation</p> <p>Edge</p> <p>Ellipse</p> <p>Freehand</p> <p>Grid</p> <p>Height</p> <p>Hidden Line</p> <p>Isometric Sketch</p> <p>Line</p> <p>Line Conventions</p> <p>Line Weight</p> <p>Manufacture</p> <p>Measurement</p> <p>Multiview Drawings</p> <p>Object Line</p> <p>Oblique Sketch</p> <p>Orthographic Projection</p> <p>Perspective Sketch</p> <p>Pictorial Sketch</p> <p>Plane</p> <p>Point</p> <p>Profile</p> <p>Projection Line</p> <p>Projection Plane</p> <p>Proportion</p>	<p><u>Teacher Resources:</u> Refer to Suggestions/ Assessments section.</p> <p><u>Student Resources:</u> Refer to Suggestions/ Assessments section.</p>

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			Scale Shading Shape Size Sketch Solid Technical Working Drawing Tone Vanishing Point Views Visualize Width	
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Suggestions/Assessments:

Lesson 1.2

Section 1 (1 hour)

- The teacher will present [Concepts](#), [Key Terms](#), and [Essential Questions](#), and provide a lesson overview.
- The teacher will present slide one through seven of the [Line Conventions.ppt](#).
- Students will take notes in their journals.

Section 2 (1 hour)

- The teacher will present the [Isometric Pictorials.ppt](#).
- Students will take notes in their journals.
- The teacher will distribute [Activity 1.2.1 Isometric Sketches](#).
- The teacher will provide [Activity 1.2.1a Isometric Graph Paper](#) handouts for or the Isometric Grid paper located in the [Teacher Guidelines](#) at the bottom of the lesson for the students to use.
- Students will begin work on Activity 1.2.1 Isometric Sketches.

Section 3 (1 hour)

- Students will complete Activity 1.2.1 Isometric Sketches.
- The teacher will assess student work using [Activity 1.2.1 Isometric Sketches Answer Key](#).

Section 4 (1 hour)

- The teacher will present the [Oblique Pictorials.ppt](#).

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- Students will take notes in their journals.
- The teacher will distribute [Activity 1.2.2 Oblique Sketches](#).
- Students will begin work on Activity 1.2.2 Oblique Sketches.

Section 5 (1 hour)

- Students will complete Activity 1.2.2 Oblique Sketches.
- The teacher will assess student work using [Activity 1.2.2 Oblique Sketches Answer Key](#).

Section 6 (1 hour)

- The teacher will present the [Perspective Sketches.ppt](#).
- Students will take notes in their journals.
- The teacher will distribute [Activity 1.2.3 Perspective Sketches](#).
- Students will begin work on Activity 1.2.3 Perspective Sketches.
- **Note:** The purpose of the activity is to show students how to quickly sketch a perspective view.

Section 7 (1 hour)

- Students will complete Activity 1.2.3 Perspective Sketches.
- The teacher will assess student work using [Activity 1.2.3 Perspective Sketches Answer Key](#).

Sections 8-11 (4 hours)

- The teacher will present the [Multiview Sketching.ppt](#).
- Students will take notes in their journals.
- The teacher will distribute [Activity 1.2.4 Multiview Sketches](#).
- The teacher will provide instruction to the class on hidden lines and center lines and their use in technical sketches.
- The teacher may use parts of the [Line Conventions.ppt](#) used earlier in the lesson to provide instruction.
- Students will begin work on Activity 1.2.4 Multiview Sketches.
- Students will complete Activity 1.2.4 Multiview Sketches.
- The teacher will assess student work using [Activity 1.2.4 Multiview Sketches Answer Key](#).
- **Note:** If the teacher needs more time for drill and practice on sketching techniques, additional time could be adjusted throughout the lesson.

Comments:

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<u>Semester 1 - Unit 1 - Introduction to Design</u>				
Competencies	Standards	Suggested Pacing	Essential Vocabulary	Resources/Materials
<p>1I - Understands measurement systems were developed out of the need for standardization.</p> <p>1J - Is able to apply dimensions to drawings to communicate size information.</p> <p>1K - Understands manufactured parts are often created in different countries, where dimensional values are often converted from one standard unit to another.</p> <p>1L - Understands that the amount of variation that can be measured depends on the precision of the measuring tool.</p> <p>1M - Presents statistical analysis of measurements that can help to verify the quality of a design or process.</p> <p>1N - Uses graphics to communicate patterns in recorded data.</p>	<p><u>Career Technical Education:</u> *ED/EDP/ C3.1 Know how the various measurement systems are used in engineering drawings. C3.2 Understand the degree of accuracy necessary for engineering design. C8.1 Understand what constitutes mating parts in engineering design. C8.2 Use tolerance in an engineering drawing.</p> <p><u>Core Academic:</u> *ED/C/2.2WSA/G11-12 (1.8) Integrate databases, graphics, and spreadsheets into word-processed documents. *ED/C/2.4LSSA/G11-12 (2.4) Deliver multimedia presentations: a. Combine text, images, and sound by incorporating information from a wide range of media, including films, newspapers, magazines, CD-ROMs, online information, television, videos, and electronic media-generated images. b. Select an appropriate medium for each element of the presentation.</p>	<p>Lesson 1.3 – 10 hours: Measurements and Statistics</p>	Data Set Dimension Dimension Lines English System Extension Lines Foot Frequency Graph Histogram Inch International Organization for Standardization (ISO) Mean Measure Median Meter Metric System Millimeter Mode Normal Distribution Numeric Constraint Precision Scale Standard Statistics Two-Dimensional Unit Variation	<p><u>Teacher Resources:</u> Refer to Suggestions/Assessments section.</p> <p><u>Student Resources:</u> Refer to Suggestions/Assessments section.</p>

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Suggestions/Assessments:

Lesson 1.3

Sections 1 - 2 (2 hours)

- The teacher will present [Concepts](#), [Key Terms](#), and [Essential Questions](#) to provide a lesson overview.
- The teacher will distribute and introduce [Project 1.3.1 History of Measurement](#).
- Students will work on and complete Project 1.3.1 History of Measurement.
- The teacher will assess student work using [Project 1.3.1 History of Measurement Rubric](#).

Section 3 (1 hour)

- The teacher will distribute [Activity 1.3.2 English and Metric Linear Measurements](#).
- The teacher will distribute and explain the use of the [Activity 1.3.2a Decimal Conversion Chart](#).
- The teacher will present [Scale Reading Basics.ppt](#).
- Students will take notes in their journal and will refer to Activity 1.3.2 English and Metric Linear Measurements while the teacher presents Scale Reading Basics.ppt.
- Students will work on Activity 1.3.2 English and Metric Linear Measurements and complete the activity for homework.

Sections 4 - 5 (2 hours)

- The teacher will assess the homework on Activity 1.3.2 English and Metric Linear Measurements using [Activity 1.3.2 English and Metric Linear Measurements Answer Key](#).
- The teacher will distribute [Activity 1.3.3 fischertechniks® Block Measurement](#) or other activity – see Teacher Notes.
- The teacher will present [Dial Calipers.ppt](#).
- Students will take notes in their journal and will refer to Activity 1.3.3 fischertechniks® Block Measurement while the teacher presents Dial Calipers.ppt.
- Students will complete Activity 1.3.3 fischertechniks® Block Measurement.

Sections 6 - 7 (2 hours)

- The teacher will assess the students on Activity 1.3.3 using [Activity 1.3.3 fischertechniks® Block Measurement Answer Key](#).
- **Note:** Activity 1.3.3 fischertechniks® Block Measurement Answer Key may have different answers than those the students get due to variance in the blocks.
- **Optional:** The teacher will want to present slide 9-10 of the [Line Convention.ppt](#)
- The teacher will present [Dimension Practices .ppt](#).
- Students will take notes in their journal.
- The teacher will distribute and explain [Activity 1.3.4 Linear Dimensions](#).
- Students will work on the Activity 1.3.4 Linear Dimensions.
- The teacher will assess Activity 1.3.4 Linear Dimensions using [Activity 1.3.4 Linear Dimensions Answer Key](#).

