



**Computer Aided Design II:  
Beginning CAD for Architecture, Engineering, and 3D Animation  
First Semester**

**Course Information**

<b>Grade(s):</b>	10-12
<b>Discipline/Course:</b>	Technology Education
<b>Course Title:</b>	Computer Aided Design II: Beginning CAD for Architecture, Engineering, and 3D Animation, Semester 1
<b>Prerequisite(s):</b>	Computer Aided Design I: Introduction to CAD for Architecture, Engineering, and 3D Animation <i>or</i> Teacher's Permission
<b>Course Description:</b> <i>Program of Studies</i>	This first semester course is a continuation of Introduction to CAD and the three areas of concentration. Students will engage with increasingly more advanced CAD concepts and techniques as they apply their CAD skills to real-world projects such as: residential building design, creating construction drawings, or rendering images and video of 3D models. Students will learn about 3D CAD and BIM software, and about creating computer simulations. They will also learn about CAD workflows, such as hand drawing, design and development, construction documentation, and rendering.
<b>Course Essential Questions:</b>	<ul style="list-style-type: none"> <li>● How can I communicate my design ideas clearly and efficiently?</li> <li>● How do people use drawings and computer software to design the products around us?</li> <li>● What is the design process used to go from concepts to finished products?</li> <li>● What tools are used to create designs, computer models, and physical prototypes?</li> <li>● How can CAD be used to create more interesting looking yet functional buildings?</li> <li>● How can CAD tools be used to create custom shapes when making buildings and component models?</li> <li>● What are the best strategies for managing my time so I can complete long term assignments by the deadline?</li> <li>● How can I utilize the skills and processes learned in the CAD courses combined with my interests to create a prototype/model that solves a real world problem?</li> <li>● What are the most important elements to include in a design portfolio?</li> </ul>

<b>Enduring Understandings:</b>	<ul style="list-style-type: none"> <li>● The design process requires the use of hands-on abilities, such as measuring, drawing, sketching, working with computers, and using tools.</li> <li>● 3D real world objects can be represented by 2D orthographic and perspective drawings.</li> <li>● Design is a distinctive process with a number of defining characteristics: it is purposeful; it is based on certain requirements; it is systematic, it is iterative; it is creative; and there are many possible solutions.</li> <li>● Design is a problem-solving discipline. Designers must consider a wide range of factors when designing a building or a product, including function, aesthetics, budget, and environmental impact.</li> <li>● Architecture has a significant impact on our lives. The buildings we live in, work in, and learn in can shape our moods, our productivity, and even our sense of well-being.</li> <li>● Design and production reflect human culture and the people and values of a society.</li> <li>● The design process requires the use of a variety of strategies, such as problem solving, creative thinking, visual imagery, critical thinking, and reasoning..</li> <li>● There is usually more than one way to create desired shapes when building 3D computer models</li> <li>● Problem solving means facing obstacles and devising a solution to overcome them</li> <li>● CAD is a creative discipline that allows us to express ourselves in unique ways.</li> <li>● Solving real world problems is a challenge for everyone.</li> </ul>
<b>Duration/Credit:</b>	Semester/ 0.5 credit
<b>Course Materials/Resources:</b>	Drawing tools, computers, software, internet, projector/screen, 3D printing technology, basic hand tools, building supplies. <b>CT Technology Education Standards 2014</b> as called out in independent Units.
<b>FPS Course Academic Expectation(s):</b>	CI: Conveying Ideas, CC: Creating and Constructing, UCT: Using Communication Tools
<b>Semester at a Glance (Units):</b>	Unit 1 – Drawing Basic Elevations and Site Plans, Perspective Drawing (4 weeks) Unit 2 – Basic Design Processes and Workflows (5 weeks)

