

# **Glen Ridge Public Schools –Visual & Performing Arts Curriculum**



**Course Title:** CAD I

**Subject:** Visual and Performing Arts

**Grade Level:** 9-12

**Duration:** Full year

**Prerequisite:** None

**Elective or Required:** Elective

## **Computer Science, Engineering, and Technology Mission Statement:**

Since computational thinking and problem solving are integral parts of our lives and 21st century learning, students must be actively involved in their Computer Science, Engineering, and Technology (CSET) education. The CSET curricula will emphasize thinking skills through a balance of computation, intuition, common sense, logic, design, analysis, and technology. Students will use a combination of technology and critical thinking to solve real-world problems. To achieve these goals, students will be taught a standards-based curriculum that is aligned with the New Jersey Curriculum Standards.

## **Course Description:**

Trough the use of demonstrations, and learning activities, the students will utilize the basic drawing tools and techniques of the technical illustrator to create production drawings. Basic skills will be developed using AutoCAD software to create computer drawings. The concepts of orthographic projection, 3D modeling and pictorial representation will be taught in addition to dimensioning and notation. AutoCAD software using a PC platform is the primary drawing program. Students who wish to proceed further will enroll in CAD II where they will broaden their knowledge of CAD.

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## **CAD I TABLE OF CONTENTS**

<b>UNIT</b>	<b>TITLE</b>	<b>Timeline</b>
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3	Auxiliary and Sectional Views	2 Weeks
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5	Residential Architecture	10 Weeks
6	Survey, Framing & Modeling	10 Weeks

## **Course Name**

CAD I

## **Topic/Unit:**

Introduction to Computer Aided Drafting & Design

**Approximate # Of Weeks: 4-5 Weeks**

### **Essential Questions:**

- How can AutoCAD be applied for creating technical drawings?
- What makes an AutoCAD drawing impressive?
- How can AutoCAD be used to communicate ideas through drawings?
- How can you use basic tools in AutoCAD to efficiently draw 2D objects?
- In a world of constant technological change, how is AutoCAD applied as a tool to aid in the design world?
- How can AutoCAD have a positive and negative impact?
- To what extent are there limitations to what CAD can do?
- Why is setting up a drawing important?
- What are the best ways to present a drawing?
- What makes a good design and bad design?

### **Upon completion of this unit students will be able to:**

- Build a working technical vocabulary in regards to CAD and geometry terms. (M.G-MG.A.1)
- Appropriate saving devices for drawing files and understand the method of retrieving private files through the public network. (8.1.12.D.1)
- Analyze and evaluate AutoCAD software as a technology. (8.2.12.A.2)
- Use AutoCAD to create two-dimensional computer representations of mechanical parts and common objects with increasing complexity. (8.2.12.C.5)
- Recognize the applications of AutoCAD in the present and future work force. (9.2.12.C.1)
- Work collaboratively and creatively with peers in the design and drawing, stage of prototyping. (8.2.12.D.1)
- Apply good elements of design when creating an original drawing. (9.3.12.AR-VIS.2)
- Understand how CAD plays a critical role in designing solutions for STEM-related careers. (9.3.ST.4)

## **Interdisciplinary Standards**

### **Math**

- **M.G-MG.A.1:** Use geometric shapes, their measures, and their properties to describe objects

### **Technology**

- **8.1.12.D.1:** Demonstrate appropriate application of copyright, fair use and/or Creative Commons to an original work.
- **8.2.12.A.2:** Analyze a current technology and the resources used, to identify the trade-offs in terms of availability, cost, desirability and waste.
- **8.2.12.C.5:** Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.
- **8.2.12.D.1:** Design and create a prototype to solve a real world problem using a design process, identify constraints addressed during the creation of the prototype, identify trade-offs made, and present the solution for peer review.

### **21<sup>st</sup> Century Life and Careers**

- **9.2.12.C.1:** Review career goals and determine steps necessary for attainment.

