Black Horse Pike Regional School District
580 Erial Road, Blackwood, NJ 08012

# Computer Aided Design II

## COURSE OF STUDY

Technology Department

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**Ken Whalen**

Date:
June 2015

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Glenn Smith

Approved by:
Dr. Brian Repici, Director of Curriculum & Instruction

# SYLLABUS
# CAD II

## Course Content

1. **CAD and Drafting** - Refine freehand sketching techniques. Interpret and apply orthographic orientation. Apply measuring skills. (*Activities* – orthographic and isometric sketching, paper/model space, 2D CAD drawings, creating a Logo; *Programs* - AutoCAD)

2. **Solid Modeling** - Introduce regions, surfaces and extrusions from 2d geometry, create drawings from orthographic projections, measurement of tangible objects. (*Activities* – solid model CAD drawings, intro to Rapid Prototyping, reading dial caliper to interpret measurements; Programs – AutoCAD, Inventor Professional)

3. **Dimensioning, Geometric Dimensioning, and Tolerance** – specify the shape, orientation, size, and critical features of the object of the drawing by properly dimensioning. (*Activities* – symbol identification, reverse engineering, feature identification; *Programs* – AutoCAD, Inventor Professional)

4. **Section & Auxiliary Views** – Create section views that look inside an object, Drawing Auxiliary views that show true shape of features when the surface is not parallel to any of the normal planes of projection (*Activities* - Sectional Views, Cutting Planes, Crosshatching, Full & Half Sectional View Orthographic Projections, Offset & Broken-Out Sectional Views Orthographic, Revolved & Removed Sectional Views Orthographic Projections, Auxiliary Section View Orthographic Projections; *Programs* – AutoCAD, Inventor Professional)

5. **Assemblies & Working Drawings –** Design working drawings that describe the features of an objects, Develop assembly drawings for products that have more than one part(Activities - Working Drawing, Exploded Assembly Drawing, and Detail Drawing of specified objects; *Programs* – AutoCAD, Inventor Professional)

6. **Application of 2D Drawings, Solid Modeling & 3-D Prototyping –** Use of 2D and 3D drafting skills to make tangible projects (Activities – vinyl cutter, laser engraver, plotter, 3D Printer; *Programs* – AutoCAD, Inventor Professional, Adobe Illustrator, Corel Draw)

**Course Expectations and Skills**

1. Keep and maintain an electronic portfolio.
2. Practice proper attitude and safe discipline.
3. Develop an industry standard of precision and quality in each activity.
4. Participate and contribute to group generated solutions.
5. Apply and analyze science and math related concepts to all activities.
6. Prepare for success in higher level technology courses and post-secondary education.

**Resources:** Mechanical Drawing CAD-Communications 12th Edition
French, Svensen, Helsel, Urbanick, 1997

**Grading Scale:**

| | |
|---|---|
| Unit Activity/Projects | 50 percent |
| Written Work/Electronic Portfolio | 25 percent |
| Class Participation | 25 percent |
| | 100 percent |

# Black Horse Pike Regional School District Curriculum Template

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

## PART I: UNIT RATIONALE

### WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

<table>
<tr>
<td>Course/Unit Title:<br><br>CAD II<br><br>Unit 1 Review of CAD & Drafting</td>
<td rowspan="2">Unit Summary:<br><br>CAD is used for detailed engineering of 2D drawings and 3D models of physical components. It is used throughout the engineering process from conceptual design through completion of a product. The use of CAD has lowered product development costs and has greatly shortened the design cycle. The skills learned are in high demand in today’s technical world.</td>
</tr>
<tr>
<td>Grade Level(s):<br>11-12</td>
</tr>
<tr>
<td>Essential Question(s):<br><br>• Why Study CAD?<br><br>• What are the requirements of this class?<br><br>• What is expected of me in this class?<br><br>• How will I be assessed for my work in this class?<br><br>• How will I complete projects for this class?</td>
<td>Enduring Understanding(s):<br><br>• CAD is used for detailed engineering of 2D drawings and 3D models of physical components<br>• Identify and use various drafting tools, aids, and equipment and their uses in graphic communication.<br>• Demonstrate the ability to compose single stroke gothic lettering both freehand and with mechanical lettering devices.<br>• Develop problem-solving skills in the use of equipment and in graphical representation and layout.<br>• Develop the ability to measure using the English and metric measurement system.<br>• Develop the ability to visualize and solve space problems graphically.<br>• Demonstrate an understanding of principles of sketching, geometric construction, orthographic projection, dimensioning, sectioning, pictorials, detail and assembly drawings, and conventional practice followed in graphical communication.<br>• Develop accurate and expedient manipulative skills for producing engineering drawings using pencils, an inking system, and a CAD system.<br>• Demonstrate a basic working understanding of a computer-aided drafting system.</td>
</tr>
</table>

## PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

**DESCRIBE THE LEARNING TARGETS.**

**After each target, identify the NJCCCS or Common Core Standards that are applicable**

| **Learning Target** | **NJCCCS or CCS** |
|---|---|
| **1.** Recognize the importance of safety in the classroom<br>**2.** Identify and use various drafting tools, aids, and equipment and their uses in graphic communication.<br>**3.** Demonstrate the ability to compose single stroke gothic lettering both freehand and with mechanical lettering devices.<br>**4.** Develop problem-solving skills in the use of equipment and in graphical representation and layout.<br>**5.** Develop the ability to measure using the English and metric measurement system.<br>**6.** Identify careers and opportunities in drafting due to technological advancement.<br>**7.** The student will learn the basic commands of computer aided drafting (CAD) which are:<br>a. Line, Arc and Circle<br>b. Trim, Extend and Erase<br>c. A system of layering to establish line color, weight and types<br>d. A system of basic dimensions and notes<br>e. Set up of a new drawing using a template<br>f. Use of Cut, Copy and Paste<br>g. Basic plotting to a paper copy | • **9.3.12.ED.4**<br>• **9.3.ST.3**<br>• **8.1.12.f.1**<br>• **8.1.12.f.2**<br>• **9.3.ST-ET.1**<br>• **9.3.ST-ET.3**<br>• **9.3.ST-ET.5**<br>• **9.3.ST-SM.4**<br>• **8.2.2.C.1-6**<br>• **8.2.5.C.1-7**<br>• **8.2.8.C.1-8**<br>• **8.2.2.D**<br>• **8.2.8.D.3**<br>• **8.2.12.D.3**<br>• **8.2.12.D.1** |

**Inter-Disciplinary Connections:**

- **STEM, Mathematics, Geometry, Engineering**

**Students will engage with the following textbook**

**Mechanical Drawing CAD Communications 12th Edition**

**Students will write:**

**Use of Cornell Notes will be used to understand the procedures for completing drawings.**

## PART III: TRANSFER OF KNOWLEDGE AND SKILLS

**DESCRIBE THE LEARNING EXPERIENCE.**

**How will students uncover content and build skills.**

Project based and self-exploration

Real life engineering problems

Examples of solution will be given first then students will problem solve and explore to create their own solutions to the problems.

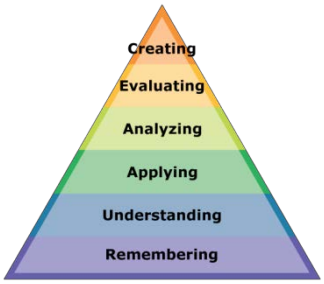
1. Students will be completing sketches of models before they complete them on the computer.
2. Students will use 3D models to create advanced orthographic projections
3. Students will use two views to create a third view.
4. Students will use real objects and take measurements to create a solid model.

Students will need to have access to Autodesk AutoCAD and Inventor. Drawing will come from the text and other engineering drawings produced by the teacher.

## PART IV: EVIDENCE OF LEARNING

**IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.**

**IDENTIFY BLOOM'S LEVELS.**




**Formative Assessments:**

**WARM UP ACTIVITIES**

**Students will read the timeline, direction and constraint page for the current design journal page.**
**Students will check the daily entry log to ensure see where they left off and ensure it is up to date**
**Students will get safety glasses on and get their plans and materials ready.**

**CHECKPOINTS OF UNDERSTANDING**

**The design journals with be checked and graded after every component.**

**Accommodations/Modifications:**

**Students have guided packets with questions that outline the research, and brainstorming.**
**The students will have an adjusted writing and mathematics packet to suit particular needs.**
**Students will receive extra one on one instruction to ensure safety and understanding.**

**Alternative assignments, additional time for assignments, preferential seating arrangements one on one interaction, after school help, and assistance for organization. Check frequently for student understanding.**

**Summative Assessments:**

**Final evaluation of the project based on a rubric.**
**Final grade of design journal as it is re-graded in its entirety**
**Reflection paper about the entire project**

**Accommodations/Modifications:**

**Alternative assignments, additional time for assignments, preferential seating arrangements one on one interaction, after school help, and assistance for organization. Check frequently for student understanding.**
**Allow students to get their work checked frequently as the assessments are build-ups.**

**Performance Assessments:**

**Construction of a solution to the challenge**
**Safely utilizing computer, shop tools, and machines**

**Accommodations/Modifications:**

**Alternative assignments, additional time for assignments, preferential seating arrangements one on one interaction, after school help, and assistance for organization. Check frequently for student understanding.**
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# Black Horse Pike Regional School District Curriculum Template

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

## PART I: UNIT RATIONALE

### WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

<table>
<tr><td>Course/Unit Title:<br><br>CAD II<br><br>Unit 2 Solid Modeling</td><td rowspan="2">Unit Summary:<br><br>Three-dimensional solid modeling has become an important aspect of modern product design. It has streamlined the design process and complex assemblies can be created. Workflow is improved by automatically updating drawing and assembly files.</td></tr>
<tr><td>Grade Level(s):<br>11-12</td></tr>
<tr><td>Essential Question(s):<br><br>• Why do we create solid models?<br>• How do I setup a solid modeling profile?<br>• How do I manage layers?<br>• How can I use the views of an orthographic projection to create a 3D Model?<br>• What are parametric constraints?<br>• How do I sketch 2d geometry to create solid models?<br>• How do I use geometry to calculate and dimension objects?<br>• What are work planes and why are they important?<br>• How do you use the advanced 3D modeling tools?<br>• What are some of the basic Modify tools?</td><td>Enduring Understanding(s):<br><br>• Determine and explain the use of 3D modeling in engineering world.<br>• Determine when to use 2D and 3D modeling.<br>• Understand why it is important to create detailed models.<br>• Understand the difference between part files, assembly files, and drawing files.<br>• Value the importance of an organizing projects and creating a clean workspace to make solid modeling run smoother and easier.<br>• Explain when to use different layers and annotative styles for different types of projects.<br>• Interpret the dimensions of an orthographic projection and apply problem solving skills to determine the missing dimensions.<br>• Comprehend the use of parametric constraints and summarize the different situations where they are used.<br>• Explain the difference between sketch mode and modeling mode.<br>• Predict what an object will look like by using geometry calculations.<br>• Outline the importance of work planes when creating advanced 3D models.<br>• Explain and determine when to use the different advanced modeling techniques including sweep, extrude, revolve and loft.<br>• Summarize the different types of modify tools when finalizing a part file including fillet, shell, split, and join.</td></tr>
</table>

## PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

**DESCRIBE THE LEARNING TARGETS.**

**After each target, identify the NJCCCS or Common Core Standards that are applicable**

| **Learning Target** | **NJCCCS or CCS** |
|---|---|
| 1. Recognize the importance of solid modeling<br>2. List the advantages and disadvantages are of 3D modeling compared to 2D modeling.<br>3. Identify when 3D models need to be drawn.<br>4. Organize the layers of a drawing file and arrange the workspace to suit the need of the drawing format.<br>5. Be able to take two views of an orthographic projection and create a solid model from these views.<br>6. Construct parts using parametric constraints including, parallel, horizontal, perpendicular, vertical, tangent, coincident, and equal constrains and troubleshoot over-constrained sketches.<br>7. Create a sketch of an object in the sketch mode and be able to finish the sketch that includes a closed entity to be able to extrude the object making it 3D.<br>8. Use math to determine missing lengths and angles of an object.<br>9. Create work planes where sketches can be drawn on to increase the complexity of a part.<br>10. Demonstrate the ability to use the advanced modeling techniques by extruding, sweeping, lofting, and/or revolving a part.<br>11. The student will learn the basic commands of solid modeling which are Regions, Extrude, Union, Subtract, Press-Pull, Model space vs paper space, Viewports, Scaling, and Plotting<br>12. Apply the finishing modify tools by creating fillets, shelling, splitting, and or joining an object | ***1.TEC.9-12.8.2.12 B.4***<br>***TEC.9-12.8.2.12 B.6***<br>***TEC.9-12.8.2.12.B.3***<br>***MA.9-12.4.2.12 A.1***<br>***SCI.9-12.5.4.12 A.1***<br><br>**2.** ***TEC.9-12.8.2.12 B.1***<br>***TEC.9-12.8.1.12.F.2***<br>***LA.9-12.3.1.12.A.1***<br><br>**3.** ***TEC.9-12.8.1.12 B.9***<br>***TEC.9-12.8.1.12.A.4***<br><br>*4.* ***TEC.9-12.8.1.12 B.3***<br>***TEC.9-12.8.1.12 B.4***<br><br>*5.* ***TEC.9-12.8.2.12 B.3***<br>***TEC.9-12.8.2.12 B.1***<br>***MA.9-12.4.2.12 A.2***<br><br>***6. TEC.9-12.8.1.12 B.10***<br>***TEC.9-12.8.1.12 B.11***<br><br>*7.* ***TEC.9-12.8.2.12 B.4***<br><br>***8. TEC.9-12.8.2.12 B.6***<br>***MA.9-12.4.2.12 A.2***<br>***MA.9-12.4.2.12 A.1***<br><br>***9. TEC.9-12.8.1.12 B.11***<br>***TEC.9-12.8.2.12.F.3***<br><br>*10.* ***TEC.9-12.8.2.12 B.4***<br>***MA.9-12.4.2.12 A.1***<br><br>***11. TEC.9-12.8.2.12 B.4***<br>***TEC.9-12.8.2.12.F.3***<br><br>***12. TEC.9-12.8.2.12 B.3***<br>***TEC.9-12.8.2.12.F.3***<br>***MA.9-12.4.2.12 A.1*** |

**Inter-Disciplinary Connections:**

- **STEM, Mathematics, Geometry, Engineering**

**Students will engage with the following textbook**

**Mechanical Drawing CAD Communications 12th Edition**

**Students will write:**

**Us e of Cornell Notes will be used to understand the procedures for completing drawings.**

## PART III: TRANSFER OF KNOWLEDGE AND SKILLS

**DESCRIBE THE LEARNING EXPERIENCE.**

**How will students uncover content and build skills.**

- Project based and self-exploration
- Real life engineering problems
- Examples of solution will be given first then students will problem solve and explore to create their own solutions to the problems.

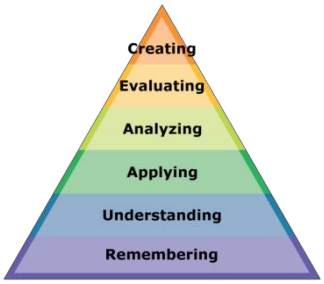
1. Students will be completing sketches of models before they complete them on the computer.
2. Students will use 3D models to create the same model
3. Students will use all three views of an orthographic projection to create a 3D solid model.
4. Students will use two views to create a solid model.
5. Students will use the revolve tool to create round objects
6. Students will use the sweep tool to create a profile that will be extruded and a path that with will follow to create parts.
7. Students will use the loft tool to create complex parts that include tapers.
8. Students will use real objects and take measurements to create a solid model.

