INTRODUCTION TO COMPUTER AIDED DESIGN 10

Description
Explore Design in Architecture, Animation, and Engineering. No experience necessary. Students will learn the CAD fundamentals needed to design houses, create computer-animated videos, and engineer simple mechanisms (such as catapults), and product design utilizing professional software. Activities will include: hand sketching, creating floor plans, multi-view drawings, 3D modeling, animation, rendering still images and video, using a 3D printer to create actual parts made of plastic, and hands-on model construction. (Software: Inventor, Revit, 3ds Max, Maya)

Course Overview

Course Objectives
Students should be able to:
- communicate design ideas through hand drawn sketches.
- modify file templates to meet project requirements.
- manipulate 2D&3D models using a variety of input devices.
- demonstrate a basic knowledge of the standard drafting conventions for both mechanical and architectural drawings.
- effectively communicate design ideas through dimensioned plans.
- demonstrate proficiency in basic 3D modeling techniques.
- use basic mathematics to ensure CAD models meet the numerical parameters of the project.
- effectively communicate design ideas through rendered images and animation techniques.
- explain the career pathways for architects, engineers, and computer animators.
- demonstrate the ability to organize files into efficient folder systems on a variety of storage devices.
- merge multiple files into one CAD model.
- create and apply a variety of materials to models.
- appropriately scale drawings to print plans to an output device for multiple ANSI sheet sizes.

Essential Questions
- How is computer technology used to create designs and to effectively communicate ideas?
- What CAD related career opportunities are out there?
- What tools are commonly used to create designs, computer models, and prototypes?
- How are Architecture, Design, Engineering, and Animation different?
- What are effective steps in creating a design?
- What are common design considerations one needs to evaluate in order to satisfy clients?
- How can I communicate my design ideas clearly and efficiently?
- What pathways are available to me if I want a career in computer aided design?

Assessments
Formative Performance Assessment
- One point perspective drawing
- Two point perspective drawing
- Alphabet of Lines Quiz
- Dimensioned Orthographic Drawing of a basic 3D object
- storyboard
- basic 2D floor plan
- 3D house model with materials
- rendered video walk through
- Simple House design and plan views
- Basic CAD prototype model
- Turntable assembly animation
- Engineering drawing conventions
- Personal Electronic Device Design
- Parametric mechanism model
- Simple machine simulation
- 3D Primitive modeling
- Material Shaders
- Key Frame Animation
- Solar System with Lens Glare Effect
- Low Polygon Character Modeling

Summative Performance Assessment
- Power transmission mechanism model
- Simple House design and dimensioned plan views
- Self-chosen Low Polygon Character Model

Content Outline
1. Unit 1 – Communication Skills for Design

Standards
Connecticut Technology Education Standards

CAD 10

BOE Approved 05/22/2012
II. **Unit 2** – Intro to Architectural Design
III. **Unit 3** – Intro to Engineering Design
IV. **Unit 4** – Intro to 3-D Modeling & Animation

have been met in the following areas:

- *Essential Skills and Knowledge*
- *Computer Aided Drafting and Design (CADD)*
- *Pre-Engineering Technology*

<table>
<thead>
<tr>
<th>Pacing Guide</th>
<th>1st Marking Period</th>
<th>2nd Marking Period</th>
<th>3rd Marking Period</th>
<th>4th Marking Period</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>September</td>
<td>October</td>
<td>November</td>
<td>December</td>
</tr>
<tr>
<td>Unit 1</td>
<td>Communication</td>
<td>6 weeks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication Skills</td>
<td>Skills for Design</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit 2</td>
<td>Intro to Architectual Design</td>
<td>10 weeks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit 3</td>
<td>Intro to Engineering Design</td>
<td>10 weeks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit 4</td>
<td>Intro to 3-D Modeling &amp; Animation</td>
<td>10 weeks</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Unit 1 - Communication Skills for Design, 6 weeks [top](#)

### Standards

**Essential Skills and Knowledge**

EKS.03 Demonstrate mathematics knowledge and skills required to pursue the full range of post-secondary education and career opportunities.

EKS.03.01, EKS.03.02, EKS.03.04

EKS.08 Identify and demonstrate positive work behaviors and personal qualities needed to be employable.

EKS.08.01, EKS.08.02, EKS.08.03, EKS.08.08

### Computer Aided Drafting and Design (CADD)

CADD.02 Analyze the use of current CADD design technology.

CADD.02.02, CADD.02.03, CADD.02.04, CADD.02.09, CADD.02.11

CADD.05 Utilize Proper projection techniques to develop orthographic and pictorial drawings.

