



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

Second Semester

Course Information

Grade(s):	10-12
Discipline/Course:	Technology Education
Course Title:	Computer Aided Design II Semester II: Beginner CAD for Architecture, Engineering, and 3D Animation Half-Year, Second Semester
Prerequisite(s):	Computer Aided Design I: Introduction to CAD for Architecture, Engineering, and 3D Animation <i>or</i> Computer Aided Design II Semester I: Beginning CAD for Architecture, Engineering, and 3D Semester I <i>or</i> Teacher's Permission
Course Description: <i>Program of Studies</i>	This second 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.
Course Essential Questions:	<ul style="list-style-type: none"> ● How can I communicate my design ideas clearly and efficiently? ● How do people use drawings and computer software to design the products around us? ● What is the design process used to go from concepts to finished products? ● How can CAD software communicate interesting functional design ideas clearly and efficiently? ● What is the design process used to go from concepts to finished products? ● How is CAD used to solve issues pertaining to function, aesthetics, budget, and environmental impact? ● How can we be as energy efficient as possible when producing things? ● How is CAD used to solve issues pertaining to function, aesthetics, budget, and environmental impact? ● What are the challenges and opportunities of using CAD to design for the future, given the

	<p>uncertainties of climate change and other global trends?</p> <ul style="list-style-type: none"> ● How can computer modeling tools create realistic representations of objects in real world scenarios? ● How can CAD be used to create more sustainable and energy-efficient products? ● What are the best strategies for managing my time so I can complete long term assignments by the deadline? ● 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? ● What are the most important elements to include in a design portfolio?
Course Enduring Understandings:	<ul style="list-style-type: none"> ● The design process requires the use of hands-on abilities, such as measuring, drawing, sketching, working with computers, and using tools. ● 3D real world objects can be represented by 2D orthographic and perspective drawings. ● 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. ● Problem solving means facing obstacles and devising a solution to overcome them. ● Design is a complex process that involves many different materials and systems. ● Choosing materials and systems involves weighing tradeoffs such as efficiency vs cost, and practicality vs beauty. ● There are many factors that influence a design, including: safety, reliability, quality control, costs, environmental concerns, manufacturability, maintenance, ergonomics, etc. ● CAD is a creative discipline that allows us to express ourselves in unique ways. ● Solving real world problems is a challenge for everyone.
Duration/Credit:	Semester / 0.5 credit
Course Materials/Resources:	Drawing tools, computers, software, internet, projector/screen, 3D printing technology, basic hand tools, building supplies. CT Technology Education Standards 2014 as called out in independent Units.
FPS Course	CI: Conveying Ideas,

Academic Expectation(s):	CC: Creating and Constructing, UCT: Using Communication Tools
Semester at a Glance (Units):	Unit 1 – Drawing Basic Elevations and Site Plans, Perspective Drawing (4 weeks) Unit 2 – Simulating Physics Systems, PBR Materials, Lighting and Rendering Images (5 weeks) Unit 3 – Introduction to Sustainable Materials and Design. (5 weeks) Unit 4 – Final Summative Project and Creating a Design Portfolio (6 weeks)

Unit Number and Title:	Unit 1: Drawing Basic Elevations, Site Plans, Two and Three Point Perspectives.
Duration:	4 weeks
Resource(s):	Computers, projector, paper, pencils, pens, erasers, internet connection
Unit Overview:	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.
Standard(s):	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.
Essential Question(s):	<ul style="list-style-type: none"> ● How can I communicate my design ideas clearly and efficiently? ● How do people use drawings and computer software to design the products around us? ● What is the design process used to go from concepts to finished products? ● How can CAD software communicate interesting functional design ideas clearly and efficiently?
Enduring Understanding(s):	<ul style="list-style-type: none"> ● The design process requires the use of hands-on abilities, such as measuring, drawing, sketching, working with computers, and using tools. ● 3D real world objects can be represented by 2D orthographic and perspective drawings.

	<ul style="list-style-type: none"> ● 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. ● Problem solving means facing obstacles and devising a solution to overcome them.
<p>Learning Goal(s): <i>Students will know and will be able to use their learning to:</i> (Content/ Skills)</p>	<p>Content: (Students will know...)</p> <ul style="list-style-type: none"> ● different types of elevation views and site plans. ● correct perspective and projected views for drawings with two and three point perspective ● symbols used in shop drawings, animations, elevations and site drawings. <p>Skills: (Students will be able to...)</p> <ul style="list-style-type: none"> ● define and explain the purpose of elevation views and site plans in architecture. ● define and explain perspective using two vanishing points versus three vanishing points. ● draw elevation views of buildings, characters or objects, using perspective and proportion to create accurate and realistic drawings. ● use a variety of hand drawing techniques, such as line weight, hatching, and shading, to create visually appealing drawings.