### **Career and Technical Education**

- **9.3.12.AR-VIS.2:** Analyze how the application of visual arts elements and principles of design communicate and express ideas.
- **9.3.ST.4:** Understand the nature and scope of the Science, Technology, Engineering & Mathematics Career Cluster and the role of STEM in society and the economy.

### **Activities:**

- Draw technical real life objects using AutoCAD.
- Use basic modify, draw and inquiry tools in AutoCAD to accurately draw mechanical shapes to precision dimensions.
- Use basic draw and modify tools in AutoCAD to design an original drawing.
- Apply 3D CAD to extrude two-dimensional objects into 3D shapes.
- Students will complete exercises for learning AutoCAD commands.
- Students will use AutoCAD to create accurate two-dimensional representations of drawings assigned.
- Students will be asked to design and create projects of their own. By drawing common objects.

- Students will be asked to design and create original two-dimensional drawings for real life applications using CAD.
- Students will use the Internet to research elements of good logo design.

### **STEAM Activities:**

- Logo Duplication: Students will use AutoCAD to duplicate a professional logo by copying and pasting a logo in to AutoCAD. They will use the poly line tool to trace the logo and the poly edit and spline tool to modify the shape of their objects. They will use the gradient and hatch tool to fill in the logo with color and texture.
- Cell Phone Stand design: Students will use 3D CAD to extrude an original 2D design for a mini 3D printed stand. They will apply the design process, use a scale and caliper to create a real life size object.

### **Enrichment Activities:**

- Athletic Field: Students will use the drawing and modify tools including Mirror, Linier Array, and Rotate to create an athletic field.
- Snowflake: Students will use the Polar Array tool to create a snowflake. They will use the Gradient tool to fill in the snowflake with color. Logo Design: The students will design an original logo that represents them or their interests using AutoCAD. They will apply elements of good design. The logo will appear in their personalized title block.

### **Methods of Assessments/Evaluation:**

- Quizzes on measuring, dividing and using polar coordinates.
- Questions of the day. (Commands, careers & computer stations)
- AutoCAD drawing quiz, and vocabulary quiz.
- Peer evaluation of drawings.
- Assessment rubrics to ensure drawings meet the requirements specified.
- Students will be assessed on the accuracy and demeanor of their drawings.
- Students will complete assigned drawing by the determined due date.
- Students will keep a digital portfolio of their drawings.
- Students will make all necessary revisions for final flawless drawing to include in their digital portfolios.

### **Resources:**

- Digital handouts of 2D drawings references
- Textbooks: *Mechanical Drawing*, & *Basic Technical Drawing*
- Computers with AutoCAD installed
- Plotter/Printers
- 3D printer
- Projector and screen

- Calculator
- Rulers
- Calipers

**Online Resources:**

- Mr. D'n'T: <http://www.mr-dt.com/>
- Technology Student: <http://www.technologystudent.com/>
- Mr. Shohen's page: <http://www.glenridge.org/Page/3605>

**Logo Websites:**

- <http://www.slideshare.net/JeanisREALLYspecial/designing-a-logo-46075505>
- <http://justcreative.com/2009/07/27/what-makes-a-good-logo/>
- <http://www.mr-d-n-t.co.uk/graphics-logos.htm>
- <http://www.davidairey.com/5-vital-logo-design-tips/>
- <http://www.logodesignworks.com/blog/iconic-logos-vs-illustrative-logos>

**Cell Phone Stand:**

- <http://www.makexyz.com/3d-models-Cell-phone>
- <https://www.youtube.com/watch?v=GW6E24rh19w>

## Course Name

CAD I

## Topic/Unit:

3D CAD

Multi-View Projection & Dimensioning

**Approximate # Of Weeks: 4-5 Weeks**

### Essential Questions:

- How do multi-views of a pictorial drawing or object help in the manufacturing process?
- Why do orthographic projection views show the top view, front view and side view of objects?
- What methods can be used to create multi-view projections from objects or isometric drawings?
- What would happen if there were no dimensions on an engineering drawing?
- What would happen if you enter in accurate dimensions during the 3D modeling process?
- Why should you edit sketches instead of creating new sketches when fixing a mistake?
- Why are geometric constraints used to control two-dimensional sketches for three-dimensional drawing?