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Sections 8 - 10 (3 hours)

- **Optional:** The teacher will introduce students to the 3-D modeling software prior to the start of Activity 1.3.5.
- The teacher will present [Introduction to Basic Statistics.ppt](#).
- Students will take notes in their journal.
- The teacher will distribute a dial caliper, 27 hardwood cubes, and [Activity 1.3.5 Applied Statistics](#) to each student.
- Students will begin work on Activity 1.3.5 Applied Statistics.
- Students will complete Activity 1.3.5 Applied Statistics.
- The teacher will assess student work. Answers will vary due to variance in cubes.

Comments:

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Semester 1 - Unit 1 - Introduction to Design				
Competencies	Standards	Suggested Pacing	Essential Vocabulary	Resources/Materials
<p>1O - Presents three-dimensional forms derived from two-dimensional shapes.</p> <p>1P - Understands the results of the design process are commonly displayed as a physical model.</p> <p>1Q - Is able to develop models to communicate and evaluate possible solutions.</p> <p>1R - Understands geometric and numeric constraints are used to define the shape and size of objects in Computer Aided Design (CAD) modeling systems.</p> <p>1S - Uses CAD modeling systems to quickly generate and annotate working drawings.</p> <p>1T - Understands packaging not only protects a product, but contributes to that product's commercial success.</p>	<p><u>Career Technical Education:</u> *ED/EDP/ C5.4 Apply two-dimensional and three-dimensional CAD operations in creating working and pictorial drawings, notes, and notations. C6.1 Know a variety of drafting applications and understand the proper dimensioning styles for each.</p> <p><u>Core Academic:</u> *ED/A/GM/G8-12 (15.0) Students use the Pythagorean theorem to determine distance and find missing lengths of sides of right triangles. *ED/C/2.2W/G9-10 (2.6) Write technical documents a. Report information and convey ideas logically and correctly. b. Offer detailed and accurate specifications.</p>	<p>Lesson 1.4 – 17 hours: Puzzle Cube</p>	Annotate Assembly Drawing Computer-Aided Design or Computer-Aided Drafting (CAD) Design Brief Design Statement Extrusion Geometric Constraint Logo Manufacturer's Joint Marketing Mock-up Model Numeric Constraint Origin Packaging Plane Prototype Scale Model Scoring Solid Modeling Three-Dimensional Two-Dimensional	<p><u>Teacher Resources:</u> Refer to Suggestions/ Assessments section.</p> <p><u>Student Resources:</u> Refer to Suggestions/ Assessments section.</p>

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Suggestions/Assessments:

Lesson 1.4

Section 1 (1 hour)

- The teacher will present [Concepts](#), [Key Terms](#), and [Essential Questions](#) to provide a lesson overview.
- The teacher will distribute and introduce [Project 1.4.1 Puzzle Design Challenge](#).
- The teacher will discuss constraints, requirements and questions about the project.
- The teacher will review the design process using [Example Design Process](#) distributed in Lesson 1.1.
- Students will keep this document available throughout this lesson.

Section 2 (1 hour)

- The teacher will distribute and introduce [Activity 1.4.2 Puzzle Part Combinations](#).
- The teacher will distribute [Activity 1.4.2 Isometric Graph Paper](#) handout or the Isometric Grid paper located in the [Teacher Guidelines](#) at the bottom of the lesson for the students to use.
- **Note:** The teacher will review the [Sketched Puzzle Parts Example](#) for details.
- Students will begin work on Activity 1.4.2 Puzzle Part Combinations.

Sections 3 - 15 (13 hours)

- The teacher will review the requirements for Project 1.4.1 Puzzle Design Challenge.
- Students will continue working on materials to be completed.
- The teacher will review [Example Sketched Puzzle Solution](#) for details on how students could hand in their decision solution.
- **Note:** The teacher will give an introduction to the 3-D Modeling software if he or she did not introduce it in Lesson 1.3.
- The teacher will keep students on task and demonstrate any details on the 3-D modeling software needed for completion of the project.
- The teacher will assess Project 1.4.1 Puzzle Design Challenge using [Project 1.4.1 Puzzle Design Rubric](#).
- **Optional:** The teacher will have students challenge each other on their cube to see the time needed to assemble puzzles. This could be set up as a trial game to see which student's puzzle cube is the most difficult to assemble and solve.

Section 16 (1hour)

- The teacher will present [Marketing.ppt](#).
- Students will take notes in their engineer's notebook.
- The teacher will introduce and distribute [Activity 1.4.3 Puzzle Cube Package](#) and [Activity 1.4.3 Puzzle Cube Package Rubric](#).
- Students will begin work on Activity 1.4.3 Puzzle Cube Package.

Section 17 (1hour)

- Students will complete Activity 1.4.3 Puzzle Cube Package.

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- The teacher will assist the students with their package designs.

Comments:

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<u>Semester 1 - Unit 2 - Design Solutions (50 hours)</u>				
Competencies	Standards	Suggested Pacing	Essential Vocabulary	Resources/Materials
<p>2A - Presents geometric shapes to describe the two or three dimensional contours that characterize an object.</p> <p>2B - Understands that properties of volume and surface area are common to all designed objects and provide useful information to the engineer.</p> <p>2C - Uses CAD systems to increase productivity and reduce design costs.</p> <p>2D - Understand solid CAD models are the result of both additive and subtractive processes.</p>	<p><u>Career Technical Education:</u> *ED/EDP/ C5.1 Understand the commands and concepts necessary for editing engineering drawings. C5.2 Know the various object-altering techniques. C10.1 Understand the process of producing proportional two- and three-dimensional sketches and designs. C10.2 Use sketching techniques as they apply to a variety of architectural and engineering models.</p> <p><u>Core Academic:</u> *ED/A/GM/G8-12 (15.0) Students use the Pythagorean theorem to determine distance and find missing lengths of sides of right triangles. (19.0) Students use trigonometric functions to solve for an unknown length of a side of a right triangle, given an angle and a length of a side.</p>	<p>Lesson 2.1 – 10 hours: Geometric Shapes and Solids</p>	<p>Acute Triangle Angle Area Axis Cartesian Coordinate System Chamfer Circle Circumscribe Computer-Aided Design or Computer-Aided Drafting (CAD) Counter bore Countersink Cylinder Diameter Ellipse Extrusion Geometric Constraint Inscribe Mass Numeric Constraint Obtuse Triangle Origin Parallelogram Pattern Pi Plane Polygon Prism</p>	<p><u>Teacher Resources:</u> Refer to Suggestions/ Assessments section.</p> <p><u>Student Resources:</u> Refer to Suggestions/ Assessments section.</p>

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			Quadrilateral Radius Rectangle Regular Polygon Revolution Right Triangle Rotation Round Solid Solid Modeling Space Square Surface Area Tap Taper Three-Dimensional Triangle Two-Dimensional Vertex Volume Working Drawings	
Suggestions/Assessments: Lesson 2.1 Sections 1 – 2 (2 hours) <ul style="list-style-type: none">• The teacher will present Concepts, Key Terms, and Essential Questions, and provide a lesson overview.• Note: The teacher will need to create a customized title block for the classroom before teaching this lesson. A tutorial is located in the Teacher Notes for this lesson.• The teacher will present Geometric Shapes and Area.ppt.• Students will take notes in their journals.• The teacher will distribute Project 2.1.1 Shape and Measurement Madness.• Students will work on Project 2.1.1 Shape and Measurement Madness and complete the project for homework.• The teacher will assess students' work based on completion.				