Unit Number and Title:	Unit 2: Simulating Physics Systems, PBR Materials, Lighting and Rendering Images
Duration:	5 weeks
Resource(s):	Computers, projector, internet
Unit Overview:	Students will learn about computer simulations in CAD, the different types of simulations that can be performed, how to set up and run simulations, and how to interpret the results of simulations. They will also learn how to use simulations to improve the design of buildings, engineering products and systems, as well as the realism of the images and animations they create. Drawing subjects increase in difficulty and complexity leading directly to the use of CAD software for 3D drawing.
Standard(s):	<p>CADD.05.03 Differentiate the various techniques for viewing objects.</p> <p>CADD.05.07 Describe the process for setting and editing drawing elements.</p> <p>CADD.06.02 Demonstrate the use of cutting planes to clarify hidden features of an object.</p> <p>CADD.06.03 Create and edit construction planes through reference geometry.</p> <p>CADD.02.08 Export and import images/files in a variety of file formats</p>
Essential Question(s):	<ul style="list-style-type: none"> ● What is the design process used to go from concepts to finished products? ● How is CAD used to solve issues pertaining to function, aesthetics, budget, and environmental impact? ● How can we be as energy efficient as possible when producing things? ● How can CAD software communicate interesting functional design ideas clearly and efficiently?
Enduring Understanding(s):	<ul style="list-style-type: none"> ● Design is a complex process that involves many different materials and systems. ● Design is a problem-solving discipline that must consider a wide range of factors, including function, aesthetics, budget, and environmental impact.

	<ul style="list-style-type: none"> ● Choosing materials and systems involves weighing tradeoffs such as efficiency vs cost, and practicality vs beauty.
<p>Learning Goal(s): <i>Students will know and will be able to use their learning to:</i> (Content/ Skills)</p>	<p>Content: (Students will know...)</p> <ul style="list-style-type: none"> ● there are many different types of simulation methods and materials. ● each system has pros and cons. ● techniques for rendering quality images efficiently. <p>Skills: (Students will be able to...)</p> <ul style="list-style-type: none"> ● apply simulated physics to objects to mimic real world phenomena ● create custom PBR materials ● apply texture mapping tools to understand how they display on a surface. ● adjust sun position, date, and geographic location. ● describe the advantages and disadvantages of different materials and systems. ● create various drawings showing what materials were used and how the pieces fit together.

Unit Number and Title:	Unit 3: Introduction to Sustainable Design and Materials
Duration:	5 weeks
Resource(s):	Computers, software, projector, paper, pencils, erasers, internet access
Unit Overview:	This unit will introduce students to the principles of sustainable design. Students will learn about the environmental and social impacts of design. They will also learn how to design buildings and products sustainably using different tools and techniques and material choices.
Standard(s):	<p>CADD.01.04 Explain the significance of the development Computer Aided Drafting and Design had on society.</p> <p>EKS.07.04 Consider issues related to self, team, community, diversity, environment, and global awareness when leading others.</p> <p>ARCH.02.01 Identify how location, resources and materials influence design.</p> <p>ENG.01.05 Describe ethics related to engineering in the following situations: environmental, sustainable engineering, and corrupt practices.</p>
Essential Question(s):	<ul style="list-style-type: none"> • How is CAD used to solve issues pertaining to function, aesthetics, budget, and environmental impact? • What are the challenges and opportunities of using CAD to design for the future, given the uncertainties of climate change and other global trends? • How can computer modeling tools create realistic representations of objects in real world scenarios? • How can CAD be used to create more sustainable and energy-efficient products?
Enduring Understanding(s):	<ul style="list-style-type: none"> • Choosing materials and systems involves weighing tradeoffs such as efficiency vs cost, and practicality vs beauty.

	<ul style="list-style-type: none"> • There are many factors that influence a design, including: safety, reliability, quality control, costs, environmental concerns, manufacturability, maintenance, ergonomics, etc. • Problem solving means facing obstacles and devising a solution to overcome them.
Learning Goal(s): <i>Students will know and will be able to use their learning to:</i> (Content/ Skills)	<p>Content: (Students will know...)</p> <ul style="list-style-type: none"> • industry standard materials. • how some materials and methods are more environmentally sustainable than others. • how the design process allows choice between numerous materials and systems. <p>Skills: (Students will be able to...)</p> <ul style="list-style-type: none"> • apply the principles of sustainability by choosing environmentally sustainable materials to be used in their designs. • consider the pros and cons of various design options.

Unit Number and Title:	Unit 4: Final Summative Project and Creating a Design Portfolio
Duration:	6 weeks
Resource(s):	Computers, projector, consumables
Unit Overview:	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.
Standard(s):	<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>
Essential Question(s):	<ul style="list-style-type: none"> • What are the best strategies for managing my time so I can complete long term assignments by the deadline?

	<ul style="list-style-type: none"> ● 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? ● What are the most important elements to include in a design portfolio?
Enduring Understanding(s):	<ul style="list-style-type: none"> ● Problem solving means facing obstacles and devising a solution to overcome them ● CAD is a creative discipline that allows us to express ourselves in unique ways. ● Solving real world problems is a challenge for everyone.
Learning Goal(s): <i>Students will know and will be able to use their learning to:</i> (Content/ Skills)	<p>Content: (Students will know...)</p> <ul style="list-style-type: none"> ● multiple methods of displaying their work from physical portfolios to digital portfolios. ● which elements of a design portfolio are the most important. ● research practices and protocols. <p>Skills: (Students will be able to...)</p> <ul style="list-style-type: none"> ● apply knowledge and skills from across the curriculum to solve a real-world problem. ● conduct independent research and analyze complex information. ● manage time effectively and meet deadlines. ● demonstrate problem-solving and critical thinking skills. ● use a variety of communication tools and strategies to effectively convey their design concepts to an audience. ● how to identify and define a real-world problem ● how to conduct research and gather evidence to inform their work. ● how to analyze and interpret complex information. ● how to develop and implement a plan to solve a problem.