### Upon completion of this unit students will be able to:

- Transfer various isometric and two-dimensional drawings into three-dimensional objects for orthographic projections. (M.G-GMD.B.4)
- Draw and dimension technical objects using CAD software. (8.2.12.C.5)
- Draw real-life technologies to specific dimensions (i.e. iphone). (8.2.12.C.2)
- Use a computer generated model to create a new product. (8.2.12.D.3)
- Analyze and evaluate the correct way to dimension a drawing with ANSI drafting standards. (9.3.ST.6)
- Prepare drawings, three-dimensional models and layouts with decimal places and tolerances as it applies to the function of the part and the rest of the drawing. (9.3.ST.1)
- Design three-dimensional models to create custom-made technology. (9.3.12.AR-VIS.3)

### Interdisciplinary Standards

#### Math

- **M.G-GMD.B.4:** Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.

## **Technology**

- **8.2.12.C.5:** Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.
- **8.2.12.C.2:** Analyze a product and how it has changed or might change over time to meet human needs and wants.
- **8.2.12.D.3:** Determine and use the appropriate resources (e.g., CNC (Computer Numerical Control) equipment, 3D printers, CAD software) in the design, development and creation of a technological product or system.

## **Career and Technical Education**

- **9.3.12.AR-VIS.3:** Analyze and create two and three-dimensional visual art forms using various media.
- **9.3.ST.1:** Apply engineering skills in a project that requires project management, process control and quality assurance.
- **9.3.ST.6:** Demonstrate technical skills needed in a chosen STEM field.

## **Activities – include 21<sup>st</sup> Century Technologies:**

- Create and extrude 3D solid models.
- Draw three-dimensional objects using and edit parametric dimensions.
- Extrude a cut feature through a base feature.
- Extrude a cut feature to the next feature encountered.
- Students will use CAD produce several orthographic and isometric projections with increasing difficulties from 3D modeled parts.
- Students will be asked to design and create projects of their own. By drawing common objects.
- Students will create a series of CAD drawings with dimensions.
- Students will complete exercises in dimensioning.

## **STEAM Activities:**

- Cell phone improvement: Analyze a cell phone (iphone) and create an improvement to meet a want or need. How can you improve the form or function of the smart phone? Add an engineering change note to the final layout to note the change.
- Cell Phone Case: Using the 3D model of a cell phone create a new part in an assembly that will fit the dimensions of the phone and allow access to the buttons, speaker and ports. Add a personal design to the case and export it for the 3D printer. How does form follow function? Why is tolerance so important when fitting parts together?



**Enrichment Activities:**

- Multi-View CAD Drawings: Students will recreate multi-view drawings from a drafting textbook to include in their digital portfolio. Each drawing will be dimensioned using proper dimensioning rules.
- Isometric views of the same objects will be produced to be included in these drawings.
- Drawings should allow students to become familiar with creating a 3D parts from 2D sketches.
- Students should learn new processes of creating constraints, using dimensions and modifying dimension.
- Layout drawings should use centerlines, hidden lines, and dimensioning.
- Hand Tool Design: The students will design a tool using multi view projection. Tools will use geometric drawing to be extruded into 3D. Materials will be applied. The tool will be dimensioned in a multi-view layout.
- Jewellery Design: The students will design jewellery using multi view projection. Jewellery will use geometric drawings and be extruded into 3D. Materials will be applied. The jewellery will be dimensioned in a multi-view layout.

**Methods of Assessments/Evaluation:**

- Assessment rubrics to ensure drawings meet the requirements specified.
- Students will be assessed on the accuracy and layout of their drawings.
- Drawings will be assessed for proper dimensioning.
- Orthographic projection quiz: Missing view quiz.
- Practical quiz on layout and dimensioning.
- Discussion on the importance of good dimensioning practices.
- Peer evaluation of drawings with dimensions.

