



**Computer Aided Design III:
Intermediate CAD for 3D Animation (Special Effects),
Architecture, or Engineering**

Second Semester

Course Information

Grade(s):	11-12
Discipline/Course:	Technology Education
Course Title:	Computer Aided Design III: Intermediate CAD for 3D Animation, Architecture, or Engineering, Semester II
Prerequisite(s):	Computer Aided Design II: Beginner CAD for Architecture, Engineering, and 3D Animation (Full Year) <i>or</i> Computer Aided Design III: Intermediate CAD for 3D Animation, Architecture, or Engineering (Semester I) with Teacher’s Permission <i>or</i> Teacher’s Permission
Course Description: <i>Program of Studies</i>	This second semester course expands on the focused skills learned in previous courses. Students will learn advanced level application and may concentrate in any of the areas: 3D Animation, Architecture or Engineering. Examples include: fine animation of character’s eyes and mouth, computer special effects (such as fire, tornados, and lightsabers), building design portfolios for college, creating architectural detail plans, “Green Building”, and engineering products or inventions to solve real world problems. (Software: Inventor, Revit, 3ds Max, Maya, Mudbox, MotionBuilder, iPi Motion Capture)
Course Essential Questions:	<ul style="list-style-type: none"> ● What common considerations must be taken into account when designing spaces, products or videos? ● What conventions exist to ensure all architectural, mechanical, etc. drawings are uniform? ● How can CAD be used to enhance our quality of life, convey complex emotions and ideas, and educate and inform people about important issues? ● What are the different ways that we can measure the success of a Design? ● How can Design be used to enhance our quality of life and how do we measure the success of a design/engineering/animation project? ● How can animation be used to convey complex emotions and ideas? ● How can engineering and Design be used to create more inclusive and accessible products and services, as well as more sustainable and efficient systems for all people? ● What are the pros and cons of using different materials and technologies?

	<ul style="list-style-type: none"> • How can architecture be used to enhance our quality of life? • What is the role of creativity and innovation in engineering and Design?
Course Enduring Understandings:	<ul style="list-style-type: none"> • Design has a significant impact on our lives. The buildings we live in, products we use and entertainment we watch can shape our moods, our productivity, and even our sense of well-being. • Design is a creative, problem-solving discipline using knowledge and skills to design and build solutions to complex problems. • Design is done through a systematic approach to identify, analyze, and solve problems. • 3D artists use a variety of software and tools to create their work, and they must have a strong understanding of the principles of 3D modeling and animation. • Design is a creative discipline that allows us to express ourselves in unique ways. • The understanding of spatial reasoning and geometry required for 3D modeling and animation can be useful in everyday life, from navigating to playing sports. Engineering is a creative discipline. • The understanding of science and mathematics required for engineering can be useful in everyday life, from making informed decisions about products and services to understanding the world around us. • 3D modeling and animation is a technical art form that can be used to create engaging educational experiences that can be more effective than traditional methods. • Architecture, Design and Animation are creative disciplines through which practitioners use their knowledge and skills to design and build solutions to complex problems. • There are multiple strategies for effectively displaying one's work from physical portfolios to digital portfolios.
Duration/Credit:	Semester /0.5 credit
Course Materials/ Resources:	Drawing tools, computers, software, projector/screen, 3D printing technology, basic hand tools.
FPS Course Academic Expectation(s):	CI: Conveying Ideas, CC: Creating and Constructing,

	UCT: Using Communication Tools
Semester at a Glance (Units):	Unit 1 – Sketching, Drawing, Schematics and Character Sketching (3 weeks). Unit 2 – Construction Methods, Character Rigging and Skinning, Prototyping (5 weeks). Unit 3 – Sustainable Architecture and Character Animation Techniques (5 weeks). Unit 4 – Final Summative Project and Portfolio Expansion (7 weeks).

Unit Number and Title:	Unit 1 - Sketching, Drawing, Schematics and Character Sketching
Duration:	3 weeks
Resource(s):	Computers, projector, paper, pencils, erasers
Unit Overview:	Students with a basic understanding of sketching will develop their skills further. Students will learn more advanced perspective drawing techniques, shading techniques, and how to sketch different types of buildings, engineered products, characters and miscellaneous detail elements and poses. Students will learn to read and interpret drawings, drawing conventions, engineering schematics, diagrams while creating their own drawings.
Learning Goals	
Standard(s):	CADD.02.01 Apply conventional Computer Aided Drafting and Design processes and procedures accurately, appropriately, and safely. CADD.02.04 Describe and demonstrate the use of graphic communication skills through sketching. CADD.02.05 Evaluate and select appropriate methods of communication for a given problem. CADD.02.07 Express a design of an object as a 3D model.
Essential Question(s):	<ul style="list-style-type: none"> ● What common considerations must be taken into account when designing spaces, products or videos? ● What conventions exist to ensure all architectural, mechanical, etc. drawings are uniform? ● How can CAD be used to enhance our quality of life, convey complex emotions and ideas, and educate and inform people about important issues? ● What are the different ways that we can measure the success of a Design?
Enduring Understanding(s):	<ul style="list-style-type: none"> ● Design has a significant impact on our lives. The buildings we live in, products we use and entertainment we watch can shape our moods, our productivity, and even our sense of well-being. ● Design is a creative, problem-solving discipline using knowledge and skills to design and build

