

**HILLSBOROUGH TOWNSHIP SCHOOL DISTRICT**

**HILLSBOROUGH HIGH SCHOOL**

**APPLIED TECHNOLOGY CURRICULUM**

**MECHANICAL DRAWING**

**August 2020**

This curriculum was approved by the Hillsborough Township  
Public Schools Board of Education on September 21, 2020.

**Mechanical Drawing**  
**Grades 9-12**  
**Course Overview**

This semester-long elective class for students in any grade level is an introduction to technical drawing. The course meets every day for approximately 50 minutes for two marking periods, culminating with a final exam at the end of the second consecutive marking period. There are no prerequisites for this course, and students do not need any prior knowledge to be successful. Content areas include creating and interpreting engineering drawings, sketching techniques, mathematical scales, geometric construction, specific types of technical drawings and several other conventional drafting concepts.

Students interested in STEAM (Science, Technology, Engineering, Art, Math) are encouraged to take this class as all aspects are covered. This 2.5 credit semester course helps fulfill the state graduation requirements for “at least 5 credits in Career Education courses”. The curriculum is aligned to the New Jersey Student Learning Standards. Additionally, this curriculum makes interdisciplinary connections in Visual and Performing Arts, Language Arts and Career Readiness, Life Literacies, & Key Skills content areas. Upon completion of this class, students will become eligible for enrollment in the Advanced Drafting course.

2020 HTPS Applied Technology Curriculum Map – Mechanical Drawing

Unit of Study	Pacing	NJ Student Learning Standards	Essential Questions	Enduring Understandings	Learning Targets	Assessment: Formative & Summative	Interdisciplinary Connections	Career Readiness, Life Literacies, & Key Skills
<b>Safety</b>	Continuous throughout the semester	1.2.2.Cn11b: Interact appropriately with media arts tools and environments considering safety, rules and fairness	<p>Why is safety and important part of Mechanical Drawing?</p> <p>How do we develop safe work habits, and create a safe work environment?</p>	Developing safe work habits as well as a safe work environment is essential to protecting yourself as well as others.	<p>Throughout the semester, demonstrate safe and proper use of:</p> <ul style="list-style-type: none"> <li>-X-Acto Knives</li> <li>-Mat Board Cutters</li> <li>-Gentlemen’s Saws</li> <li>-All tools and equipment</li> <li>-General Classroom Safety (such as tripping hazards and electrical equipment)</li> </ul>	<p><b>Formative:</b> Teacher observation</p> <p><b>Summative:</b> Quizzes</p> <p>Hands on demonstrations</p>	1.5.12prof.Cr2b: Explain how traditional and non-traditional materials may impact human health and the environment, and demonstrate safe handling of materials, tools and equipment	9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition

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<b>Reflection</b>	Continuously throughout the school year	<p>1.5.12prof.Pr4a: Analyze, select and curate artifacts and/or artworks for presentation and preservation.</p> <p>1.5.12prof.Pr5a: Analyze and evaluate the reasons and ways an exhibition is presented</p> <p>1.5.12acc.Re7b: Evaluate the effectiveness of visual artworks to influence ideas, feelings, and behaviors of specific audiences.</p>	What benefits are there to self and peer critiquing?	<p>People in all aspects of life must be open to constructive criticism from peers and outsiders.</p> <p>Having access to an audience’s point of view will help to enhance final products by considering their suggestions and critiques.</p>	Critique the work of myself and others while identifying areas of improvement as well as areas of strength in regard to final projects.	<p><b>Formative:</b> In-class discussions with peers and/or teacher</p> <p>Several different critiquing activities</p> <p><b>Summative:</b> N/A</p>	<p>WHST.9-10.2.E. Establish and maintain a style and tone appropriate to the audience and purpose (e.g. formal and objective for academic writing) while attending to the norms and conventions of the discipline in which they are writing.</p> <p>WHST.11-12.1.D. Establish and maintain a style and tone appropriate to the audience and purpose (e.g. formal and objective for academic writing) while attending to the norms and conventions of the discipline in which they are writing.</p>	<p>9.2.12.CAP.6: Identify transferable skills in career choices and design alternative career plans based on those skills.</p> <p>9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities</p> <p>9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition</p>