**Resources:**

- Digital Handouts of Isometric drawings references.
- Handouts on dimensioning and notes
- Handouts on dimensioning rules
- Textbooks: *Engineering Drawing And Design*, *Design Dimensioning And Tolerance & Mechanical Drawing*
- Computers with Autodesk Inventor installed
- Plotter/Printers
- 3D printer
- Projector and screen
- Calculator
- Rulers

- Calipers

**Online Resources:**

- Mr. D'n'T: <http://www.mr-dt.com/>
- Technology Student: <http://www.technologystudent.com/>
- Mr. Shohen's page: <http://www.glenridge.org/Page/3605>

Cell Phone Case:

- <http://www.instructables.com/id/How-to-create-your-own-3D-Printed-iPhone-Case-from/>

Jewellery

- <http://blog.ocad.ca/wordpress/gdes3b20-fw2011-01/about/>

## Course Name

CAD I

## Topic/Unit:

Auxiliary and Sectional Views

**Approximate # Of Weeks: 1-2 Weeks**

### Essential Questions:

- What is the purpose of using an auxiliary view of an object if you can provide an orthographic projection and an isometric view?
- How can auxiliary projections help in the creation of mechanical parts?
- How can a sectional view help in the creation of mechanical parts?
- How are auxiliary views used to show unseen sides of objects to detail their true shape and size?
- There are many ways to create an auxiliary view drawing using multiple CAD software.
- Why is a cutaway view sometimes required for additional information and dimensioning clarification when drawing mechanical parts?

### Upon completion of this unit students will be able to:

- Draw auxiliary projections of objects using the line of site perpendicular to the inclined surface of the object. (8.2.12.C.5)
- Use three-dimensional objects to produce drawings an auxiliary view and drawings with sectional views. (9.3.ST.6)
- Apply hidden lines, centerlines, and dimension lines in auxiliary view and sectional drawings. (M.G-CO.D.12)
- Draw full and half sectional views of an object by using cut planes. (M.G-GMD.B.4)
- Draw real life technical objects that are on non-perpendicular angles and objects that can be detailed with a section view. (9.3.MN.6)

### Interdisciplinary Standards

#### Math

- **M.G-GMD.B.4:** Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.
- **M.G-CO.D.12:** Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.).

#### Technology

- **8.2.12.C.5:** Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.

### **Career and Technical Education**

- **9.3.MN.6:** Demonstrate workplace knowledge and skills common to manufacturing.
- **9.3.ST.6:** Demonstrate technical skills needed in a chosen STEM field.

### **Activities – include 21<sup>st</sup> Century Technologies:**

- Students will recreate auxiliary view and sectional view drawings from a drafting textbook to include in their digital portfolio. Each drawing should be dimensioned using proper dimensioning rules.
- Drawings should allow students to become familiar with the process of creating 2D representations of auxiliary views.
- Part design: Students can re-create a small part or ornament using precision measurement tools (calipers) to be printed using the dimension printer.

### **STEAM Activities:**

- Section it: Use the small part in the previous unit (tool or Jewellery) to create a section view to show to inner workings of the part.
- Auxiliary View Students will measure and draw common objects with angles that require an auxiliary view. Example objects could be a flip phone, stapler, or kickstand for a cell phone case or tablet. Add materials and render the object.

### **Enrichment Activities:**

- Students will measure and draw common objects that require a section view. Example objects could be a caster, piston, or writing instrument.
- Sample drawings for each assigned project and each assigned drawing.
- Sample real life objects for the students to draw.

### **Methods of Assessments/Evaluation:**

- Assessment rubrics to ensure drawings meet the requirements specified.
- Students will be assessed on the accuracy and layout of their drawings.
- Sectional and auxiliary drawing quizzes.
- Peer evaluation of drawings.
- Students will complete self-assessments prior to submitting drawings.