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Section 3 (1 hour)

- The teacher will distribute [Activity 2.1.2 Calculating Properties of Shapes](#).
- Students will work on Activity 2.1.2 Calculating Properties of Shapes and complete the activity for homework.
- The teacher will assess student work using [Activity 2.1.2 Calculating Properties of Shapes Answer Key](#)

Sections 4 – 5 (2 hours)

- The teacher will distribute [Activity 2.1.3 Making Sketches in CAD](#).
- The teacher will demonstrate how to use the sketch tools within a CAD solid modeling program needed to complete the activity.
- **Note:** The files needed for this project can be found in the [Inventor files](#) folder. The teacher can access how to assemble and apply motion to the train from the tutorial on the Virtual Academy.
- Students will begin work on Activity 2.1.3 Making Sketches in CAD.
- The teacher will assist students when needed.
- Students will complete Activity 2.1.3 Making Sketches in CAD.
- The teacher will assess students' work based on completion.

Section 6 (1 hour)

- The teacher will present [Properties of Geometric Solids.ppt](#).
- Students will take notes in their journals.
- The teacher will distribute [Activity 2.1.4 Calculating Properties of Solids](#).
- Students will begin work on Activity 2.1.4 Calculating Properties of Solids.
- Students will complete Activity 2.1.4 Calculating Properties of Solids for homework.
- The teacher will assess student work using [Activity 2.1.4 Calculating Properties of Solids Answer Key](#)

Sections 7 - 8 (2 hours)

- The teacher will distribute [Activity 2.1.5 CAD Model Features](#).
- The teacher will discuss the Cartesian coordinate system along with the axes and planes associated with this system.
- The teacher will demonstrate how to use the feature tools within a CAD solid modeling program needed to complete the activity.
- **Note:** The files needed for this project can be found in the [Inventor files](#) folder. The teacher can access how to assemble and apply motion to the train from the tutorial on the Virtual Academy.
- Students will begin work on Activity 2.1.5 CAD Model Features.
- The teacher will assist students when needed.
- Students will complete Activity 2.1.5 CAD Model Features.
- The teacher will assess students' work based on completion.

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Sections 9 - 10 (2 hours)

- The teacher will present [Additive and Subtractive Solid Modeling.ppt](#).
- Students will take notes in their journals.
- The teacher will distribute [Project 2.1.6 Modeling Creation](#).
- Students will begin work on Project 2.1.6 Modeling Creation.
- The teacher will assist students when needed.
- Students will complete Project 2.1.6 Modeling Creation.
- The teacher will assess students' work based on completion.

Comments:

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<u>Semester 1 - Unit 2 - Design Solutions</u>				
Competencies	Standards	Suggested Pacing	Essential Vocabulary	Resources/Materials
<p>2E - Presents working drawings that contain only the dimensions that are necessary to build and inspect an object.</p> <p>2F - Understands object features require specialized dimensions and symbols to communicate technical information, such as size.</p> <p>2G - Understands there is always a degree of variation between the actual manufactured object and its dimensioned drawing.</p> <p>2H - Specifies tolerances to indicate the amount of dimensional variation that may occur without adversely affecting an object's function.</p> <p>2I - Understands tolerances for mating part features are determined by the type of fit.</p>	<p><u>Career Technical Education:</u> *ED/EDP/ C3.2 Understand the degree of accuracy necessary for engineering design. C8.1 Understand what constitutes mating parts in engineering design. C8.2 Use tolerance in an engineering drawing. <u>Core Academic:</u> *ED/A/1.1M/G7 (2.7) Indicate the relative advantages of exact and approximate solutions to problems and give answers to a specified degree of accuracy.</p>	<p>Lesson 2.2 – 9 hours: Dimensions and Tolerances</p>	<p>Aligned Dimension</p> <p>American National Standards Institute (ANSI)</p> <p>American Society of Mechanical Engineers (ASME)</p> <p>Arrowheads</p> <p>Baseline Dimensioning</p> <p>Bilateral Tolerance</p> <p>Chain Dimensioning</p> <p>Datum</p> <p>Datum Dimension</p> <p>Dimension</p> <p>Dimension Lines</p> <p>Dual Dimensions</p> <p>Extension Lines</p> <p>General Notes</p> <p>Leaders</p> <p>Least Material Condition (LMC)</p> <p>Limits of Dimension</p> <p>Local Notes</p> <p>Location Dimension</p> <p>Maximum Material Condition (MMC)</p> <p>Nominal Size</p> <p>Reference Dimension</p> <p>Size Dimensions</p> <p>Tolerance</p> <p>Unidirectional Dimension</p> <p>Unilateral Tolerance</p>	<p><u>Teacher Resources:</u> Refer to Suggestions/ Assessments section.</p> <p><u>Student Resources:</u> Refer to Suggestions/ Assessments section.</p>

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Suggestions/Assessments:

Lesson 2.2

Section 1 (1 hour)

- The teacher will present the [Concepts](#), [Key Terms](#) and [Essential Questions](#), and provide students with a lesson overview.
- The teacher will present [Dimension Guidelines.ppt](#).
- Students will take notes in their journals.
- The teacher will introduce and distribute [Activity 2.2.1 What Is Wrong with this Picture?](#)
- Students will work in teams of two on Activity 2.2.1 What Is Wrong with This Picture?

Sections 2 - 3 (2 hours)

- Students will complete Activity 2.2.1 What Is Wrong with this Picture.
- The teacher will assist the students and assess their work using [Activity 2.2.1 What Is Wrong with this Picture Answer Key](#).
- The teacher will moderate a class discussion on the results of Activity 2.2.1 What Is Wrong with this Picture?
- Students will participate in a class discussion to identify the problems associated with the three dimensioned drawings in Activity 2.2.1 What Is Wrong with this Picture?
- **Note:** The teacher will need to demonstrate how to dimension one of the above drawings in the 3-D CAD Modeling Software before moving to the next activity.

Sections 4 - 6 (3 hours)

- The teacher will present [Dimensioning Standards.ppt](#).
- Students will take notes in their journals.
- **Optional:** The teacher may want to distribute [Activity 2.2.2a General Rules for Dimensioning](#).
- The teacher will introduce and distribute [Activity 2.2.2 Model Dimensioning](#).
- Students will begin work on Activity 2.2.2 Model Dimensioning.
- The teacher will assist the students when needed.
- The teacher will assess student work using [Activity 2.2.2 Model Dimensioning Answer Key](#).

Section 7 (1 hour)

- The teacher will present [Tolerances.ppt](#).
- Students will take notes in their journals.
- The teacher will introduce and distribute [Activity 2.2.3 Tolerances](#).
- Students will begin work on Activity 2.2.3 Tolerances.

Sections 8 – 9 (2 hours)

- Students will finish work on Activity 2.2.3 Tolerances.

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- The teacher will assist the students and assess their work.

Comments:

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<u>Semester 1 - Unit 2 - Design Solutions</u>				
Competencies	Standards	Suggested Pacing	Essential Vocabulary	Resources/Materials
<p>2J - Understands solid modeling programs allow the designer to create quality designs for production in far less time than traditional design methods.</p> <p>2K - Uses CAD models, assemblies, and animations to check for design problems, verify the functional qualities of a design, and communicate information to other professionals and clients.</p> <p>2L - Understands auxiliary views allow the engineer to communicate information about an object's inclined surfaces that appear foreshortened in basic multiview drawings.</p> <p>2M - Uses sectional views to communicate an object's interior features that may be difficult to visualize from the outside.</p> <p>2N - Understands as individual objects are assembled together, their degrees of freedom are systematically removed.</p> <p>2O - Creates mathematical formulas to establish geometric and functional relationships within their designs.</p> <p>2P - Produces a title block to</p>	<p><u>Career Technical Education:</u> *ED/EDP/ C2.3 Apply the concepts of engineering design to the tools, equipment, projects, and procedures of the Engineering Design Pathway. C5.2 Know the various object-altering techniques. C7.1 Understand the function of sectional views. C7.2 Use a sectional view and appropriate cutting planes to clarify hidden features of an object. C9.2 Develop drawings using notes and specifications. C10.1 Understand the process of producing proportional two- and three-dimensional sketches and designs.</p>	<p>Lesson 2.3 – 19 hours: Advance Modeling Skills</p>	<p>Assembly Assembly Drawing Auxiliary View Balloons Blind Hole Break Line Broken-Out Section Chamfer Clearance Fit Component Constraint Counterbore Countersink Cutting Plane Line Degree of Freedom Detail Drawing Documentation Exploded Assembly Fillet Foreshorten Formula Full Section Half Section Interference Key Keyseat Keyway</p>	<p><u>Teacher Resources:</u> Refer to Suggestions/ Assessments section.</p> <p><u>Student Resources:</u> Refer to Suggestions/ Assessments section.</p>