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<p><b>Drafting Basics: Vocabulary and Tools</b></p>	<p>Continuously throughout semester as tools are introduced</p>	<p>8.1.12.F.2 Analyze the capabilities and limitations of current and emerging technology resources and assess their potential to address educational, career, personal, and social needs.</p> <p>8.2.12.F.1 Determine and use the appropriate application of resources in the design, development, and creation of a technological product or system.</p> <p>8.2.12.F.2 Explain how material science impacts the quality of products.</p>	<p>How are these tools used specifically in technical drawings rather than in casual crafting?</p> <p>What is the main goal of technical drawing?</p> <p>Which tool would be best to use when creating <u>(insert criteria/subject area)</u>?</p>	<p>The proper use of drafting tools allows for accurate drawings and measurements that can be reproduced by the work's viewer(s).</p> <p>While many tools can create the same shapes or designs, there are reasons that one tool may be more appropriate than another depending on the task at hand.</p>	<p>Identify tools by name and sight including:</p> <ul style="list-style-type: none"> <li>-T-Square</li> <li>-Drafting Template</li> <li>-Protractor</li> <li>-Ruler</li> <li>-Architect's Scale</li> <li>-Dusting Brushes</li> <li>-Drafting Triangle</li> <li>-Compass</li> <li>-Erasing Sheild</li> </ul> <p>Describe how and when tools should be used.</p> <p>Defend tool selection when more than one tool can be used for a single purpose.</p>	<p><b>Formative:</b> Teacher observation  Class discussions  Tools notes</p> <p><b>Summative:</b> Vocaberary and tools quiz</p>	<p>1.5.12acc.Cr1b: Choose from a range of materials and methods of traditional and contemporary artistic practices to plan works of art and design.</p>	<p>9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition</p>

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<b>Drafting Basics: Sketching</b>	Approx. 5 days	<p>1.2.12acc.Cr3b: Demonstrate an understanding of media art principles through a selection of tools and production processes.</p> <p>1.2.12acc.Pr5c: Demonstrate the skillful adaptation and combination of tools, styles and techniques to achieve specific expressive goals in the production of a variety of media artworks.</p>	<p>What is the importance of sketching?</p> <p>How can I sketch if I am not a good artist?</p> <p>How can I improve my sketches?</p>	<p>All initial ideas can be conveyed in sketches to give the artist a better idea of sizing, dimensions and logistics.</p> <p>Becoming a “good” artist requires practice.</p> <p>Sketching is a learned skill.</p> <p>The more a person practices their sketching, the better they get at it.</p>	<p>Demonstrate practiced sketching techniques</p> <p>Differentiate between sketching and tracing</p> <p>Create a drawing using common sketching techniques</p>	<p><b>Formative:</b> Teacher observation</p> <p>Class discussions</p> <p>Following along with sketching presentation and examples</p> <p><b>Summative:</b> Sketching practice</p>	<p>1.2.12acc.Cr1c: Critique plans, prototypes, constraint of resources, and production processes considering purposeful and expressive artistic intention and personal aesthetic.</p> <p>1.2.12acc.Cr1d: Apply aesthetic criteria in developing and refining media arts artwork.</p> <p>1.2.12acc.Pr5a: Demonstrate effective command of artistic, design, technical and soft skills in managing and producing media artworks.</p>	<p>9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas</p> <p>9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities</p> <p>9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition</p>

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<b>Scaling</b>	Approx. 15 days	<p>8.2.12.F.2 Explain how material science impacts the quality of products.</p> <p>G-SRT.A.1. Verify experimentally the properties of dilations given by a center and a scale factor</p> <p>G-SRT.A.2. Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.</p>	<p>How is it possible to create similar drawings of objects that are extremely large or small?</p> <p>How do you know whether to scale an object up or down?</p>	<p>With the proper information, scaling can be used to take any full-size object and recreate it at a more reasonable size for the task at hand.</p> <p>The ability to scale allows artists to create rough drafts and models of creations that are not the appropriate size for presenting, reading, or understanding detail.</p> <p>Proper scaling ensures that all measurements remain proportional despite the size of the drawing or model.</p>	<p>Define what scaling is.</p> <p>Explain how to determine a scale.</p> <p>Execute proper notation for writing scales.</p> <p>Construct scaled drawings (up or down) depending on the given information.</p> <p>Determine the scale based on the given drawings.</p> <p>Create a to-scale model of a sports field indicating appropriate notation, mathematical calculations</p>	<p><b>Formative:</b> Teacher observation</p> <p>Class discussions</p> <p><b>Summative:</b> Field Project</p>	<p>1.5.12acc.Cr1a: Individually and collaboratively formulate new creative problems based on student’s existing artwork.</p> <p>1.5.12acc.Cr1b: Choose from a range of materials and methods of traditional and contemporary artistic practices to plan works of art and design.</p> <p>1.5.12acc.Cr2c: Redesign an object, system, place, or design in response to contemporary issues.</p>	<p>9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas</p> <p>9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities</p> <p>9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition</p>