Students will need to have access to Autodesk AutoCAD and Inventor. Drawing will come from the text and other engineering drawings produced by the teacher.

## PART IV: EVIDENCE OF LEARNING

**IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.**

**IDENTIFY BLOOM'S LEVELS.**




**Formative Assessments:**

**WARM UP ACTIVITIES**

**Students will read the timeline, direction and constraint page for the current design journal page.**
**Students will check the daily entry log to ensure see where they left off and ensure it is up to date**
**Students will get safety glasses on and get their plans and materials ready.**

**CHECKPOINTS OF UNDERSTANDING**

**The design journals with be checked and graded after every component.**

**Observation of student progress and skill development, checkpoints of understanding at:**

1. Set-up of program, layers, and workspace
2. Sketching of models
3. Parts created coping another model
4. Models created by looking at the three views of an orthographic projection
5. Create using two views
6. Revolving
7. Sweeping
8. Lofting
9. Measure and create part from looking at a real object.

**Do-now's and checkpoint quizzes will be given during and at the conclusion of these topics**

**Accommodations/Modifications:**

**Students have guided packets with questions that outline the research, and brainstorming.**
**The students will have an adjusted writing and mathematics packet to suit particular needs.**
**Students will receive extra one on one instruction to ensure safety and understanding.**
**Alternative assignments, additional time for assignments, preferential seating arrangements one on one interaction, after school help, and assistance for organization. Check frequently for student understanding.**

**Summative Assessments:**

**Final evaluation of the project based on a rubric.**
**Final grade of design journal as it is re-graded in its entirety**
**Reflection paper about the entire project**

**Accommodations/Modifications:**

**Alternative assignments, additional time for assignments, preferential seating arrangements one on one interaction, after school help, and assistance for organization. Check frequently for student understanding.**
**Allow students to get their work checked frequently as the assessments are build-ups.**

**Performance Assessments:**

**Construction of a solution to the challenge**
**Safely utilizing computer, shop tools, and machines**

**Accommodations/Modifications:**

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# Black Horse Pike Regional School District Curriculum Template

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## PART I: UNIT RATIONALE

### WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

<table>
<tr>
<td>Course/Unit Title:<br><br>CAD II<br><br>Unit 3:<br>Dimensioning, Geometric Dimensioning, and Tolerance</td>
<td rowspan="2">Unit Summary:<br><br>An effective design plan needs to have information properly conveyed from the sender to the recipient. Annoations are nesscary to transfer the information clearly and accurately. Without effective dimensioning and annotation important details will be lost.</td>
</tr>
<tr>
<td>Grade Level(s):<br>11-12</td>
</tr>
<tr>
<td>Essential Question(s):<ul><li>How and why do we create annotations in a drawing?</li><li>How do I modify text styles?</li><li>How is text scaled in AutoCAD and Inventor?</li><li>What are the proper dimension techniques?</li><li>How do I correctly dimension a drawing?</li><li>What is the formula to calculate scale?</li><li>What is the difference between model and paper space?</li><li>Why and symbols used and what do they mean?</li><li>What are some different measuring devices?</li><li>What is Geometric dimensioning and tolerancing?</li><li>When and why is Geometric dimensioning and tolerancing used?</li></ul></td>
<td>Enduring Understanding(s):<ul><li>Create, manage and alter the display of annotation in a drawing</li><li>Create text, create and modify text styles</li><li>Demonstrate knowledge of scaling text.</li><li>Identify the accepted standards for mechanical dimensioning practices</li><li>Explain the procedures for dimensioning mechanical drawings</li><li>Construct dimensions on an engineering drawing..</li><li>Discover mathematical calculations relating to scale of drawings created.</li><li>Understand relationship of scale and model/paper space;</li><li>Identify Symbols and annotation signs</li><li>Explain the terms and different measurement devices</li><li>Choosing the correct system for geometric dimensioning and tolerancing</li><li>Understand the purpose of geometric dimensioning and tolerancing</li></ul></td>
</tr>
</table>

## PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

**DESCRIBE THE LEARNING TARGETS.**

**After each target, identify the NJCCCS or Common Core Standards that are applicable**

| **Learning Target** | **NJCCCS or CCS** |
|---|---|
| 1. Become familiar with creating, managing and altering the display of annotation in a drawing | *TECH.8.2.12.D.3*<br>*TECH.8.2.12.D.2*<br>*TEC.9-12.8.2.12.B.3*<br>*MA.9-12.4.2.12 A.1*<br>*SCI.9-12.5.4.12 A.1* |
| 2. Use basic knowledge and techniques to create text, create and modify text styles. | *TEC.9-12.8.2.12 B.1*<br>*TEC.9-12.8.1.12.F.2*<br>*LA.9-12.3.1.12.A.1* |
| 3. Create text using of the correct scale. | *TEC.9-12.8.1.12 B.9*<br>*TEC.9-12.8.1.12.A.4* |
| 4. Choose the accepted standards for mechanical dimensioning practices to dimension a drawing | *TECH.8.2.12.D.CS2*<br>*TECH.8.2.12.D* |
| 5. Show the correct procedures for dimensioning mechanical drawings | *TEC.9-12.8.2.12 B.3*<br>*MA.9-12.4.2.12 A.2* |
| 6. Calculate the dimensions on an engineering drawing. | *TEC.9-12.8.1.12 B.10*<br>*TEC.9-12.8.1.12 B.11* |
| 7. Using mathematical calculations scale drawings to the correct size. | *TEC.9-12.8.2.12 B.4* |
| 8. Use the relationship of scale and model/paper space to print a drawing on a layout. | *TEC.9-12.8.2.12 B.6*<br>*MA.9-12.4.2.12 A.2*<br>*MA.9-12.4.2.12 A.1* |
| 9. Compare and use the accurate symbols and annotation signs in a drawing | *TEC.9-12.8.1.12 B.11*<br>*TEC.9-12.8.2.12 B.4*<br>*MA.9-12.4.2.12 A.1* |
| 10. Use different measurement devices to measure an physical | *TEC.9-12.8.2.12 B.4*<br>*TEC.9-12.8.2.12.F.3* |
| 11. Select the correct system for geometric dimensioning and tolerancing | *TEC.9-12.8.2.12 B.3*<br>*MA.9-12.4.2.12 A.1* |
| 12. Use geometric dimensioning and tolerancing to interpret a drawing. | |

**Inter-Disciplinary Connections:**

- **STEM, Mathematics, Geometry, Engineering**

**Students will engage with the following textbook**

- **Mechanical Drawing CAD Communications 12th Edition**
- **TECHNOLOGY EDUCATION: LEARNING BY DESIGN Pearson**
  **Prentice Hall**
  **ISBN 0133639894**

- **Periodicals to include but not limited to newspapers, magazine articles, internet web pages**

**Students will write:**

**Us e of Cornell Notes will be used to understand the procedures for completing drawings.**

## PART III: TRANSFER OF KNOWLEDGE AND SKILLS

**DESCRIBE THE LEARNING EXPERIENCE.**

**How will students uncover content and build skills.**

Project based and self-exploration
Real life engineering problems
Examples of solution will be given first then students will problem solve and explore to create their own solutions to the problems.

Students will need to have access to Autodesk AutoCAD, Inventor, and Corel Draw.

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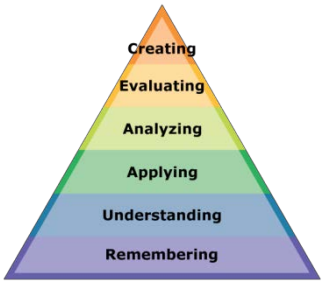


**Formative Assessments:**

**WARM UP ACTIVITIES**

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## PART I: UNIT RATIONALE

### WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

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<tr>
<td>Course/Unit Title:<br><br>CAD II<br><br>Unit 4:<br>Section & Auxiliary Views</td>
<td rowspan="2">Unit Summary:<br><br>When orthographic projections are not enough to convey detailed information a section view and/or an auxiliary needs to be created. Section views are used to clarify the interior construction of an object that cannot be clearly described by hidden lines in exterior views. Auxiliary views are used to show the true shape of features that are not parallel to any of the principal planes of projection.</td>
</tr>
<tr>
<td>Grade Level(s):<br>11-12</td>
</tr>
<tr>
<td>Essential Question(s):<ul><li>What is a section view?</li><li>When is a section view used?</li><li>How is a section view drawn?</li><li>What are the correct lines and hatches used for section views?</li><li>How do you set up the layers for a section view drawing?</li><li>What are the different types of section views?</li><li>How can a section view aid in the understanding of engineering plans?</li><li>When is an auxiliary needed?</li><li>What are the different types of engineering drawings and when should they be used to describe an object.</li><li>How are section and auxiliary views created in CAD software?</li></ul></td>
<td colspan="2">Enduring Understanding(s):<ul><li>Understand the concept of a section view.</li><li>Determine when a section view is necessary in an engineering plan</li><li>Comprehend how to draw a section view.</li><li>Determine the proper lines to use in a section view.</li><li>Explain the use of layers and line types when drawing section views</li><li>Describe the different types of section views</li><li>Describe the interworkings of an object with a section view.</li><li>Explain what an auxiliary view is.</li><li>Determine when to use an auxiliary view.</li><li>Summarize the differences in engineering drawings</li><li>Develop section and auxiliary views in CAD software</li></ul></td>
</tr>
</table>

## PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

**DESCRIBE THE LEARNING TARGETS.**

**After each target, identify the NJCCCS or Common Core Standards that are applicable**

| **Learning Target** | **NJCCCS or CCS** |
|---|---|
| 1. Explain the reasons why section views are used.<br>2. Looking at different objects, choose ones that need and do not need section views.<br>3. Create a section view of a given object.<br>4. Create profiles in ACAD that include the correct line types and hatches<br>5. Demonstrate the ability to identify and create the different types of section views.<br>6. Using a section view, describe the details of the object in the given plan.<br>7. Explain what an auxiliary is and when they are needed to increase the detail of an engineering drawing.<br>8. Create engineering drawings with standard, auxiliary and pictorial views<br>9. Use basic knowledge and techniques learned in unit 1 to create more advanced solid models and engineering drawings in CAD software. | • **9.3.12.ED.4**<br>• **9.3.ST.3**<br>• **8.1.12.f.1**<br>• **8.1.12.f.2**<br>• **9.3.ST-ET.1**<br>• **9.3.ST-ET.3**<br>• **9.3.ST-ET.5**<br>• **9.3.ST-SM.4**<br>• **8.2.2.C.1-6**<br>• **8.2.5.C.1-7**<br>• **8.2.8.C.1-8**<br>• **8.2.2.D**<br>• **8.2.8.D.3**<br>• **8.2.12.D.3**<br>• **8.2.12.D.1** |