	Unit 3 – Novice Level CAD Tools and 3-D Modeling Techniques (5 weeks) Unit 4 – Final Summative Project and Creating a Design Portfolio (6 weeks)
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<b>Unit Number and Title:</b>	Unit 1: Drawing Basic Elevations, Site Plans, Two and Three Point Perspectives.
<b>Duration:</b>	4 weeks
<b>Resource(s):</b>	Computers, projector, paper, pencils, pens, erasers, internet connection
<b>Unit Overview:</b>	This unit introduces students to hand drawing skills. Students will learn the basics of drawing varied views in proportion and two and three point perspectives. These are essential skills for architects, engineers and 3D modeling and animation. Students learn how to construct two and three point perspective drawings using simple geometric shapes. Drawing subjects increase in difficulty and complexity leading directly to the use of CAD software for 3D drawing.
<b>Standard(s):</b>	CADD.02.04 Describe and demonstrate the use of graphic communication skills through sketching. CADD.05.11 Explain and demonstrate the process for creating orthographic, isometric, section views, and auxiliary view CADD.08.01 Produce proportional two- and three-dimensional sketches and designs. CADD.08.02 Use sketching techniques as they apply to a variety of objects.
<b>Essential Question(s):</b>	<ul style="list-style-type: none"> <li>● How can I communicate my design ideas clearly and efficiently?</li> <li>● How do people use drawings and computer software to design the products around us?</li> <li>● What is the design process used to go from concepts to finished products?</li> </ul>
<b>Enduring Understanding(s):</b>	<ul style="list-style-type: none"> <li>● The design process requires the use of hands-on abilities, such as measuring, drawing, sketching, working with computers, and using tools.</li> <li>● 3D real world objects can be represented by 2D orthographic and perspective drawings.</li> <li>● Design is a distinctive process with a number of defining characteristics: it is purposeful; it is based on certain requirements; it is systematic, it is iterative; it is creative; and there are many possible solutions.</li> </ul>

<p><b>Learning Goal(s):</b>  <i>Students will know and will be able to use their learning to:</i>          (Content/ Skills)</p>	<p><b>Content:</b> (Students will know...)</p> <ul style="list-style-type: none"> <li>● different types of elevation views and site plans.</li> <li>● correct perspective and projected views for drawings with two and three point perspective</li> <li>● symbols used in shop drawings, animations, elevations and site drawings.</li> </ul> <p><b>Skills:</b> (Students will be able to...)</p> <ul style="list-style-type: none"> <li>● define and explain the purpose of elevation views and site plans in architecture.</li> <li>● define and explain perspective using two vanishing points versus three vanishing points.</li> <li>● draw elevation views of buildings, characters or objects, using perspective and proportion to create accurate and realistic drawings.</li> <li>● use a variety of hand drawing techniques, such as line weight, hatching, and shading, to create visually appealing drawings.</li> </ul>
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<b>Unit Number and Title:</b>	Unit 2: Basic Design Processes and Workflows
<b>Duration:</b>	5 weeks
<b>Resource(s):</b>	Computers, projector, paper, pencils, erasers, internet connection
<b>Unit Overview:</b>	This unit will introduce students to the basics of animation, residential and product design. Students learn about building types, factors influencing design, and the process of designing products, building and animations from start to finish. Students will study the design process as purposeful, systematic, iterative and creative with many possible solutions. The students will be challenged to solve real world problems utilizing prior knowledge and new learning.
<b>Standard(s):</b>	DD.01.04 Plan multiple design solutions to solve a problem. DD.01.06 Critique designs and products created to solve a problem. CADD.0207 Express a design of an object as a 3D model. CADD.02.10 Revise a design and update finished drawings appropriately.
<b>Essential Question(s):</b>	<ul style="list-style-type: none"> <li>● How do people use drawings and computer software to design the products around us?</li> <li>● What is the design process used to go from concepts to finished products?</li> <li>● What tools are used to create designs, computer models, and physical prototypes?</li> </ul>
<b>Enduring Understanding(s):</b>	<ul style="list-style-type: none"> <li>● Design is a distinctive process with a number of defining characteristics: it is purposeful; it is based on certain requirements; it is systematic, it is iterative; it is creative; and there are many possible solutions.</li> <li>● Design is a problem-solving discipline. Designers must consider a wide range of factors when designing a building or a product, including function, aesthetics, budget, and environmental impact.</li> </ul>