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<p>provide the engineer and manufacturer with important information about an object and its creator. 2Q - Understands parts list and balloons are used to identify individual components in an assembly drawing.</p>			<ul style="list-style-type: none"> Parameter Parametric modeling Parts List Phantom Line Ratio Rib Rotation Round Scale Section Lines Sectional View Spotface Subassembly Tap Taper Title Block Translation Working drawings 	
<p>Suggestions/Assessments: Lesson 2.3 Sections 1-2 (2 hours)</p> <ul style="list-style-type: none"> • The teacher will present Concepts, Key Terms, and Essential Questions, and provide a lesson overview. • The teacher will present Work Points, Work Axes, and Work Planes.ppt. • Students will take notes in their journals. • The teacher will introduce and distribute Project 2.3.1 Arbor Press or Project 2.3.1a Miniature Train depending on available time and teacher preference. • Note: The files needed for this project can be found in the Inventor files folder. The teacher can access how to assemble and apply motion to the train from the tutorial on the Virtual Academy. • Optional: The teacher may want to divide the students with half of them working on Project 2.3.1 Arbor Press and the other half on Project 2.3.1a Miniature Train. The students could then discuss differences and similarities with each project. • Students will begin work on Project 2.3.1 Arbor Press or Project 2.3.1a Miniature Train. 				

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Sections 3-4 (2 hours)

- The teacher will introduce and distribute [Activity 2.3.2 Parametric Constraints](#).
- The teacher will present [Parametric Modeling.ppt](#).
- Students will take notes in their journals.
- Students will begin work on Activity 2.3.2 Parametric Constraints.
- The teacher will assist the students with Activity 2.3.2 Parametric Constraints.
- Students will complete Activity 2.3.2 Parametric Constraints.
- The teacher will assess student work using [Activity 2.3.2 Parametric Constraints Answer Key](#).
- Students will continue working on Project 2.3.1 Arbor Press or Project 2.3.1a Miniature Train.

Sections 5-6 (2 hours)

- The teacher will present [Auxiliary Views.ppt](#).
- Students will take notes in their journals.
- The teacher will introduce and distribute [Activity 2.3.3 Auxiliary Views](#).
- Students will begin work on Activity 2.3.3 Auxiliary Views.
- The teacher will assist the students with Activity 2.3.3 Auxiliary Views.
- Students will finish work on Activity 2.3.3 Auxiliary Views.
- The teacher will assess student work using [Activity 2.3.3 Auxiliary Views Answer Key](#).
- Students will continue working on Project 2.3.1 Arbor Press or Project 2.3.1a Miniature Train.

Sections 7-8 (2 hours)

- The teacher will present [Sectional Views.ppt](#).
- Students will take notes in their journals.
- The teacher will introduce and distribute [Activity 2.3.4 Sectional Views](#).
- Students will begin work on Activity 2.3.4 Sectional Views.
- The teacher will assist the students with Activity 2.3.4 Sectional Views.
- Students will finish work on Activity 2.3.4 Sectional Views.
- The teacher will assess student work using [Activity 2.3.4 Sectional Views Answer Key](#).
- Students will continue working on Project 2.3.1 Arbor Press or Project 2.3.1a Miniature Train.

Sections 9-10 (2 hours)

- The teacher will present [Basic Assembly Constraints and Concepts.ppt](#).
- Students will take notes in their journals.

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- The teacher will introduce and demonstrate the exercises in [Activity 2.3.5 Assembly Models](#).
- Students will begin work on Activity 2.3.5 Assembly Models.
- The teacher will assist the students with Activity 2.3.5 Assembly Models.
- Students will complete Activity 2.3.5 Assembly Models.

Sections 11-12 (2 hours)

- **Optional:** The teacher will present [Exploded CAD Assembly Models.ppt](#). The teacher may want to demonstrate this to students instead of showing the presentation.
- Students will take notes in their journals.
- The teacher will demonstrate how to explode an assembly using the Arbor Press or the miniature train project.
- Students will explode their Arbor Press or Miniature Train assembly.
- The teacher will assist the students when needed.

Sections 13-14 (2 hours)

- **Optional:** The teacher will present [Animating Assembly Models and Exporting Video.ppt](#). The teacher may want to demonstrate this to students instead of showing the presentation.
- Students will take notes in their journals.
- The teacher will demonstrate how to animate an assembly using the Arbor Press or the Miniature Train project.
- Students will animate their Arbor Press or Miniature Train assembly.
- The teacher will assist the students when needed.

Sections 15-19 (5 hours)

- The teacher will introduce and distribute [Activity 2.3.6 Arbor Press Drawings](#) and [Activity 2.3.6 Detail Drawing Rubric](#).
- The teacher will let students know they can use the same activity set up for the Miniature Train.
- The teacher will demonstrate creating a dimensioned multiview drawing from one of the Arbor Press part models or Miniature Train part. The demonstration will include the creation of section and auxiliary views, centerlines, dimensions, and tolerances.
- Students will take notes in their journals.
- Students will begin work on Activity 2.3.6 Arbor Press Drawings.
- The teacher will use the Activity 2.3.6 Detail Drawing Rubric to assess the students' drawings.
- The teacher can use the same rubric set up for the Miniature train set-up.
- **Optional:** The teacher will present [Assembly Drawings, Balloons, and Parts Lists.ppt](#). The teacher may want to demonstrate this to students instead of showing the presentation.
- Students will take notes in their journals.
- The teacher will demonstrate the application of balloons and a parts list to an exploded isometric pictorial assembly drawing of the Arbor Press, and the creation of a sectioned assembly view.

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- Students will complete Activity 2.3.6 Arbor Press Drawings or Miniature Train.

Comments:

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<u>Semester 1 - Unit 2 - Design Solutions</u>				
Competencies	Standards	Suggested Pacing	Essential Vocabulary	Resources/Materials
<p>2R - Understands design solutions can be created as an individual or in teams.</p> <p>2S - Understands engineers use design briefs to explain the problem, identify solution expectations, and establish project constraints.</p> <p>2T - Understands that teamwork requires constant communication to achieve the goal at hand.</p> <p>2U - Researches to develop knowledge base, stimulate creative ideas, and make informed decisions.</p> <p>2V - Uses a design process to create solutions to existing problems.</p> <p>2W - Uses CAD modeling systems to quickly generate and annotate working drawings.</p> <p>2X - Understand Fluid Power Concepts that could be used to enhance design solutions.</p>	<p><u>Career Technical Education:</u> *ED/LT 9.3 Understand how to organize and structure work individually and in teams for effective performance and attainment of goals. *ED/EDP/ C10.1 Understand the process of producing proportional two- and three-dimensional sketches and designs. *ED/ETP/ D5.1 Understand the steps in the design process. D5.2 Determine what information and principles are relevant to a problem and its analysis. <u>Core Academic:</u> *ED/C/2.2W/WSA/G9-10 (1.8) Design and publish documents by using advanced publishing software and graphic programs.</p>	<p>Lesson 2.4 – 12 hours: Advanced Designs</p>	<p>Accuracy</p> <p>Assembly</p> <p>Assembly Drawing</p> <p>Component</p> <p>Consensus</p> <p>Constraint</p> <p>Decision Matrix</p> <p>Design Brief</p> <p>Design Process</p> <p>Design Statement</p> <p>Designer</p> <p>Fluid Power</p> <p>Hydraulics</p> <p>Marketing</p> <p>Multiview Drawing</p> <p>Pneumatics</p> <p>Problem Statement</p> <p>Purpose</p> <p>Solid Modeling</p> <p>Target Consumer</p> <p>Team</p>	<p><u>Teacher Resources:</u> Refer to Suggestions/ Assessments section.</p> <p><u>Student Resources:</u> Refer to Suggestions/ Assessments section.</p>