CADD.05.01, CADD.05.02, CADD.05.03, CADD.05.04, CADD.05.06, CADD.05.07, CADD.05.08, CADD.05.09, CADD.05.10, CADD.05.11, CADD.05.12, CADD.05.13, CADD.05.14, CADD.05.15, CADD.05.16, CADD.05.17

CADD.08 Explain and Utilize the concepts of sketching and the sketching process used in preliminary design and development.

CADD.08.01, CADD.08.02, CADD.08.03, CADD.08.04

### Unit Objectives

Students will be able to:

- create basic sketches of their design ideas.
- identify the properties of the components within the alphabet of lines.
- describe the types of multi-view drawings.
- use measurement tools to mathematically describe features of a design.
- apply basic drafting conventions to properly dimension a drawing.
- use a coordinate system to locate exact locations of design features.
- create simple storyboards to plan and coordinate computer animations.

### Essential Question

- Why is effective communication necessary for transferring technical design information?

### Focus Questions

- How can I communicate my design ideas clearly and efficiently?
- What conventions exist to ensure all architectural and mechanical drawings are uniform?

### Assessments

- One point perspective drawing
- Two point perspective drawing
- Alphabet of Lines Quiz
- Dimensioned Orthographic Drawing of a basic 3D object
- Storyboard of animated short

### Skill Objectives

Students will:

- select and use the appropriate pencil type for constructions and object lines.
- create hand drawings of two dimensional primitives.
- create hand drawings of one and two point perspectives.
- list the common types of lines used in architectural and mechanical drawings.
- create simple orthographic drawings of 3 dimensional objects.
- apply the Cartesian Coordinate system to create precise representations of 3D objects.
- draw a storyboard of a simple scene.
Unit 2 - Intro to Architectural Design, 10 weeks

Standards

Essential Skills and Knowledge
EKS.03 Demonstrate mathematics knowledge and skills required to pursue the full range of post-secondary education and career opportunities.
   EKS.03.01, EKS.03.02
EKS.05 Employ critical thinking skills independently and in teams to solve problems and make decisions (e.g., analyze, synthesize and evaluate).
   EKS.05.02, EKS.05.03, EKS.05.04, EKS.05.05, EKS.05.07
EKS.08 Identify and demonstrate positive work behaviors and personal qualities needed to be employable.
   EKS.08.01, EKS.08.02

Computer Aided Drafting and Design (CADD)
CADD.02 Analyze the use of current CADD design technology.
   CADD.02.01 through .12
CADD.03 Utilize measurement and annotation systems as they apply to CADD technology design.
   CADD.03.01 through .08
CADD.05 Utilize Proper projection techniques to develop orthographic and pictorial drawings.
   CADD.05.01 through .17
CADD.07 Create assemblies and views in 3-D format.
   CADD.07.01 & .02
CADD.08 Explain and Utilize the concepts of sketching and the sketching process used in preliminary design and development.
   CADD.08.01 through .04

Unit Objectives
Students will be able to:

- list and describe architectural drawing types.
- create residential floor plans utilizing accepted room planning strategies.
- use basic CAD tools to create 2D computer sketches.
- manipulate 2D & 3D objects using basic transforms (i.e. move, scale, mirror).
- load and customize component files.
- apply standard materials in preparation for rendering.
- create cameras and animate a walk-through.
- demonstrate mastery of basic computer skills to produce scaled & printed drawings of a design.
- dimension architectural drawings using ANSI

Essential Question
- How has architectural design been impacted by CADD technology?

Focus Questions
- How can I utilize computer technology to design functional and aesthetic buildings and spaces?
- What tools are there in a CAD program to help me test concepts and modify designs?

Assessments
- Basic 2D floor plan
- 3D house model with materials
- Rendered video walk through
- Simple House design and plan views
- Simple House design and dimensioned plan views

Skill Objectives
Students will:
- create 2D CAD sketches of floor plans.
- manipulate 2D sketches using editing tools and transforms.
- create 3D building models from 2D sketches
- insert and modify furniture and fixtures as component files.
| standards. • utilize basic modeling materials and techniques to create physical models of their building designs. | use CAD tools to apply realistic materials to 3D models. • create elevation and dimensioned floor plan drawings. • render realistic still images of their CAD model. • create a walkthrough animation. • construct physical display models of their building design. |
## Standards
### Essential Skills and Knowledge
- **EKS.03** Demonstrate mathematics knowledge and skills required to pursue the full range of post-secondary education and career opportunities.
  - EKS.03.01, EKS.03.02
- **EKS.05** Employ critical thinking skills independently and in teams to solve problems and make decisions (e.g., analyze, synthesize and evaluate).
  - EKS.05.02, EKS.05.03, EKS.05.04, EKS.05.05, EKS.05.07
- **EKS.08** Identify and demonstrate positive work behaviors and personal qualities needed to be employable.
  - EKS.08.01, EKS.08.02