### **Resources:**

- Digital Handouts of Auxiliary and Section drawings references.
- Textbooks: *Engineering Drafting And Design, Dimensioning and tolerance Mechanical Drafting, AutoCAD and its applications*
- Computers with AutoCAD and Inventor installed
- Plotter/Printers
- 3D printer
- Projector and screen

- Calculator
- Rulers
- Calipers

**Online Resources:**

- Mr. Shohen's page: <http://www.glenridge.org/Page/3605>
- <http://slideplayer.com/slide/4645606/>
- <http://slideplayer.com/slide/4714595/>

## Course Name

CAD I

## Topic/Unit:

Advanced 3D CAD Operations

**Approximate # Of Weeks: 6 Weeks**

### Essential Questions:

- How has parametric modeling with advanced 3D software changed the drafting industries?
- Why should you choose to use a modeling program that allows for editing of each step when creating a mechanical part?
- Why should you delete unused sketches when using a 3D modeling program?
- Why are geometric constraints used to control two-dimensional sketches for three-dimensional drawing?
- Why are assembly drawings so useful to the manufacturing process?
- Why is communication during the manufacturing process so important?
- What would happen if the world didn't have standard threads?

### Upon completion of this unit students will be able to:

- Create and extrude 3D solid models and shell parts for the 3D printer. (8.2.12.D.3)
- Draw three-dimensional objects using and edit parametric dimensions. (8.2.12.C.5)
- Use Inventor to produce mechanical parts and assemblies of parts at a geometric level. (M.G-MG.A.1)
- Add threads and coils to parts to create screws, bolts and other hardware or assembly of parts. (9.3.MN.6)
- Assemble parts: use mate surfaces and align surfaces. (8.2.12.C.4)
- Inserts screws and create assemblies of mechanical systems. (8.2.12.C.3)
- Discover the basics of how parts are manufactured and how they fit together to form a working group. (8.2.12.D.5)
- Show mechanical motion and part interaction by creating surface contacts. (9.3.ST.1)

### Interdisciplinary Standards

#### Math

- **M.G-MG.A.1:** Use geometric shapes, their measures, and their properties to describe objects.

#### Technology

- **8.2.12.C.3:** Analyze a product or system for factors such as safety, reliability, economic considerations, quality control, environmental

concerns, manufacturability, maintenance and repair, and human factors engineering (ergonomics).

- **8.2.12.C.4:** Explain and identify interdependent systems and their functions.
- **8.2.12.C.5:** Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.
- **8.2.12.D.3:** Determine and use the appropriate resources (e.g., CNC (Computer Numerical Control) equipment, 3D printers, CAD software) in the design, development and creation of a technological product or system.
- **8.2.12.D.5:** Explain how material processing impacts the quality of engineered and fabricated products.

### **Career and Technical Education**

- **9.3.MN.6:** Demonstrate workplace knowledge and skills common to manufacturing.
- **9.3.ST.1:** Apply engineering skills in a project that requires project management, process control and quality assurance.

### **Activities:**

- The Paramedic Modeling textbook can be used for basic tutorials of how to draw three- dimensional parts, shelling parts assemblies and working drawings.
- Pats can be drawn from the Parametric Modeling Text or the Engineering Drawing and design Text.
- Drawings should allow students to become familiar with using the model browser tool bar for modifications.
- Drawings should allow students to become familiar with the process of creating a 2D sketch and extruding the sketch to 3D.
- Drawings will support advanced 3D CAD concepts of shelling, threading, coiling, sweep, loft assembling and creating mechanical motion.

### **STEAM Activities:**

- Ornament: Students will create a shelled 3D printed ornament. They will calculate the volume of the part before and after the shell operation and compare the reduction of materials needed for the part.
- Product Re-Design: The students will re-design an existing product to enhance its capabilities. Students can also invent a new product.

### **Enrichment Activities:**

- Sample drawings for each assigned project and each assigned drawing.
- Sample real life objects for the students to draw.

- Crane hook: Students will draw parts for a crane hook and assemble parts. This teaches sweep, loft, revolve, threading and other advanced 3D modeling procedures.