	<p>solutions to complex problems.</p> <ul style="list-style-type: none"> ● Design is done through a systematic approach to identify, analyze, and solve problems. ● 3D artists use a variety of software and tools to create their work, and they must have a strong understanding of the principles of 3D modeling and animation.
<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"> ● standard views and projection systems, and detail and section views. ● standard drawing formats architects and advanced formats use to convey their designs. ● the ‘Perspective Drawing System’. <p>Skills: (Students will be able to...)</p> <ul style="list-style-type: none"> ● sketch complex architectural forms and spaces using advanced perspective drawing techniques. ● create realistic and expressive architectural sketches with a variety of shading techniques. ● construct two and three point perspective drawings of three-dimensional objects. ● sketch different types of buildings, products or characters . ● apply their sketching skills to real-world design projects, such as developing detailed design proposals or creating presentation drawings.

Unit 2

Unit Number and Title:	Unit 2 - Construction Methods, Character Rigging and Skinning, Prototyping
Duration:	5 weeks.
Resource(s):	Computers, projector, paper, pencils, erasers.
Unit Overview:	This unit will introduce students to the use of computer-aided design (CAD) software to simulate physical behavior of various mechanisms and methods of construction or production. Students will learn how to create and manipulate CAD models of physical systems, various commercial construction methods and then use these models to predict the behavior of the systems under different conditions. In this unit, students will learn about the importance of building, testing, and analyzing prototypes in the engineering design process. They will gain experience using a variety of simple building materials and tools to create prototypes of their own designs. They will also learn how to test their prototypes to determine whether they meet the design requirements and how to analyze the results of their tests to identify areas for improvement
Learning Goals	
Standard(s):	CADD.02.04 Describe and demonstrate the use of graphic communication skills through sketching. CADD.02.05 Evaluate and select appropriate methods of communication for a given problem. CADD.02.06 Send and access information through a network. CADD.02.07 Express a design of an object as a 3D model. CADD.07.01 Create an assembly in 3-D geometry. CADD.05.02 Understand the orthographic projection process for developing multi-view drawings. CADD.05.03 Differentiate the various techniques for viewing objects
Essential Question(s):	<ul style="list-style-type: none"> How can Design be used to enhance our quality of life and how do we measure the success of a

	<p>design/engineering/animation project?</p> <ul style="list-style-type: none"> ● How can animation be used to convey complex emotions and ideas? ● How can engineering and Design be used to create more inclusive and accessible products and services, as well as more sustainable and efficient systems for all people? ● What are the pros and cons of using different materials and technologies?
Enduring Understanding(s):	<ul style="list-style-type: none"> ● Design is a creative discipline that allows us to express ourselves in unique ways. ● 3D artists use a variety of software and tools to create their work, and they must have a strong understanding of the principles of 3D modeling and animation. ● The understanding of spatial reasoning and geometry required for 3D modeling and animation can be useful in everyday life, from navigating to playing sports. Engineering is a creative discipline. ● The understanding of science and mathematics required for engineering can be useful in everyday life, from making informed decisions about products and services to understanding the world around us.
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"> ● how to select, describe and identify the different types of commercial construction methods. ● how to export CAD models for 3D printing. ● safe use of basic tools. ● basic hardware and prototyping materials available for building. ● what character rigging is, it's components and its importance in animation. <p>Skills: (Students will be able to...)</p> <ul style="list-style-type: none"> ● design and build a model commercial structure using a variety of construction methods and through prototyping various model iterations. ● design, build and analyze physical prototype/model using a variety of tools and materials. ● use prototypes to test and improve designs. ● create a simple character rig using 3D animation software. ● create controls for the character's facial expressions and other details and animate the character to produce movement over time.

- Navigate character structure to alter it.
- Put “skin” on a character or put an outside envelope on a rig.