		G-SRT.A.3. Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.		Depending on the object and the amount of space you have available to you, you have to determine whether to scale an object up or down.	and necessary details and/or markings.			
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<p><b>Compass: Bisecting Lines and Angles</b></p>	<p>Approx. 5 days</p>	<p>G-CO.D. 12. Make formal geometric constructions with a variety of tools and methods.</p>	<p>How can you bisect a line and angle using basic drawing tools?</p>	<p>There are specific steps that need to be taken in order to accurately bisect a line or figure.</p> <p>All that is needed to bisect a line or figure is basic drawing tools.</p>	<p>Define the following terms:</p> <ul style="list-style-type: none"> <li>-Bisect</li> <li>-Line segment</li> <li>-Point</li> <li>-Radius</li> <li>-Diameter</li> <li>-Acute Angle</li> <li>-Right Angle</li> <li>-Obtuse Angle</li> <li>-Compass</li> <li>-Pin</li> <li>-Led</li> </ul> <p>Identify basic geometric shapes based on number of lines and vertices.</p> <p>Bisect lines using the appropriate steps.</p> <p>Bisect angles using the appropriate steps according to angle specifications.</p>	<p><b>Formative:</b> Teacher observation</p> <p>Class discussions</p> <p>Geometric shapes Quizizz</p> <p><b>Summative:</b> Bisecting and Geometric figures quiz (following compass unit on triangles and geometric shapes)</p>	<p>1.5.12acc.Cr1b: Choose from a range of materials and methods of traditional and contemporary artistic practices to plan works of art and design</p> <p>1.5.12acc.Re7b: Evaluate the effectiveness of visual artworks to influence ideas, feelings, and behaviors of specific audiences.</p> <p>1.5.12acc.Re8a: Identify types of contextual information useful in the process of constructing interpretations of an artwork or collection of works.</p>	<p>9.2.12.CAP.6: Identify transferable skills in career choices and design alternative career plans based on those skills.</p> <p>9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas</p> <p>9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities</p>

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<b>Compass: Triangles and other Geometric Shapes</b>	Approx. 5 days	G-CO.D. 12. Make formal geometric constructions with a variety of tools and methods.	<p>How can you create geometric shapes using a compass?</p> <p>How does the knowledge of constructing triangles help in the creation of other geometric figures?</p>	<p>There are specific steps that need to be taken in order to accurately construct a particular type of triangle.</p> <p>All that is needed to create a triangle or geometric shape is basic drawing tools.</p> <p>Triangles can be found in many shapes, so the knowledge of how to create triangles assists in creating many other geometric shapes.</p>	<p>Define the following terms:</p> <ul style="list-style-type: none"> <li>-Acute Triangle</li> <li>-Compass</li> <li>-Diameter</li> <li>-Equilateral Triangle</li> <li>-Isosceles Triangle</li> <li>-Led</li> <li>-Obtuse Triangle</li> <li>-Pin</li> <li>-Radius</li> <li>-Right Triangle</li> <li>-Scalene Triangle</li> </ul> <p>Construct triangles and other geometric shapes based on the appropriate formulas using common drawing tools.</p> <p>Create triangles of specific dimensions using a compass.</p>	<p><b>Formative:</b> Teacher observation</p> <p>Class discussions</p> <p><b>Summative:</b> Bisecting and Geometric figures quiz</p>	<p>1.5.12acc.Cr1b: Choose from a range of materials and methods of traditional and contemporary artistic practices to plan works of art and design</p> <p>1.5.12acc.Re7b: Evaluate the effectiveness of visual artworks to influence ideas, feelings, and behaviors of specific audiences.</p> <p>1.5.12acc.Re8a: Identify types of contextual information useful in the process of constructing interpretations of an artwork or collection of works.</p>	<p>9.2.12.CAP.6: Identify transferable skills in career choices and design alternative career plans based on those skills.</p> <p>9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas</p> <p>9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities</p>

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<p><b>Alphabet of Lines and Orthographic Projections</b></p>	<p>Approx. 10 days</p>	<p>1.5.12prof.Cr1a: Use multiple approaches to begin creative endeavors.</p> <p>1.5.12acc.Cr2c: Redesign an object, system, place, or design in response to contemporary issues.</p>	<p>What is the Alphabet of Lines?</p> <p>How could 2 technical drawings from different countries be interpreted?</p> <p>Why is technical drawing known as a “universal language”?</p> <p>What factors make reading a technical drawing more easy for an audience?</p> <p>What is an orthographic projection?</p> <p>What views are</p>	<p>Lines in technical drawings are part of a specialized graphic language that is standardized throughout the industry.</p> <p>Each type of line has a very precise symbolic meaning based on its shape, darkness and line pattern.</p> <p>The correct usage of the Alphabet of Lines is essential whether traditional or electronic methods are being used.</p> <p>Aside from writing in all capitals and</p>	<p>Define the following terms:</p> <ul style="list-style-type: none"> <li>-Alphabet of Lines</li> <li>-Arc</li> <li>-Center Lines</li> <li>-Cutting Plane Lines</li> <li>-Diagonal</li> <li>-Dimension Lines/Text</li> <li>-Extension Lines</li> <li>-Hidden Lines</li> <li>-Horizontal</li> <li>-Isometric Projection</li> <li>-Line Weight</li> <li>-Orthographic Projection</li> <li>-Phantom Lines</li> </ul>	<p><b>Formative:</b> Teacher observation</p> <p>Class discussions</p> <p>Dimensioning activity</p> <p>Alphabet of Lines notes</p> <p>Reflection day(s)</p> <p><b>Summative:</b> Wood Block Project</p>	<p>1.5.12acc.Pr4a: Analyze, select and critique personal artwork for a collection or portfolio presentation.</p> <p>1.5.12acc.Re8a: Identify types of contextual information useful in the process of constructing interpretations of an artwork or collection of works.</p> <p>1.5.12acc.Re9a: Determine the relevance of criteria used by others to evaluate a work of art or collection of works.</p>	<p>9.2.12.CAP.6: Identify transferable skills in career choices and design alternative career plans based on those skills.</p> <p>9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas</p> <p>9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities</p>

			<p>orthographic projections drawn in?</p> <p>Why do we need orthographic projections in the world of technical drawing?</p>	<p>having neat penmanship, it is essential to use unidirectional dimensions in technical drawings.</p> <p>Orthographic drawings take a three dimensional object and project it onto a two-dimensional plane.</p> <p>Orthographic projections are drawn in top, front and side views.</p> <p>By taking a 3D object and projecting it as a 2D object, it allows the viewer to see all sides of the object that may not be seen from an isometric drawing.</p>	<p>-Sectional Views</p> <p>-Tangible</p> <p>-Three Dimensional</p> <p>-Two Dimensional</p> <p>-Unidirectional dimensions</p> <p>-Vertical</p> <p>Demonstrate effective notetaking skills during Alphabet of Lines presentation</p> <p>Design an orthographic projection of a wood block of a specific shape and includes several different features (ex: rough edges, drilled holes, etc.)</p>			
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<p><b>Pictorial Drawings: Oblique and Isometric</b></p>	<p>Approx. 15 days</p>	<p>G-CO.D. 12. Make formal geometric constructions with a variety of tools and methods.</p>	<p>What is a pictorial drawing?</p> <p>What is the difference between isometric and oblique drawings?</p> <p>How are pictorial projections related to orthographic projections?</p>	<p>There are several types of pictorial projections, which all three dimensions are shown in one view.</p> <p>Isometric drawings are typically more easily understood by viewers than orthographic.</p> <p>Oblique drawings focus more on the front side of the object, as opposed to an isometric drawing which is typically drawn at a 45 degree angle.</p> <p>Pictorial and orthographic projections can show the same object in different ways.</p> <p>Pictorial and orthographic projections are both necessary</p>	<p>Explain what pictorial, isometric and oblique drawings are.</p> <p>Create a basic pictorial drawing of a wood block to accompany an original set of orthographic projections.</p> <p>Describe (in written form) how to accomplish a physical task involving the transformation of a Styrofoam block.</p> <p>Demonstrate steps by accompanying written instructions with orthographic projections complete with</p>	<p><b>Formative:</b> Teacher observation  Class discussions</p> <p><b>Summative:</b> Wood Block Project (final portion)  Building project</p>	<p>1.5.12prof.Cr1a: Use multiple approaches to begin creative endeavors.</p> <p>1.5.12acc.Cr2c: Redesign an object, system, place, or design in response to contemporary issues</p> <p>1.5.12acc.Re8a: Identify types of contextual information useful in the process of constructing interpretations of an artwork or collection of works.</p> <p>1.5.12acc.Re9a: Determine the relevance of criteria used by others to evaluate a work of art or collection of works.</p>	<p>9.2.12.CAP.6: Identify transferable skills in career choices and design alternative career plans based on those skills.</p> <p>9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas</p> <p>9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities</p>

				<p>components when creating and interpreting directions</p>	<p>the Alphabet of Lines details.</p> <p>Organize information in a meaningful way for peer interpretation.</p> <p>Design a pictorial drawing for peak understanding.</p> <p>Interpret and demonstrate understanding of peer directions.</p> <p>Use classroom tools to design, assemble and create final product.</p>			
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<p><b>Perspective Drawing: One, Two- and Three-Point Perspective</b></p>	<p>Approx. 45 days</p>	<p>G-CO.D. 12. Make formal geometric constructions with a variety of tools and methods.</p>	<p>What is perspective drawing?  Why is it important to accurately set up your canvas for perspective drawing?</p>	<p>Perspective drawing allows your audience to see something on paper exactly as it would look in real life with proportion and depth taken into consideration.  Setting up a canvas properly allows for appropriate proportions, sizing, and depth to be conveyed.  One-point perspective drawings are set up with one vanishing point on the horizon line.  Two-point perspective drawings are set up with two vanishing points on the horizon line.</p>	<p>Explain the difference between one, two- and three-point perspective drawings.  Describe how to set up a paper for one, two- and three-point perspective drawings.  Create several one-point perspective drawings either from an indoor or outdoor point of view.  Create several two-point perspective drawings from an indoor or outdoor point of view.  Design or recreate a</p>	<p><b>Formative:</b> Teacher observation  Class discussions  One, two- and three-point perspective check in assignments  <b>Summative:</b> One-point perspective hallway drawing project  Two-point perspective city drawing project  Three-point perspective building drawing project</p>	<p>1.5.12prof.Cr1a: Use multiple approaches to begin creative endeavors.  1.5.12acc.Cr2c: Redesign an object, system, place, or design in response to contemporary issues  1.5.12acc.Re8a: Identify types of contextual information useful in the process of constructing interpretations of an artwork or collection of works.  1.5.12acc.Re9a: Determine the relevance of criteria used by others to evaluate a work of art or</p>	<p>9.2.12.CAP.6: Identify transferable skills in career choices and design alternative career plans based on those skills.  9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas  9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities</p>

				<p>Three-point perspective drawings are set up with two vanishing points on the horizon line, and a third vanishing point either above or below the horizon line.</p> <p>Three-point perspective drawings can be done in “bird’s eye” or “worm’s eye” view.</p>	<p>building in three-point perspective.</p>		<p>collection of works.</p>	
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**ASSOCIATED JOBS LIST BY UNIT**

<b>Unit</b>	<b>Jobs List</b>
Safety	<ul style="list-style-type: none"> <li>• Various</li> </ul>
Reflection	<ul style="list-style-type: none"> <li>• Various</li> </ul>
Drafting Basics: Vocabulary and Tools	<ul style="list-style-type: none"> <li>• Various</li> </ul>
Drawing Basics: Sketching	<ul style="list-style-type: none"> <li>• Designer</li> <li>• Engineer</li> <li>• Art Teacher</li> <li>• Advertising</li> <li>• Illustrator</li> <li>• Animator</li> <li>• Construction</li> </ul>
Scaling	<ul style="list-style-type: none"> <li>• Engineer (several)</li> <li>• Architect</li> <li>• Manufacturing Designer</li> <li>• Construction</li> </ul>
Compass: Bisecting Lines and Angles	<ul style="list-style-type: none"> <li>• Engineer (several)</li> <li>• Architect</li> <li>• Physicist</li> <li>• Teacher</li> </ul>
Compass: Triangles and other Geometric Shapes	<ul style="list-style-type: none"> <li>• Engineer (several)</li> <li>• Architect</li> <li>• Physicist</li> <li>• Teacher</li> </ul>
Alphabet of Lines and Orthographic Projections	<ul style="list-style-type: none"> <li>• Engineer (several)</li> <li>• Architect</li> <li>• Manufacturing Designer</li> </ul>
Pictorial Drawings: Oblique and Isometric	<ul style="list-style-type: none"> <li>• Engineer (several)</li> <li>• Architect</li> <li>• Manufacturing Designer</li> </ul>
Perspective Drawings: One, Two- and Three-Point Perspective	<ul style="list-style-type: none"> <li>• Engineer (several)</li> <li>• Architect</li> <li>• Mechanic</li> <li>• Contractor</li> </ul>