**Methods of Assessments/Evaluation:**

- Assessment rubrics to ensure drawings meet the requirements specified.
- Students will be assessed on the accuracy and layout of their drawings.
- Peer evaluation of pictorial and 3D drawings.
- A benchmark project will be assigned to evaluate if students can apply 2D CAD sketching and 3D CAD in the creation of an original product.

**Resources:**

- Digital Handouts of drawings and procedures.
- Textbooks: *Engineering Drafting And Design, Dimensioning and tolerance Mechanical Drafting, AutoCAD and its applications*
- Computers with AutoCAD and Inventor installed
- Plotter/Printers
- 3D printer
- Projector and screen
- Calculator
- Rulers
- Calipers

**Online Resources:**

- Mr. Shohen's page: <http://www.glenridge.org/Page/3605>  
Ornament challenge:
- <https://www.whitehouse.gov/blog/2014/12/03/announcing-winners-first-ever-white-house-3d-printed-ornament-challenge>
- <https://go-3dprint.com/product/p3006>  
Crane Hook:
- <https://grabcad.com/library/crane-hook-assembly-3>



## **Course Name**

CAD I

## **Topic/Unit:**

Residential Architecture

**Approximate # Of Weeks: 9-10 Weeks**

### **Essential Questions:**

- How does CAD affect an architectural plan?
- How do architects design for modern society?
- How do building codes affect the art of architectural design?
- What identifies a good design as it relates to residential architecture?
- What construction material are the best material for the job?
- Are green building materials always the best materials to use?
- How are electrical schematics used for residential floor plans?
- Why should you follow building codes when placing switches, lights, and outlets on a floor plan?
- What is the working triangle?
- How does the work triangle affect the layout of the kitchen?
- How do building codes affect the design and layout of bathrooms?

### **Upon completion of this unit students will be able to:**

- Produce architectural drawings utilizing appropriate Computer Aided Drafting and Design software. (9.3.12.AC.6)
- Draw and dimension a residential building from the foundation to the roof. (9.3.12.AC.2)
- Identify common residential architectural styles. (9.3.12.AC.4)
- Insert walls, windows, doors, roofs, and many others building materials into a CAD drawing. (9.3.12.AC-DES.8)
- Draw an electrical schematic plan for a residential house. (9.3.12.AC.1)
- Create a legend for the electrical schematic plan. (9.3.12.AC.1)
- Generate interior and exterior elevation drawings and sketches. (9.3.12.AC-DES.6)
- Use appropriate building materials and common architectural themes when designing interior and exterior spaces. (9.3.12.AC-DES.7)
- Construct a kitchen plan identifying the work triangle appliances and electrical needs considering the human factors. (8.2.12.C.3)
- Construct bathroom plans including ½ bath, full bath, and master bathroom that follow building codes for proper locations of fixtures and electrical schematics. (9.3.12.AC.3)

## **Interdisciplinary Standards:**

### **Technology**

- **8.2.12.C.3:** Analyze a product or system for factors such as safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, and human factors engineering (ergonomics).

### **Career and Technical Education**

- **9.3.12.AC.1:** Use vocabulary, symbols and formulas common to architecture and construction.
- **9.3.12.AC.2:** Use architecture and construction skills to create and manage a project.
- **9.3.12.AC.3:** Comply with regulations and applicable codes to establish and manage a legal and safe workplace.
- **9.3.12.AC.4:** Evaluate the nature and scope of the Architecture & Construction Career Cluster and the role of architecture and construction in society and the economy.
- **9.3.12.AC.6:** Read, interpret and use technical drawings, documents and specifications to plan a project.
- **9.3.12.AC-DES.6:** Apply the techniques and skills of modern drafting, design, engineering and construction to projects.
- **9.3.12.AC-DES.7:** Employ appropriate representational media to communicate concepts and project design.
- **9.3.12.AC-DES.8:** Apply standards, applications and restrictions pertaining to the selection and use of construction materials, components and assemblies in the project design.

### **Activities – include 21<sup>st</sup> Century Technologies:**

- Students will research architectural styles common to the area.
- Students will use sample drawings of floor plans to be recreated using a CAD architecture program.
- Students will create a series of architectural drawings including floor plans, electrical plans kitchens, bathrooms and elevations.
- Students will complete exercises for developing design skills in architecture.

### **STEAM Activities:**

- **Bathroom Design:** Students will design a bathroom that has both function and form while still meeting local building code requirements. The interior space will be rendered.
- **Kitchen Design:** Students will design a kitchen renovation following local building codes and the minimum requirements for the work triangle. Students will build a foam model of the kitchen to display to the client their plan for the renovation.

**Enrichment Activities:**

- Students will research common architectural styles by using house plans web sites and the *Architecture Residential Drafting and Design* textbook.
- Students will research electrical codes for residential buildings.
- Students will use online resources to develop an understanding of the work triangle and kitchen designs.
- Students will use on line resources to identify building codes for bathrooms for proper placement of plumbing and electrical fixtures.
- Sample architectural plans may be shown to display real life working architectural drawings.
- Drawings will include design a house showing floor plans, electrical plans and schematic charts, kitchen plans with detail elevations, bathroom plans and exterior elevations.

**Methods of Assessments/Evaluation:**

- Performance-based assessment on architectural standards and building codes as used in industry.
- Assessment on the creation of detailed drawings in the following areas:
  1. Floor Plans
  2. Electrical Plans and ledges.
  3. Detailed wall elevation.
  4. Kitchen Plans incorporating the work triangle
  5. Bathroom plans
  6. Exterior elevation drawing of residential structures
- Quizzes —Architectural styles, Kitchens, Bathrooms and electrical codes.

**Resources:**

- Digital Handouts of drawings and procedures.
- Textbooks: *Architecture Residential Drafting and Design*
- Computers with AutoCAD, AutoCAD Architecture and Rivet installed
- Plotter/Printers
- 3D printer
- Projector and screen
- Calculator
- Rulers
- Foam core
- Balsa wood
- Modeling tools

**Online Resources:**

- Mr. Shohen's page: <http://www.glenridge.org/Page/3605>
- Revit City: <http://www.revitcity.com/index.php>
- Autodesk Seek: <http://seek.autodesk.com/>
- House Plans: <https://www.houseplans.com/>

- Bathroom Design Rules:  
[http://starcraftcustombuilders.com/bath.design.rules.htm#.V6t-iSMrK\\_E](http://starcraftcustombuilders.com/bath.design.rules.htm#.V6t-iSMrK_E)
- Kitchens Design and Codes:  
[http://starcraftcustombuilders.com/kitchen.design.rules.htm#.V6t-2CMrK\\_E](http://starcraftcustombuilders.com/kitchen.design.rules.htm#.V6t-2CMrK_E)

## **Course Name**

CAD I

## **Topic/Unit:**

Survey, Framing & Modeling

**Approximate # Of Weeks: 9-10 Weeks**

### **Essential Questions:**

- How do surveyors affect the world's landscape?
- How is Autodesk Revit used to produce a modern survey?
- How can Global Positioning Satellites (GPS) affect modern surveying?
- How are topography drawings created using CAD?
- Why do surveyors use degrees, minutes and seconds for the unit of measurement?
- How do framing plans help in the creation of a structure?
- What is the purpose of a section view drawing?
- How can you determine the proper width and depth for foundation walls?
- What would happen if building did not use footing?
- Why do architects create models of structures?