Unit Number and Title:	Unit 3 – Sustainable Architecture and Character Animation Techniques
Duration:	5 weeks.
Resource(s):	Computers, projector, paper, pencils, erasers.
Unit Overview:	<p>In this unit, students will learn about the principles and practices of sustainable commercial architecture. They will explore how to design and build commercial buildings that are energy-efficient, water-efficient, and use sustainable materials. Students will also learn about the importance of sustainable design for the environment and for human health and well-being.</p> <p>This course will introduce students to the fundamental principles and techniques of character animation. Students will learn how to design and animate characters that are both expressive and believable. They will also learn about the different types of animation software and how to use them to create their own animated short films</p>
Learning Goals	
Standard(s):	<p>CADD.02.05 Evaluate and select appropriate methods of communication for a given problem.</p> <p>CADD.02.09 Evaluate the choice and placement of dimensions, notes and annotations to clearly communicate design intent.</p> <p>CADD.02.10 Revise a design and update finished drawings appropriately.</p> <p>CADD.05.01 Understand the commands and concepts necessary for producing drawings through traditional or computer-aided means.</p> <p>CADD.05.02 Understand the orthographic projection process for developing multi-view drawings.</p> <p>CADD.05.03 Differentiate the various techniques for viewing objects.</p>
Essential Question(s):	<ul style="list-style-type: none"> ● What common considerations must be taken into account when designing spaces, products or videos? ● What conventions exist to ensure all architectural, mechanical, etc. drawings are uniform?

	<ul style="list-style-type: none"> ● How can architecture be used to enhance our quality of life? ● What are the different ways that we can measure the success of a Design?
Enduring Understanding(s):	<ul style="list-style-type: none"> ● 3D artists use a variety of software and tools to create their work, and they must have a strong understanding of the principles of 3D modeling and animation. ● The understanding of spatial reasoning and geometry required for 3D modeling and animation can be useful in everyday life, from navigating to playing sports. ● 3D modeling and animation is a technical art form. 3D artists use a variety of software and tools to create their work, and they must have a strong understanding of the principles of 3D modeling and animation. ● 3D modeling and animation can be used to create educational experiences that are more engaging and effective than traditional methods.
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"> ● key principles of sustainable design. ● 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. <p>Skills: (Students will be able to...)</p> <ul style="list-style-type: none"> ● apply sustainability principles to the designworld. ● evaluate the sustainability of commercial buildings using various rating systems. ● apply knowledge and skills from across the curriculum to solve a real-world problem. ● conduct independent research and analyze complex information. ● alter character movement in a predictable way. ● create distinct character motions like: running, standing, jumping. ● record animation clips that contain character animation. ● design and develop characters with unique personalities and physical characteristics. ● animate characters in a variety of poses and movements, including walking, running, jumping, and facial expressions.

	<ul style="list-style-type: none"> • use animation software to create their own animated short films.
Unit Number and Title:	Unit 4 – Final Summative Project and Portfolio Expansion.
Duration:	7 weeks.
Resource(s):	Computers, projector, paper, pencils, erasers.
Unit Overview:	Students will use their knowledge of the design process to create hand sketches of their designs. Using teacher feedback students make any improvements needed to demonstrate learning by designing a final project in the form of a computer model. Students will then put together finished drawings and renderings for use in their portfolios. Students assemble their best work from this and prior years to continue a design portfolio demonstrating their talent and skill. Students will go beyond a basic portfolio to include customized detail content.
Learning Goals	
Standard(s):	ENG.02.06 Analyze and research between alternate solutions. ENG.02.09 Build a prototype from working drawings using appropriate materials. ENG.02.10 Test prototype to defined criteria. CADD.07 Create assemblies and views in 3-D format. CADD.10 Maintain a portfolio to document knowledge, skills, materials and experience in CAD. CADD.10.01 Gather educational and work highlights to include in portfolio.
Essential Question(s):	<ul style="list-style-type: none"> • What conventions exist to ensure all architectural, mechanical, etc. drawings are uniform? • What is the role of creativity and innovation in engineering and Design? • What are the different ways that we can measure the success of a Design project? • What are the pros and cons of using different materials and technologies?
Enduring	<ul style="list-style-type: none"> • 3D modeling and animation is a technical art form that can be used to create engaging

Understanding(s):	<p>educational experiences that can be more effective than traditional methods.</p> <ul style="list-style-type: none"> ● Architecture, Design and Animation are creative disciplines through which practitioners use their knowledge and skills to design and build solutions to complex problems. ● There are multiple strategies for effectively displaying one's work from physical portfolios to digital portfolios.
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. ● strategies for effective communication. ● 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. <p>Skills: (Students will be able to...)</p> <ul style="list-style-type: none"> ● use a variety of communication tools and strategies to effectively convey their design concepts to an audience.