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Suggestions/Assessments:

Lesson 2.4

Sections 1-2 (2 hours)

- The teacher will present [Concepts](#), [Key Terms](#), and [Essential Questions](#) to provide a lesson overview.
- The teacher will distribute and introduce [Project 2.4.1 Design Challenge](#) and [Project 2.4.1 Design Challenge Rubric](#).
- The teacher will divide the class into groups of two.
- The teacher will discuss constraints, requirements and design briefs for each project.
- The teacher will present [Teamwork.ppt](#) and the [Fluid Power.ppt](#).
- Students will take notes in their journals.
- The teacher will review the design process using [Example Design Process](#) distributed in Lesson 1.1.
- Students will keep Example Design Process document available throughout this lesson.
- The teacher will distribute the graph paper located in the [Teacher Guidelines](#) at the end of this lesson.
- Students will begin work on Project 2.4.1 Design Challenge.

Sections 3-12 (10 hours)

- The teacher will distribute [Decision Matrix Template](#)
- The teacher will present the [Decision Making Matrix.ppt](#).
- Students will take notes in their journals.
- Students will continue working on materials to be completed for Project 2.4.1 Design Challenge.
- The teacher will keep students on task and answer any questions during the process.
- Students will complete Project 2.4.1 Design Challenges.
- Students will present their design solution using their three-fold brochure and an oral report to the class.
- The teacher will assess students using Project 2.4.1 Design Challenges Rubric.
- **Optional:** The teacher may want to have students take the [Midterm Exam](#) located in the Instructional Resources area below

Comments:

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<u>Semester 2 - Unit B - Career Development (10 hours)</u>				
Competencies	Standards	Suggested Pacing	Essential Vocabulary	Resources/Materials
<p>A - Completes an appropriate resume and job application.</p> <p>B - Acquires job interview techniques.</p> <p>C - Attains awareness of advanced career and educational opportunities.</p>	<p><u>Career Technical Education:</u> *ED/CPM/ 3.1 Know the personal qualifications, interests, aptitudes, knowledge, and skills necessary to succeed in careers. 3.2 Understand the scope of career opportunities and know the requirements for education, training, and licensure. 3.6 Know important strategies for self-promotion in the hiring process, such as job applications, résumé writing, interviewing skills, and preparation of a portfolio.</p> <p><u>Core Academic:</u> *ED/A/1.4VPA/VA/ADV/G9-12/ (5.3) Prepare portfolios of their original works of art for a variety of purposes (e.g., review for postsecondary application, exhibition, job application, and personal collection). *ED/C/2.2W/WSA/G11-12/ (2.5) Write job applications and résumés: a. Provide clear and purposeful information and address the intended audience appropriately. b. Use varied levels, patterns, and types of language to achieve intended effects and aid comprehension. c. Modify the tone to fit the purpose and audience. d. Follow the conventional style for that type of document (e.g., résumé, memorandum) and use page formats,</p>	<p>A - 3 hours: Resume and 2 hours: Job Application</p> <p>B – 2.5 hours: Job interviews</p> <p>C - 2.5 hours: Career awareness</p>	<p>Career Characteristics Convicted Description Disability Extracurricular Interview skills Job Application Job Interview Labor Laws Limitations Objective Position Portfolio Previous/Former Reference Referred Resume Salary Skills Strengths</p>	<p><u>Teacher Resources:</u> Job Finder's Guide</p> <p>Employability Skills Handbook (lesson plan examples) http://www.baldyviewrop.com/teachers_staff/lesson_plans.htm</p> <p><u>Student Resources:</u> Master Application Job Finder's Guide www.snagajob.com www.monster.com http://www.ca.gov/Job/s/</p>

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	<p>fonts, and spacing that contribute to the readability and impact of the document.</p> <p>*ED/C/2.3WO/ELC/G11-12/ (1.2) Produce legible work that shows accurate spelling and correct punctuation and capitalization.</p> <p>*ED/C/2.2W/WSA/G11-12/ (1.6) Develop presentations by using clear research questions and creative and critical research strategies (e.g., field studies, oral histories, interviews, experiments, electronic sources).</p>		
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Suggestions/Assessments:

Resume/Job Application/Letters

- Have students start by writing a Personal Statement (See Job Finder’s Guide)
- Have students properly request a job application in person, and/or print one from the Internet. Students should fill out and complete the application. Also have students complete an online job application for a company.
- Use technology to show students exemplary and poor-quality examples of resumes, cover letters, and follow-up letters. Identify the components of business letters and a resume. Have students identify errors in the examples.
- Show Resume PowerPoint presentation and have students fill out a Resume Worksheet with all the information they will need to type in their Resume in order to best prepare and complete the Resume Document.
- Have students prepare a Cover Letter Document, References Document, and Thank you letter Document.

Job Interviews

- Have students type up responses to interview questions. Have students practice with a partner, then present in front of the class.
- Have students participate in mock interviews.

Career Awareness

- Have students visit selected college and university Web sites to discover what courses are taught and what majors are offered in the field of information technology.
- Have students share their findings with the class using electronic presentation software.
- Have students use the online *Occupational Outlook Handbook* (<http://www.bls.gov/oco/>) to select an area of occupational interest. Have them research salary and educational requirements for the chosen career and then prepare a one-page summary of the information using word processing software or do a multimedia presentation using presentation software, such as Microsoft PowerPoint.
- Have students understand:
 - Keeping informed of the job market will ensure that you have every opportunity to obtain the best jobs available.
 - Well-prepared job candidates perform much better in the job application and interview process and are more likely to be hired for desirable positions.
- Have students conduct a job search.
- Guest Speakers: College representatives, Professional in the Industry

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- The teacher will assess the Resume, Cover Letter, References Page and Thank you letter documents, and mock interviews.

Comments:

- At the beginning of the unit, use the **KWL Chart** to determine what students Know and what they Want to know about careers and emerging technologies in the industry. At the end of the unit, use K-W-L to review by having students recall what they have learned.

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<u>Semester 2 - Unit 3 - Reverse Engineering (43 hours)</u>				
Competencies	Standards	Suggested Pacing	Essential Vocabulary	Resources/Materials
<p>3A - Understands visual design principles and elements constitute an aesthetic vocabulary that is used to describe any object independent of its formal title, structural, and functional qualities.</p> <p>3B - Understands tangible design elements are manipulated according to conceptual design principles.</p> <p>3C - Understands aesthetic appeal results from the interplay between design principles and elements.</p> <p>3D - Understands a design's visual characteristics which are influenced by its structural and functional requirements.</p> <p>3E - Understands visual appeal influences a design's commercial success.</p> <p>3F - Understands graphic designers are concerned with developing visual messages that make people in a target audience respond in a predictable and favorable manner.</p>	<p><u>Career Technical Education:</u> *ED/EDP/ C1.2 Understand the development of graphic language in relation to engineering design. *ED/ETP/ D6.1 Know the common structure and processes of a quality assurance cycle.</p>	<p>Lesson 3.1 – 8 hours: Visual Analysis</p>	<p>Aesthetic</p> <p>Asymmetry</p> <p>Audience Analysis</p> <p>Balance</p> <p>Color</p> <p>Contrast</p> <p>Demographics</p> <p>Element</p> <p>Emphasis</p> <p>Form</p> <p>Gestalt</p> <p>Graphic Design</p> <p>Harmony</p> <p>Juxtapose</p> <p>Line</p> <p>Market Research</p> <p>Message Analysis</p> <p>Pattern</p> <p>Pictograph</p> <p>Principle</p> <p>Proportion</p> <p>Radial Symmetry</p> <p>Rhythm</p> <p>Scale</p> <p>Shape</p> <p>Space</p> <p>Survey</p>	<p><u>Teacher Resources:</u> Refer to Suggestions/ Assessments section.</p> <p><u>Student Resources:</u> Refer to Suggestions/ Assessments section.</p>