	<ul style="list-style-type: none"> <li>● Architecture has a significant impact on our lives. The buildings we live in, work in, and learn in can shape our moods, our productivity, and even our sense of well-being.</li> <li>● Design and production reflect human culture and the people and values of a society.</li> </ul>
<p><b>Learning Goal(s):</b>  <i>Students will know and will be able to use their learning to:</i>          (Content/ Skills)</p>	<p><b>Content:</b> (Students will know...)</p> <ul style="list-style-type: none"> <li>● major design styles that have been used over the centuries.</li> <li>● major types of residential building typology, such as single-family homes, multi-family homes, and condominiums.</li> <li>● factors that influence the design of products.</li> <li>● components of effective videos and animations.</li> </ul> <p><b>Skills:</b> (Students will be able to...)</p> <ul style="list-style-type: none"> <li>● define and explain the different design elements over time.</li> <li>● explain how the factors such as climate, budget, and the needs of the end users influence design decisions.</li> <li>● describe the process of designing from start to finish.</li> <li>● create their own projects, using the knowledge and skills they have learned in the unit.</li> <li>● apply the principles of design, such as balance, proportion, and unity, and how to apply them to residential design, engineering design, and animation.</li> </ul>



<b>Unit Number and Title:</b>	Unit 3: Novice Level CAD Tools and 3-D Modeling Techniques
<b>Duration:</b>	5 weeks
<b>Resource(s):</b>	Computers, projector, paper, pencils, erasers, internet connection, software
<b>Unit Overview:</b>	Students will begin to explore beyond basic CAD tools learned in the CAD I course. Students will learn to utilize tools such as: curved walls, complex toposurfaces, basic massing, custom models using extrusions and sweeps, freeform mesh modeling, and adding modifier tools to primitive geometry to create more complex shapes. Students will gain understanding of constraints and joints in 3D assemblies to combine part files into functional models of machines.
<b>Standard(s):</b>	CADD.02.07 Express a design of an object as a 3D model. CADD.07 Create assemblies and views in 3D format. CADD.03 Utilize measurement and annotation systems as they apply to CADD technology design. CADD.06 Demonstrate use and application of alternate view applications and functions.
<b>Essential Question(s):</b>	<ul style="list-style-type: none"> <li>● What tools are used to create designs, computer models, and physical prototypes?</li> <li>● How can CAD be used to create more interesting looking yet functional buildings?</li> <li>● How can CAD tools be used to create custom shapes when making buildings and component models?</li> </ul>
<b>Enduring Understanding(s):</b>	<ul style="list-style-type: none"> <li>● The design process requires the use of a variety of strategies, such as problem solving, creative thinking, visual imagery, critical thinking, and reasoning..</li> <li>● There is usually more than one way to create desired shapes when building 3D computer models</li> <li>● Design is a problem-solving discipline that must consider a wide range of factors, including function, aesthetics, budget, and environmental impact.</li> </ul>