### Computer Aided Drafting and Design (CADD)
- **CADD.02** Analyze the use of current CADD design technology.
  - CADD.02.01 through .12
- **CADD.03** Utilize measurement and annotation systems as they apply to CADD technology design.
  - CADD.03.01 through .08
- **CADD.05** Utilize Proper projection techniques to develop orthographic and pictorial drawings.
  - CADD.05.01 through .17
- **CADD.07** Create assemblies and views in 3-D format.
  - CADD.07.01 & .02
- **CADD.08** Explain and Utilize the concepts of sketching and the sketching process used in preliminary design and development.
  - CADD.08.01 through .04

### Pre-Engineering Technology
- **ENG.02** Use the design process to solve problems by creating and refining prototypes.
  - ENG.02.02, ENG.02.05, ENG.02.09, ENG.02.10, ENG.02.11

## Unit Objectives
Students will be able to:
- use basic CAD tools to create 2D computer sketches.
- create 2D objects using basic primitives.
- create 3D objects using basic primitives.
- create 3D objects from 2D sketches using basic modeling tools (i.e. extrude, revolve).
- manipulate 2D & 3D objects using basic transforms (i.e. move, scale, mirror).
- describe parametric modeling.
- use basic 2D & 3D constraints.
- combine multiple part files into assemblies.

## Essential Question
- How is engineering design enhanced by utilizing a CADD software application?

## Focus Questions
- How can I utilize computer technology to design functional machines and products?
- What tools are there in a CAD program to help me test concepts and modify designs?

## Assessments
- Basic product model (i.e. ring, keychain)
- Parametric mechanism model
- Simple machine simulation
- Turntable assembly animation
- Engineering drawing conventions
- Personal Electronic Device Design
- Power transmission mechanism model

## Skill Objectives
Students will:
- create assembly drawing & animations.
- run a dynamic simulation.
- demonstrate mastery of basic computer skills to produce printed drawings of a design.

- create fully constrained 2D CAD sketches.
- manipulate 2D sketches using editing tools and transforms.
- create 3D part models from 2D sketches.
- create fully constrained 3D part assemblies.
- create dimensioned drawings from part files and assembly files.
- create turntable animations from assembly files.
- test design functionality using dynamic simulations.
# Unit 4 - Intro to 3-D Modeling & Animation, 10 weeks

## Standards

### Essential Skills and Knowledge

- **EKS.03** Demonstrate mathematics knowledge and skills required to pursue the full range of post-secondary education and career opportunities.
  - EKS.03.01, EKS.03.02

- **EKS.05** Employ critical thinking skills independently and in teams to solve problems and make decisions (e.g., analyze, synthesize and evaluate).
  - EKS.05.02, EKS.05.03, EKS.05.04, EKS.05.05, EKS.05.07

- **EKS.08** Identify and demonstrate positive work behaviors and personal qualities needed to be employable.
  - EKS.08.01, EKS.08.02

## Computer Aided Drafting and Design (CADD)

- **CADD.02** Analyze the use of current CADD design technology.
  - CADD.02.01 through .12

- **CADD.05** Utilize proper projection techniques to develop orthographic and pictorial drawings.
  - CADD.05.01 through .17

- **CADD.08** Explain and utilize the concepts of sketching and the sketching process used in preliminary design and development.
  - CADD.08.01 through .04

## Unit Objectives

Students will be able to:
- navigate the complex user interface.
- create basic 3D primitives.
- modify 3D primitive properties.
- create simple 3D model using basic tools and modifiers.
- apply standard materials and create their own materials.
- use key framing to animate 3D models.
- apply basic special effects.
- render still images and animated video.

## Essential Question

- What is the impact of computer software on the digital media industry?

## Focus Questions

- How can I utilize computer technology to design 3D models for use in animated movies and video games?
- How can I create rendered images and video of 3D models?

## Assessments

- 3D Primitive modeling
- Material Shaders
- Key Frame Animation
- storyboard
- Solar System with Lens Glare Effect
- Guided Low Polygon Character Model
- Self-chosen Low Polygon Character Model

## Skill Objectives

Students will:
- create basic primitive shapes and prepare them for modeling.
- apply materials to primitives to represent real-world objects.
- use the Internet and computer software to create and apply their own material shaders.
- render still images of 3D models.
- utilize key frame animating techniques to produce a short video.
- learn to use basic special effects such as glow and lens glare.
- create an original low polygon character model.