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			Symbol Symbolism Symmetry Texture Typography Unity Value Variety	
Suggestions/Assessments: Lesson 3.1 Section 1 (1 hour) <ul style="list-style-type: none">• The teacher will present Concepts, Key Terms, and Essential Questions to provide a lesson overview.• The teacher will present Visual Design Principles and Elements.ppt.• Students will take notes in their engineer's notebook.• The teacher will display various products, art forms, and printed media to the students that represent visual design principles and elements.• The teacher will review and distribute Activity 3.1.1 Visual Design Principles and Elements Identification.• Students will begin work on Activity 3.1.1 Visual Design Principles and Elements Identification. Section 2 (1 hour) <ul style="list-style-type: none">• Students will continue working on Activity 3.1.1 Visual Design Principles and Elements Identification.• The teacher will provide comments and additional information as needed to clarify student understanding and to prevent misconceptions. Section 3 (1 hour) <ul style="list-style-type: none">• The teacher will ask students at random to explain the principles and elements of one of their objects.• The teacher will assign each student to bring to class one mechanical artifact consisting of no more than 12 component parts. Section 4 (1 hour) <ul style="list-style-type: none">• The teacher will review and distribute Activity 3.1.2 Visual Design Principles and Elements Study.• Students will work in teams on Activity 3.1.2 Visual Design Principles and Elements Study. Section 5 (1 hour) <ul style="list-style-type: none">• Students will work in teams on Activity 3.1.2 Visual Design Principles and Elements Study.				

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- Alert students that they will need to bring in advertisements for upcoming Activity 3.1.3.

Section 6 (1 hour)

- The teacher will distribute [Lesson 3.1 Visual Design Principles and Elements Quiz](#).
- Students will complete Visual Design Principles and Elements Test.
- Students will submit their engineer's notebooks for evaluation of Activity 3.1.2 Visual Design Principles and Elements Study.
- The teacher will evaluate the students' work using the [Activity 3.1.2 Visual Design Principles and Elements Study Rubric](#).

Section 7 (1 hour)

- The teacher will present [Graphic Design.ppt](#).
- Students will take notes in their engineer's notebook.
- The teacher will introduce and distribute [Activity 3.1.3 What's going on in this graphic design?](#) and [Activity 3.1.3 Graphic Design Rubric](#).
- Students will work in groups of two on Activity 3.1.3 What's going on in this graphic design?
- Students will complete the activity for homework.

Section 8 (1 hour)

- Students will present and defend their analyses orally, in a round table discussion.
- The teacher will monitor and chair the discussion.
- Students will submit their analysis for teacher evaluation according to [Graphic Design Rubric](#).

Comments:

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<u>Semester 2 - Unit 3 - Reverse Engineering</u>				
Competencies	Standards	Suggested Pacing	Essential Vocabulary	Resources/Materials
<p>3G - Examines that mechanisms use simple machines to move loads through the input of applied effort forces.</p> <p>3H - Performs reverse engineering on products to study their visual, functional, and structural qualities.</p> <p>3I - Examines through observation and analysis, a product's function can be divided into a sequence of operations.</p> <p>3J - Understands products operate as systems, with identifiable inputs and outputs.</p>	<p><u>Career Technical Education:</u> *ED/PSCT 5.1 Apply appropriate problem-solving strategies and critical thinking skills to work-related issues and tasks. 5.2 Understand the universal, systematic problem-solving model that incorporates input, process, outcome, and feedback components. 5.3 Use critical thinking skills to make informed decisions and solve problems.</p>	<p>Lesson 3.2 – 4 hours: Functional Analysis</p>	<p>Black Box Model</p> <p>Compound Machine</p> <p>Function</p> <p>Hypothesis</p> <p>Input</p> <p>Mechanism</p> <p>Observation</p> <p>Output</p> <p>Process</p> <p>Reverse Engineering</p> <p>System</p>	<p><u>Teacher Resources:</u> Refer to Suggestions/ Assessments section.</p> <p><u>Student Resources:</u> Refer to Suggestions/ Assessments section.</p>
<p>Suggestions/Assessments: Lesson 3.2</p> <p>Section 1 (1 hour)</p> <ul style="list-style-type: none"> • The teacher will present Concepts, Key Terms, and Essential Questions to provide a lesson overview • The teacher will show SX-70. • Students will take notes in their engineer's notebook. • The teacher will lead the class in a group discussion on how design objects may be described as a sequence of operations, using the SX-70 camera as an example. <p>Section 2 (1 hour)</p> <ul style="list-style-type: none"> • The teacher will present Reverse Engineering and Functional Analysis.ppt. • Students will take notes in their engineer's notebook. • The teacher will introduce and distribute Activity 3.2.1a Example Product Observation and Activity 3.2.1 Product Observation. • Students will begin work on Activity 3.2.1 Product Observation. 				

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Sections 3-4 (2 hours)

- Students will complete Activity 3.2.1 Product Observation.
- The teacher will assist the students with Activity 3.2.1 Product Observation.

Comments:

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<u>Semester 2 - Unit 3 - Reverse Engineering</u>				
Competencies	Standards	Suggested Pacing	Essential Vocabulary	Resources/Materials
<p>3K - Understands objects are held together by means of joinery, fasteners, or adhesives.</p> <p>3L - Uses measurement tools and techniques to accurately record an object's geometry.</p> <p>3M - Examines operational conditions, material properties, and manufacturing methods to help determine the material makeup of a design.</p> <p>3N - Uses reference sources and computer-aided design (CAD) systems to calculate the mass properties of designed objects.</p>	<p><u>Career Technical Education:</u> *ED/EDP C3.1 Know how the various measurement systems are used in engineering drawings. C3.2 Understand the degree of accuracy necessary for engineering design. C5.3 Know the CADD components and the operational functions of CADD systems.</p>	<p>Lesson 3.3 – 15 hours: Structural Analysis</p>	<p>Adhesive</p> <p>Adhesive Bonding</p> <p>Analysis</p> <p>Competitor</p> <p>Compression</p> <p>Fastener</p> <p>Hypothesis</p> <p>Joinery</p> <p>Manufacturing Process</p> <p>Mass</p> <p>Mechanical Fastener</p> <p>Non-Renewable Resource</p> <p>Part Interaction</p> <p>Renewable Resource</p> <p>Reverse Engineering</p> <p>Snap-Fit</p> <p>Stress</p> <p>Surface Area</p> <p>Teardown</p> <p>Tension</p> <p>Torsion</p> <p>Volume</p>	<p><u>Teacher Resources:</u> Refer to Suggestions/ Assessments section.</p> <p><u>Student Resources:</u> Refer to Suggestions/ Assessments section.</p>

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Suggestions/Assessments:

Lesson 3.3

Section 1 (1 hour)

- The teacher will present [Concepts](#), [Key Terms](#), and [Essential Questions](#) to provide a lesson overview.
- The teacher will distribute [Project 3.3.4 Product Disassembly Display](#) and [Project 3.3.4a Sample Disassembly Display](#), and explain how this project will serve as the lesson capstone. Students will be creating a poster presentation of their reverse engineered product in disassembled array with the appropriate components modeled using 3D CAD software.
- The teacher will present [Wood Fasteners, Joinery, & Adhesives, Metal Fasteners, Joining & Adhesives, and Plastic Fasteners, Welding & Bonding.ppt](#).
- Students will take notes on the nomenclature and how the terms are used to distinguish between the types of processes and materials being used in joining, fastening, and adhering a product. It is imperative that students understand the basic differences between joinery, fasteners, and adhesives.
- **Optional:** The teacher may have students work through the following optional activities in class or as homework assignments after having students view the related PowerPoint presentations:
 - [Optional Activity 3.3.1a Wood Joinery Identification](#)
 - [Optional Activity 3.3.1b Wood Fasteners Adhesives Classification](#)
 - [Optional Activity 3.3.1c Metal Joining Process Identification](#)
 - [Optional Activity 3.3.1d Metal Fasteners and Adhesive Classification](#)
 - [Optional Activity 3.3.1e Plastic Welding Procedure Identification](#)
 - [Optional Activity 3.3.1f Plastic Fasteners Bonding Classification](#)
- The teacher will present [Product Disassembly.ppt](#) and explain to students the need to take a product apart in order to learn more about how it functions.