### **Upon completion of this unit students will be able to:**

- Create formal survey drawings from an engineer's sketch. (M.G-MG.A.3)
- Draw common site plan details including exterior items such as decks, fences, trees, shrubs, driveways and walkways using CAD software. (9.3.12.AC.3)
- Import terrain from GPS to a CAD drawing to accurately create foundation plans. (9.3.12.AC.2)
- Annotate the property lines using use degrees, minutes and seconds.
- Use common architectural scales when plotting. (9.3.12.AC.1)
- Create a foundation plan showing masonry walls, foundations, footings, support beams, and columns. (9.3.12.AC-DES.8)
- Create a detailed section view of a house from the footing to the roof. (9.3.12.AC.6)
- Annotate a detailed section view by providing labels of all construction materials (9.3.12.AC-DES.8)
- Create a framing plan for floors, walls, and truss roofs for residential structures. (9.3.12.AC-DES.6)
- Identify structural members in a framing plan to gain an understanding of the framing process. (9.3.12.AC-DES.7)
- Build models of residential structures from the foundation footing to the roof. (9.3.12.AC-CST.7)

## **Interdisciplinary Standards:**

### **Math**

- **M.G-MG.A.3:** Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).★

### **Career and Technical Education**

- **9.3.12.AC.1:** Use vocabulary, symbols and formulas common to architecture and construction.
- **9.3.12.AC.2:** Use architecture and construction skills to create and manage a project.
- **9.3.12.AC.3:** Comply with regulations and applicable codes to establish and manage a legal and safe workplace.
- **9.3.12.AC.6:** Read, interpret and use technical drawings, documents and specifications to plan a project.
- **9.3.12.AC-CST.7:** Compare and contrast the building systems and components required for a construction project.
- **9.3.12.AC-DES.6:** Apply the techniques and skills of modern drafting, design, engineering and construction to projects.
- **9.3.12.AC-DES.7:** Employ appropriate representational media to communicate concepts and project design.
- **9.3.12.AC-DES.8:** Apply standards, applications and restrictions pertaining to the selection and use of construction materials, components and assemblies in the project design.

### **Activities – include 21<sup>st</sup> Century Technologies:**

- Students will use survey units in the creation of a survey plan.
- Students will use GPS information to import a site plan from the Internet.
- Students will draw a site plan, foundation plan, framing plan, roof truss plan, and a section plan.
- Students will construct an architectural model using CAD created framing plans.

### **STEAM Activities:**

- **Tiny House:** Students will design and create a framing model of a basic residential structure to enhance their understanding of the construction process. The design should meet residential building codes while still using good elements of design and common architectural themes. The model will include framed walls, window and door openings and roof trusses.

### **Enrichment Activities:**

- Students will complete CAD exercises to learn how to draw a survey plan using degrees, minutes and seconds.
- Students can use Google Earth and Google sketch up to import terrain created by GPS elevations.
- Sample drawings of survey plans will be provided to show the house, driveway, landscaping, setbacks, easements, north system with bearings,
- Sample models of traditional wall framing will be provided to detail the materials and parts of a stick framed house.
- Students will use online resources to develop an understanding of the section view.
- Sample architectural plans detailing the section view may be used as an aid to explain and display real life working architectural drawings.

#### **Methods of Assessments/Evaluation:**

- Performance-based assessment on architectural standards and building codes as used in industry.
- Assessment on the creation of detailed drawings in the following areas:
  1. Survey Plans including labeled property lines and elevations.
  2. Site plans with exterior components common to residential homes.
  3. Foundation Plans
  4. Detailed section views with labeled building materials.
  5. Framing plans of walls, floors, and truss roofs.
- Quizzes —Detailed section view foundation walls and framed walls.

#### **Resources:**

- Digital Handouts of drawings and procedures.
- Textbooks: *Architecture Residential Drafting and Design*
- Computers with AutoCAD, AutoCAD Architecture and Rivet installed
- Plotter/Printers
- 3D printer
- Projector and screen
- Calculator
- Rulers
- Calipers

#### **Online Resources:**

- Mr. Shohen's page: <http://www.glenridge.org/Page/3605>
- Google Sketch Up: <http://www.sketchup.com/>
- Google Earth: <https://www.google.com/earth/>
- House Plans: <https://www.houseplans.com/>
- Tiny house floor plans:  
<http://www.eplans.com/house-plans/epl/collections/tiny-homes.html>