<p><b>Learning Goal(s):</b>  <i>Students will know and will be able to use their learning to:</i>          (Content/ Skills)</p>	<p><b>Content:</b> (Students will know...)</p> <ul style="list-style-type: none"> <li>● options for building computer models (e.g. drawings walls one at a time vs using massing tools. to create a form and then applying wall types to the massing model.</li> <li>● a variety of modeling techniques incorporating more complex tools</li> <li>● strategies for placing cameras for impactful renderings.</li> <li>● a variety of 2D drawing types are used to clearly communicate design intent</li> <li>● multiple methods for creating the same 3D shapes</li> <li>● the importance of keeping low polygon counts to maximize model efficiency</li> </ul> <p><b>Skills:</b> (Students will be able to...)</p> <ul style="list-style-type: none"> <li>● utilize the CAD tools in increasingly creative ways to create more complex shapes and interesting designs.</li> <li>● accurately express their creative visions by creating their own custom shapes and components.</li> <li>● modify the properties and settings to create visually stunning rendered images of their designs.</li> <li>● produce a basic set of construction drawings.</li> <li>● use the extrude, loft, sweep, and void form tools.</li> <li>● modify component properties.</li> <li>● set up 2D drawing views of their 3D models.</li> <li>● adjust the sun position and time of day.</li> </ul>
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<b>Unit Number and Title:</b>	Unit 4: Final Summative Project and Creating a Design Portfolio
<b>Duration:</b>	6 weeks
<b>Resource(s):</b>	Computers, projector, consumables
<b>Unit Overview:</b>	Students will design a custom “model” (house, animation/engineered product). Hand drawings of their designs will be created, and with teacher feedback, improvements made to build a computer model and/or physical model. Students will assemble a set of dimensioned construction/fabrication drawings and renderings, as well as photos and/or videos of physical models built for use in portfolios. Students will begin a design portfolio assembling their best work from CAD 1 and CAD 2 to demonstrate their talent and skill to potential employers. Students will learn about the different types of portfolios, choosing the correct format or media for their portfolio, and how to select their work to present it professionally.
<b>Standard(s):</b>	<p>CADD.02.04 Describe and demonstrate the use of graphic communication skills through sketching.</p> <p>CADD.02.05 Evaluate and select appropriate methods of communication for a given problem.</p> <p>CADD.02.07 Express a design of an object as a 3D model.</p> <p>CADD.05 Utilize proper projection techniques to develop orthographic and pictorial drawings.</p> <p>CADD.08 Explain and utilize the concepts of sketching and the sketching process used in preliminary design and development.</p> <p>CADD.10.01 Gather educational and work highlights to include in portfolio. CADD.10.02 Organize and provide a compact disc, web site and/or other digital media for use in demonstrating knowledge, skills, and experience.</p> <p>CADD.10.03 Prepare and conduct effective portfolio oral presentation(s).</p>
<b>Essential Question(s):</b>	<ul style="list-style-type: none"> <li>• What are the best strategies for managing my time so I can complete long term assignments by the deadline?</li> </ul>

	<ul style="list-style-type: none"> <li>● How can I utilize the skills and processes learned in the CAD courses combined with my interests to create a prototype/model that solves a real world problem?</li> <li>● What are the most important elements to include in a design portfolio?</li> </ul>
<b>Enduring Understanding(s):</b>	<ul style="list-style-type: none"> <li>● Problem solving means facing obstacles and devising a solution to overcome them</li> <li>● CAD is a creative discipline that allows us to express ourselves in unique ways.</li> <li>● Solving real world problems is a challenge for everyone.</li> <li>● Design is a problem-solving discipline. Designers must consider a wide range of factors when designing a building or a product, including function, aesthetics, budget, and environmental impact.</li> </ul>
<b>Learning Goal(s):</b> <i>Students will know and will be able to use their learning to:</i> (Content/ Skills)	<p><b>Content:</b> (Students will know...)</p> <ul style="list-style-type: none"> <li>● multiple methods of displaying their work from physical portfolios to digital portfolios.</li> <li>● which elements of a design portfolio are the most important.</li> <li>● research practices and protocols.</li> </ul> <p><b>Skills:</b> (Students will be able to...)</p> <ul style="list-style-type: none"> <li>● apply knowledge and skills from across the curriculum to solve a real-world problem.</li> <li>● conduct independent research and analyze complex information.</li> <li>● manage time effectively and meet deadlines.</li> <li>● demonstrate problem-solving and critical thinking skills.</li> <li>● use a variety of communication tools and strategies to effectively convey their design concepts to an audience.</li> <li>● how to identify and define a real-world problem</li> <li>● how to conduct research and gather evidence to inform their work.</li> <li>● how to analyze and interpret complex information.</li> <li>● how to develop and implement a plan to solve a problem.</li> </ul>