Sections 2-4 (3 hours)

- The teacher will review and distribute [Activity 3.3.2 Product Disassembly](#), [Activity 3.3.2a Product Disassembly Chart](#), and [Activity 3.3.2b Materials Usages Charts](#).
- Students will use Activity 3.3.2a Product Disassembly Chart to record their work, and Activity 3.3.2b Materials Usages Chart to identify the various materials that exist in their reverse engineered products.
- Students will begin disassembling their product used in prior lessons for this unit.

Section 5 (1 hour)

- Students will complete Activity 3.3.2a Product Disassembly Chart.
- The teacher will remind students about Activity 3.3.2b Materials and their Usages information sheet and explain how to use the document with the activity.

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- The teacher will assist students with the function and material section of the chart using Activity 3.3.2b Materials Usages Chart.

Sections 6-10 (5 hours)

- The teacher will introduce [Mass Property Analysis.ppt](#).
- Students will take notes in their engineer's notebook.
- The teacher will present [Activity 3.3.3 Mass Property Analysis](#) and offer students additional practice with the following extra activity:
- [Optional Activity 3.3.3a-g Mass Property Analysis Extras](#)
- Students will begin drawing the parts with a 3D modeling program and complete Activity 3.3.3 Mass Property Analysis.
- The teacher will assist students as needed.

Sections 11-12 (2 hours)

- The teacher will review expectations of [Project 3.3.4 Product Disassembly Display](#).
- Students will complete Project 3.3.4 Product Disassembly Display by constructing the foam core presentation display to document their disassembly process and related components needed for the display that have not been created earlier.

Section 13 (1 hour)

- Students will prepare an oral presentation for the poster session.

Sections 14-15 (2 hours)

- The teacher will review the poster session presentation requirements with students.
- Students will give oral presentations and provide feedback to other teams in a poster style presentation.

Comments:

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<u>Semester 2 - Unit 3 - Reverse Engineering</u>				
Competencies	Standards	Suggested Pacing	Essential Vocabulary	Resources/Materials
<p>3O - Analyzes designs to identify shortcomings and opportunities for innovation.</p> <p>3P - Works in design teams to generate large numbers of ideas in short time periods.</p> <p>3Q - Uses decision matrices to help make design decisions that are based on analysis and logic.</p> <p>3R - Writes technical reports to explain project information to various audiences.</p>	<p><u>Career Technical Education:</u> *ED/LT 9.3 Understand how to organize and structure work individually and in teams for effective performance and attainment of goals. 9.4 Know multiple approaches to conflict resolution and their appropriateness for a variety of situations in the workplace. *ED/EDP C11.3 Know how to give an effective oral presentation of a portfolio. <u>Core Academic:</u> *ED/C/2.4LSSA/G11-12 (2.4) Deliver multimedia presentations: a. Combine text, images, and sound by incorporating information from a wide range of media, including films, newspapers, magazines, CD-ROMs, online information, television, videos, and electronic media-generated images. b. Select an appropriate medium for each element of the presentation.</p>	<p>Lesson 3.4 – 16 hours: Product Improvement by Design</p>	<p>Appendix</p> <p>Bias</p> <p>Brainstorming</p> <p>Criteria</p> <p>Decision Matrix</p> <p>Descriptive Abstract</p> <p>Executive Summary</p> <p>Innovation</p> <p>Invention</p> <p>Product</p> <p>Purpose</p> <p>Technical Report</p>	<p><u>Teacher Resources:</u> Refer to Suggestions/Assessments section.</p> <p><u>Student Resources:</u> Refer to Suggestions/Assessments section.</p>
<p>Suggestions/Assessments: Lesson 3.4 Section 1 (1 hour)</p> <ul style="list-style-type: none"> • The teacher will present Concepts, Key Terms, and Essential Questions to provide a lesson overview • The teacher will introduce and distribute Activity 3.4.1a Child Toy Design Brief. • The teacher will present Writing a Design Brief.ppt. • Students will take notes in their engineer’s notebook. 				

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- The teacher will introduce and distribute [Activity 3.4.1 Writing a Design Brief](#) and [Activity 3.4.1b Design Brief Template](#).
- Students will begin work on Activity 3.4.1 Writing a Design Brief.

Sections 2-3 (2 hours)

- Students will complete Activity 3.4.1 Writing a Design Brief.
- The teacher will assist the students with Activity 3.4.1 Writing a Design Brief.
- The teacher will assess student work using [Activity 3.4.1 Writing a Design Brief Answer Key](#).

Sections 4-5 (2 hours)

- The teacher will administer [Activity 3.4.1c Framing a Design Brief Quiz](#).
- Students will complete the quiz.
- The teacher will assess student work using [Activity 3.4.1c Framing a Design Brief Quiz Answer Key](#).
- The teacher will introduce and distribute [Activity 3.4.2 The Deep Dive](#).
- The teacher will show **The Deep Dive** DVD.
- Students will watch the film and complete Activity 3.4.2 The Deep Dive.

Sections 6-7 (2 hours)

- The teacher will present [The Deep Dive.ppt](#), review Activity 3.4.2 The Deep Dive, and lead the students in a discussion on the difference between invention and innovation.
- Students will take notes in their engineer's notebook.
- The teacher will introduce and distribute [Problem 3.4.3 Product Improvement](#).
- Students will begin working in teams to identify a visual, structural, or functional shortcoming in their reverse engineered products, and create design briefs to address those problems for homework.

Section 8 (1 hour)

- Students will submit their design briefs from Problem 3.4.3 Product Improvement.
- The teacher will review the design briefs with the class.
- Students will begin brainstorming ideas for each design brief as a class team.

Sections 9-13 (5 hours)

- Students will continue brainstorming ideas for each design brief as a class team.
- The teacher will facilitate the brainstorming session and collect the ideas generated.
- Students will continue working on Problem 3.4.3 Product Improvement.
- The teacher will assist the students with Problem 3.4.3 Product Improvement.

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Section 14 (1 hour)

- The teacher will present [Technical Report Elements.ppt](#).
- Students will take notes in their engineer's notebook.
- Students will continue working on Problem 3.4.3 Product Improvement.

Sections 15-16 (2 hours)

- Students will complete Problem 3.4.3 Product Improvement and submit their technical reports to the teacher
- The teacher will assist the students with Problem 3.4.3 Product Improvement.