**Inter-Disciplinary Connections:**

- **STEM, Mathematics, Geometry, Engineering**

**Students will engage with the following textbook**

- **Mechanical Drawing CAD Communications 12th Edition**
- **TECHNOLOGY EDUCATION: LEARNING BY DESIGN Pearson**
  **Prentice Hall**
  **ISBN 0133639894**

- **Periodicals to include but not limited to newspapers, magazine articles, internet web pages**

**Students will write:**

**Us e of Cornell Notes will be used to understand the procedures for completing drawings.**

## PART III: TRANSFER OF KNOWLEDGE AND SKILLS

**DESCRIBE THE LEARNING EXPERIENCE.**

**How will students uncover content and build skills.**

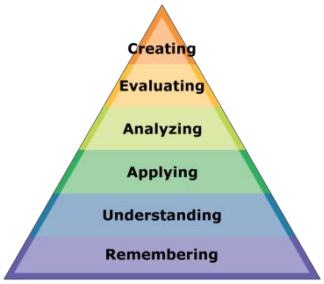
Project based and self-exploration
Real life engineering problems
Examples of solution will be given first then students will problem solve and explore to create their own solutions to the problems.

Students will need to have access to Autodesk AutoCAD, Inventor, and Corel Draw.

## PART IV: EVIDENCE OF LEARNING

**IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.**

**IDENTIFY BLOOM'S LEVELS.**




**<u>Formative Assessments</u>:**

**WARM UP ACTIVITIES**

**Students will read the timeline, direction and constraint page for the current design journal page.**
**Students will check the daily entry log to ensure see where they left off and ensure it is up to date**
**Students will get safety glasses on and get their plans and materials ready.**

**CHECKPOINTS OF UNDERSTANDING**

**The design journals with be checked and graded after every component.**

**Observation of student progress and skill development, checkpoints of understanding at:**

**Do-now's and checkpoint quizzes will be given during and at the conclusion of these topics**

**<u>Accommodations/Modifications</u>:**

**Students have guided packets with questions that outline the research, and brainstorming.**
**The students will have an adjusted writing and mathematics packet to suit particular needs.**
**Students will receive extra one on one instruction to ensure safety and understanding.**
**Alternative assignments, additional time for assignments, preferential seating arrangements one on one interaction, after school help, and assistance for organization. Check frequently for student understanding.**

**Summative Assessments:**

**Final evaluation of the project based on a rubric.**
**Final grade of design journal as it is re-graded in its entirety**
**Reflection paper about the entire project**

**Accommodations/Modifications:**

**Alternative assignments, additional time for assignments, preferential seating arrangements one on one interaction, after school help, and assistance for organization. Check frequently for student understanding.**
**Allow students to get their work checked frequently as the assessments are build-ups.**

**Performance Assessments:**

**Construction of a solution to the challenge**
**Safely utilizing computer, shop tools, and machines**

**Accommodations/Modifications:**

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**Allow students to get their work checked frequently as the assessments are build-ups.**

# Black Horse Pike Regional School District Curriculum Template

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

## PART I: UNIT RATIONALE

### WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

<table>
<tr>
<td>Course/Unit Title:<br><br>CAD II<br><br>Unit 5:<br>Assemblies & Working Drawings</td>
<td rowspan="2">Unit Summary:<br><br>After all parts are created, an assembly drawing is used to show how a product is put together as well as fit and function of components. These are combined with detail views and compiled in a set of working drawings. All details needed to convey the size, shape, and operation of an object are included in the final working drawings.</td>
</tr>
<tr>
<td>Grade Level(s):<br>11-12</td>
</tr>
<tr>
<td>Essential Question(s):<br>• What is the importance of effective communication of engineering plans through working and assembly drawings?<br>• How can every component of an assembly be accurately shown?<br>• How can I create effective working plans?<br>• What are exploded views?<br>• How can I use a working drawing in engineering problems?<br>• What is reverse engineering?</td>
<td>Enduring Understanding(s):<br>• Explain the importance of working and assembly drawing in engineering<br>• Develop plans that show all parts of an object<br>• Communicate clear plans through the use of working and assembly drawings<br>• Develop an understanding of exploded views and the process to create one.<br>• Decipher working and assembly drawings to create the specified object.<br>• Demonstrate the ability to reverse engineer an object using working and assembly drawings</td>
</tr>
</table>

## PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

**DESCRIBE THE LEARNING TARGETS.**

**After each target, identify the NJCCCS or Common Core Standards that are applicable**

| **Learning Target** | **NJCCCS or CCS** |
|---|---|
| 1. Demonstrate the ability to communicate an assembly through the use of working and assembly drawings.<br>2. Create working and assembly drawings that describe all parts of an object.<br>3. Read and create working and assembly drawings.<br>4. Use exploded views to show the different parts of an object.<br>5. Demonstrate a working ability to place view within an engineering drawing.<br>6. Use advanced view placement techniques to create engineering drawings.<br>7. Creating 3d models capable of being used in an assembly drawing.<br>8. Demonstrate a working ability to use constraints to position parts within an assembly drawing. | • **9.3.12.ED.4**<br>• **9.3.ST.3**<br>• **8.1.12.f.1**<br>• **8.1.12.f.2**<br>• **9.3.ST-ET.1**<br>• **9.3.ST-ET.3**<br>• **9.3.ST-ET.5**<br>• **9.3.ST-SM.4**<br>• **8.2.2.C.1-6**<br>• **8.2.5.C.1-7**<br>• **8.2.8.C.1-8**<br>• **8.2.2.D**<br>• **8.2.8.D.3**<br>• **8.2.12.D.3**<br>• **8.2.12.D.1** |

**Inter-Disciplinary Connections:**

- **STEM, Mathematics, Geometry, Engineering**

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**Students will write:**

**Us e of Cornell Notes will be used to understand the procedures for completing drawings.**

## PART III: TRANSFER OF KNOWLEDGE AND SKILLS

**DESCRIBE THE LEARNING EXPERIENCE.**

**How will students uncover content and build skills.**

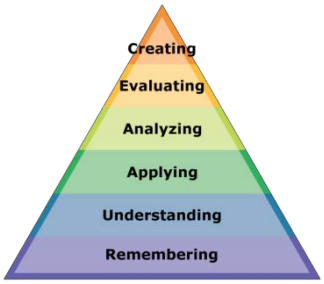
Project based and self-exploration
Real life engineering problems
Examples of solution will be given first then students will problem solve and explore to create their own solutions to the problems.

Students will need to have access to Autodesk AutoCAD, Inventor, and Corel Draw.

## PART IV: EVIDENCE OF LEARNING

**IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.**

**IDENTIFY BLOOM'S LEVELS.**




**<u>Formative Assessments</u>:**

**WARM UP ACTIVITIES**

**Students will read the timeline, direction and constraint page for the current design journal page.**
**Students will check the daily entry log to ensure see where they left off and ensure it is up to date**
**Students will get safety glasses on and get their plans and materials ready.**

**CHECKPOINTS OF UNDERSTANDING**

**The design journals with be checked and graded after every component.**

**Observation of student progress and skill development, checkpoints of understanding at:**

**Do-now's and checkpoint quizzes will be given during and at the conclusion of these topics**

**<u>Accommodations/Modifications</u>:**

**Students have guided packets with questions that outline the research, and brainstorming.**
**The students will have an adjusted writing and mathematics packet to suit particular needs.**
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**Summative Assessments:**

**Final evaluation of the project based on a rubric.**
**Final grade of design journal as it is re-graded in its entirety**
**Reflection paper about the entire project**

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**Construction of a solution to the challenge**
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# Black Horse Pike Regional School District Curriculum Template

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

## PART I: UNIT RATIONALE

### WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

<table>
<tr>
<td>Course/Unit Title:<br><br>CAD II<br><br>Unit 6:<br>Application of 2D Drawings, Solid Modeling & 3-D Prototyping</td>
<td rowspan="2">Unit Summary:<br><br>With the use of a 3D printer and CAD software, this has drastically lowered product development costs and has greatly shortened the design cycle. CAD is used throughout the engineering process from conceptual design through completion of a product. The skills learned are in high demand in today’s ever-changing technical world.</td>
</tr>
<tr>
<td>Grade Level(s):<br>11-12</td>
</tr>
<tr>
<td>Essential Question(s):<br><br>• What’s the purpose of the Cartesian coordinate system?<br>• How do I convert AutoCAD drawing to Inventor sketch and reverse?<br>• What is 3d modeling?<br>• What are the benefits of solid modeling a part or object?<br>• How to create objects with several components?<br>• Why add dimensions and constrains?<br>• How do I create an assemble drawing?<br>• Why generating an engineering drawing?<br>• How do you create orthographic views from a solid model?<br>• What is the most common view for engineering drawings?<br>• Why are constraints important in an assembly drawing?</td>
<td>Enduring Understanding(s):<br><br>• Have a fluent understanding of terminology used in solid modeling.<br>• Analyze and contrast the differences Coordinate Systems.<br>• Determine and explain the use of 3D modeling in engineering world.<br>• Examine and determine what industry would most benefit from using solid modeling techniques and rapid prototyping with a 3D printer .<br>• Examine and determine what industries would benefit from Prototyping.<br>• Understand the purpose of creating sketches and profiles?<br>• Understand the relationship between sketches, solid models and engineering drawings.<br>• Understand the organization and discipline necessary to create efficient solid models.<br>• Explain the purpose of adding parts to an assemble drawing.<br>• Compare and contrast the different types of constraints used in assembly drawings.<br>• Investigate and understand the different between dimensions and constraints.<br>• Understand the procedure for placing views into a drawing.<br>• Review and demonstrate the proper techniques necessary to create an engineering drawing.<br>• Utilize proper techniques necessary to insert dimensions into engineering drawings.</td>
</tr>
</table>

## PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

**DESCRIBE THE LEARNING TARGETS.**

**After each target, identify the NJCCCS or Common Core Standards that are applicable**

| Learning Target | NJCCCS or CCS |
|---|---|
| 1. Become familiar with using solid modeling as an engineering and product development tool. | *TEC.9-12.8.2.12 B.4*<br>*TEC.9-12.8.2.12 B.6*<br>*TEC.9-12.8.2.12.B.3*<br>*MA.9-12.4.2.12 A.1*<br>*SCI.9-12.5.4.12 A.1* |
| 2. Use basic knowledge and techniques learned in unit 2 to create more advanced solid models and engineering drawings. | *2. TEC.9-12.8.2.12 B.1*<br>*TEC.9-12.8.1.12.F.2*<br>*LA.9-12.3.1.12.A.1* |
| 3. Create sketches and solid models utilizing revolve, sweep and loft commands. | |
| 4. Use geometric formulas and techniques to create geometric shapes. | *3. TEC.9-12.8.1.12 B.9*<br>*TEC.9-12.8.1.12.A.4* |
| 5. Demonstrate the ability to modify and reengineer sketches after they are transformed into 3d models that can be 3D printed. | *4. TEC.9-12.8.1.12 B.3*<br>*TEC.9-12.8.1.12 B.4* |
| 6. Create engineering drawings with standard, auxiliary and pictorial views | *5. TEC.9-12.8.2.12 B.3*<br>*TEC.9-12.8.2.12 B.1*<br>*MA.9-12.4.2.12 A.2* |
| 7. Create profiles in ACAD and importing them into an Inventor sketch and solid model. | *6. TEC.9-12.8.1.12 B.10*<br>*TEC.9-12.8.1.12 B.11* |
| 8. Demonstrate the ability to use problem solving skills to complete drawing and modeling assignments. | *7. TEC.9-12.8.2.12 B.4* |
| 9. Complete drawing and modeling assignments using different working planes and axis. | *8. TEC.9-12.8.2.12 B.6*<br>*MA.9-12.4.2.12 A.2*<br>*MA.9-12.4.2.12 A.1* |
| 10. Demonstrate the ability to use the advanced modeling techniques by extruding, sweeping, lofting, and/or revolving a part. | *9. TEC.9-12.8.1.12 B.11*<br>*TEC.9-12.8.2.12.F.3* |
| 11. Demonstrate a working ability to place view within an engineering drawing. | *10. TEC.9-12.8.2.12 B.4*<br>*MA.9-12.4.2.12 A.1* |
| 12. Use advanced view placement techniques to create engineering drawings. | *11. TEC.9-12.8.2.12 B.4*<br>*TEC.9-12.8.2.12.F.3* |
| 13. Creating 3d models capable of being used in an assembly drawing. | *12. TEC.9-12.8.2.12 B.3*<br>*TEC.9-12.8.2.12.F.3*<br>*MA.9-12.4.2.12 A.1* |
| 14. Demonstrate a working ability to use constraints to position parts within an assembly drawing. | |
| 15. Create color and texture to assembly drawing. | |

**Inter-Disciplinary Connections:**

- **STEM, Mathematics, Geometry, Engineering**

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**Students will write:**

**Us e of Cornell Notes will be used to understand the procedures for completing drawings.**

## PART III: TRANSFER OF KNOWLEDGE AND SKILLS

**DESCRIBE THE LEARNING EXPERIENCE.**

**How will students uncover content and build skills.**

Project based and self-exploration
Real life engineering problems
Examples of solution will be given first then students will problem solve and explore to create their own solutions to the problems.

1. Students will be completing sketches of models before they complete them on the computer.
2. Students will use 3D models to create the same model
3. Students will use laser to cut and engrave
4. Students will use CNC router to carve and cut material
5. Students will use vinyl cutter to create graphic stickers
6. Students will use the design process to design and create products
7. Students will use different programs to design a product and export to the CNC machine
8. Students will use real objects and take measurements to create a solid model.

Students will need to have access to Autodesk AutoCAD, Inventor, and Corel Draw.

## PART IV: EVIDENCE OF LEARNING

**IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.**

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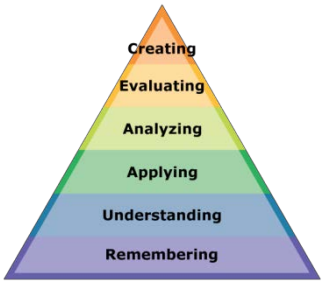


**Formative Assessments:**

**WARM UP ACTIVITIES**

**Students will read the timeline, direction and constraint page for the current design journal page.**
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**Students will get safety glasses on and get their plans and materials ready.**

**CHECKPOINTS OF UNDERSTANDING**

**The design journals with be checked and graded after every component.**

**Observation of student progress and skill development, checkpoints of understanding at:**

1. Knowledge of machines
2. Set-up CNC machines
3. Sketching of models
4. Exporting of parts
5. Models created by looking at the three views of an orthographic projection
6. Design process
7. Measure and create part from looking at a real object.
8. Editing of NC Code

**Do-now's and checkpoint quizzes will be given during and at the conclusion of these topics**

**Accommodations/Modifications:**

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