Comments:

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<u>Semester 2 - Unit 4 - Design Problems (33 hours)</u>				
Competencies	Standards	Suggested Pacing	Essential Vocabulary	Resources/Materials
<p>4A - Understands the material of a product, how the material is prepared for use, its durability, and ease of recycling all impact a product's design, marketability, and life expectancy.</p> <p>4B - Understands all products made, regardless of material type, may have both positive and negative impacts.</p> <p>4C - Understands in addition to economics and resources, manufacturers must consider human and global impacts of various manufacturing process options.</p> <p>4D - Is aware of laws and guidelines to protect humans and the global environment.</p> <p>4E - Investigates the recyclable uses of materials which play a vital role in the future of landfills and the environment.</p>	<p><u>Career Technical Education:</u> *ED/ELR 8.2 Understand the concept and application of ethical and legal behavior consistent with workplace standards. 8.3 Understand the role of personal integrity and ethical behavior in the workplace.</p> <p><u>Core Academic:</u> *ED/C/2.2W/WSA/G11-12 (1.6) Develop presentations by using clear research questions and creative and critical research strategies (e.g., field studies, oral histories, interviews, experiments, electronic sources).</p>	<p>Lesson 4.1 – 8 hours: Engineering Design Ethics</p>	<p>Attorney General</p> <p>By-product</p> <p>Carcinogen</p> <p>Ecosystem</p> <p>EPA</p> <p>Ergonomics</p> <p>Ethical</p> <p>Ethics</p> <p>Hazard</p> <p>Impact</p> <p>Landfill</p> <p>OSHA</p> <p>Product lifecycle</p> <p>Raw Material</p> <p>Recycle</p> <p>Refurbish</p> <p>Refuse</p> <p>Residue</p> <p>Trade-off</p> <p>Waste</p>	<p><u>Teacher Resources:</u> Refer to Suggestions/ Assessments section.</p> <p><u>Student Resources:</u> Refer to Suggestions/ Assessments section.</p>
<p>Suggestions/Assessments: Lesson 4.1 Section 1 (1 hour)</p> <ul style="list-style-type: none"> • The teacher will present Concepts, Key Terms, and Essential Questions, and provide a lesson overview. • The teacher will present Global, Human, and Ethical Impacts.ppt and begin a dialogue with students on how products can provide positive and negative impacts. • The teacher will explain the expectations of Activity 4.1.1 Product Lifecycle. • Students will brainstorm possible products to be used. 				

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- Students will divide into groups of two, pick an instructor approved product for Activity 4.1.1 Product Lifecycle and Recycling and begin work.

Section 2 (1 hour)

- Students will continue work on Activity 4.1.1 Product Lifecycle and Recycling and report findings as described in the activity.

Section 3 (1 hour)

- Students will complete Activity 4.1.1 and present to the class.
- The teacher will assess Activity 4.1.1 using the [Product Lifecycle Rubric](#).

Sections 4 – 8 (5 hours)

- The teacher will introduce and distribute [Problem 4.1.2 Engineering Design Ethics Design Brief](#), [Problem 4.1.2a Sample Engineering Design Ethics Design Brief](#) and [Problem 4.1.2b Engineering Ethics Design Brief Template](#).
- Students will complete Problem 4.1.2 Engineering Design Ethics Design Brief.
- **Optional:** The teacher may have the students create their design briefs first and then have them exchange their design briefs with students in the class. The students would follow the design briefs in order to do the research and create the report either as a CD cover, book cover, or poster.
- The teacher will assess student work through the completion of the problem as well as students' responses to the Conclusion questions of the problem.
- The teacher will lead students in a class discussion of their findings from their research.
- **Optional:** The teacher will have students present their findings or the CD cover, book cover, or posters and may them displayed around the school.

Comments:

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Semester 2 - Unit 4 - Design Problems				
Competencies	Standards	Suggested Pacing	Essential Vocabulary	Resources/Materials
<p>4F - Understands the positive impact of group work versus individual work.</p> <p>4G - Establishes group norms through brainstorming and consensus to regulate proper and acceptable behavior by and between team members.</p> <p>4H - Develops cant charts to plan, manage, and control a design team’s actions on projects that have definite beginning and end dates.</p> <p>4I - Understands virtual teams rely on communications other than face-to-face contact to work effectively to solve problems.</p> <p>4J - Understands each team member’s strengths are a support mechanism for the other team members’ weaknesses.</p> <p>4K - Understands conflict between team members is a normal occurrence, and can be addressed using formal conflict resolution strategies.</p>	<p>Career Technical Education: *ED/LT</p> <p>9.1 Understand the characteristics and benefits of teamwork, leadership, and citizenship in the school, community, and workplace settings.</p> <p>9.3 Understand how to organize and structure work individually and in teams for effective performance and attainment of goals.</p> <p>9.4 Know multiple approaches to conflict resolution and their appropriateness for a variety of situations in the workplace.</p> <p>9.5 Understand how to interact with others in ways that demonstrate respect for individual and cultural differences and for the attitudes and feelings of others.</p> <p>9.6 Understand how to organize, conduct, lead, and participate in student-centered activities and events through student-based organizations.</p>	<p>Lesson 4.2 – 25 hours: Design Teams</p>	<p>Arbitration</p> <p>Consensus</p> <p>Critique</p> <p>Evaluate</p> <p>Gantt Chart</p> <p>Mediation</p> <p>Negotiation</p> <p>Norms</p> <p>Open-Ended</p> <p>Protocol</p> <p>Storming</p> <p>Synergy</p> <p>Virtual Team</p>	<p>Teacher Resources: Refer to Suggestions/ Assessments section.</p> <p>Student Resources: Refer to Suggestions/ Assessments section.</p>
<p>Suggestions/Assessments: Lesson 4.2 Section 1 (1 hour)</p> <ul style="list-style-type: none"> • The teacher will present Concepts, Key Terms, and Essential Questions, and provide a lesson overview. • The teacher will introduce and distribute Project 4.2.1 Virtual Design Challenge, Design Project Tally Sheet, Engineer’s Notebook Evaluation, Periodic Self-Evaluation, Periodic Teammate 10-Point Evaluation, and Summary Presentation Evaluation. • Students will review the design briefs contained in Project 4.2.1 Virtual Design Challenge and identify two challenges that they 				

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would be willing to pursue as a final design project.

- The teacher will collaborate with his/her IED colleague to pair students up into virtual teams based on their interests.

Section 2 (1 hour)

- The teacher will present [Teamwork.ppt](#) and relate the information to class experiences that have occurred since the beginning of the course.
- Students will take notes in their engineer's notebook.
- The teacher will introduce and distribute [Activity 4.2.2 Team Norms](#), assign students to their virtual teams, and identify their design challenges.
- Students will introduce themselves to their virtual teammates, and begin work on Activity 4.2.2 Team Norms.

Sections 3-5 (3 hours)

- Students will work to complete Activity 4.2.2 Team Norms.
- The teacher will work with the students and collaborate with his/her IED colleague to formalize each team's Gantt chart and list of group norms.
- Students will fill out and submit their first [Periodic Self-Evaluation](#) and [Periodic Teammate 10-Point Evaluation](#).

Sections 6-18 (13 hours)

- Students will work in their virtual teams on Project 4.2.1 Virtual Design Challenge.
- The teacher will assist the students with their design projects.
- Students will fill out a [Periodic Teammate 10-Point Evaluation](#) and [Periodic Self-Evaluation](#) every three class periods and submit them to the instructor for assessment.
- The teacher will collaborate with his/her IED colleague to coordinate the exchange of evaluation materials and other related project correspondence.

Sections 19-20 (2 hours)

- Students will work on their final summary PowerPoint presentations.
- The teacher will assist the students with their presentations.

Section 21 (1 hour)

- Students will submit all of their associated project drawings and engineer's notebooks for evaluation.
- Students will begin delivering five-minute summary presentations that chronicle their design experiences, and explain their solutions to the class.
- The teacher will evaluate the students' presentations using the [Summary Presentation Evaluation](#).
- Students will evaluate each others' presentations using the Summary Presentation Evaluation.

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Sections 22-24 (3 hours)

- Students will continue delivering five-minute summary presentations that chronicle their design experiences, and explain their solutions to the class.
- The teacher will evaluate the students' presentations using the Summary Presentation Evaluation.
- Students will evaluate each others' presentations using the Summary Presentation Evaluation.

Section 25 (1 hour)

- Students will evaluate the visual, structural, and functional qualities of each team's solution, and submit their assessments to the instructor.
- Students will fill out a [Teammate Performance Summary](#) and submit it to the instructor.
- The teacher will evaluate all documents and collaborate with his/her IED colleague to share evaluation materials.

Comments: