

Glen Ridge Public Schools –Visual & Performing Arts Curriculum



Course Title: CAD II

Subject: Visual and Performing Arts

Grade Level: 10-12

Duration: Full year

Prerequisite: CAD I

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:

Upon the successful completing of Computer Aided Design & Drawings I, students may continue to develop their knowledge and skill in preparing a foundation for careers in engineering, architecture, industrial design and construction. Areas of study will include pictorial drawings, auxiliary, sectioning, assembly, working and detail drawing, architectural planning and construction drawing. Autodesk AutoCAD, Inventor, and Revit software will be utilized during this course. Students who wish to proceed further will enroll in CAD III where they will broaden their knowledge of CAD.

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Date Submitted: Summer 2016

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1	Review of CAD	4 Weeks
2	Design Fundamentals	6 Weeks
3	3D Modeling and Layouts	5 Weeks
4	Mechanical Design	5 Weeks
5	Residential Architectural Design	10 Weeks
6	Commercial Architecture	10 Weeks

Course Name

CAD II

Topic/Unit:

Review of CAD

Approximate # Of Weeks: 3-4 Weeks

Essential Questions:

- How do the rules of geometry affect a CAD drawing?
- How can the use of shortcuts and particular commands help in the efficiency of producing CAD drawings?
- What would happen in the manufacturing process if the design did not include specific dimensions?
- Why are accurate 2D drawings so important in the creation of 3D models?
- How can 3D modeling and mechanical design expand your career opportunities?

Upon completion of this unit students will be able to:

- Understand the method of retrieving private files through the public network and have a positive approach to original design. (8.1.12.D.1)
- Draw and dimension 2D mechanical parts with increasing difficulty and apply shortcut functions in CAD. (8.2.12.C.5)
- Apply geometric concepts and constraints to 2D drawings to solve technical problems. (M.G-MG.A.3)
- Demonstrate an understanding of mathematic principles as they relate to a CAD drawing. (M.G-MG.A.1)
- Use Boolean operations; extrude 2D drawing in to 3D models for the creation of a product. (8.2.12.D.3)
- Compare and contrast 2D CAD with 3D CAD systems in terms of skills and career paths. 9.2.12.C.3
- Apply the design process in the creation of prototypes to solve real-life technical problems. (8.2.12.D.1)
- Apply good elements of design when creating an original logo or products. (9.3.12.AR-VIS.2)
- Use arrays in the creation of a tessellation. (M.G-CO.A.5)
- Understand how CAD and 3D modeling plays a critical role in designing solutions for STEM-related careers. (9.3.ST.4)
- Design three-dimensional models that have both function and form. (9.3.12.AR-VIS.3)

Interdisciplinary Standards

Math

- **M.G-CO.A.5:** Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing

paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.

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

Technology

- **8.1.12.D.1:** Demonstrate appropriate application of copyright, fair use and/or Creative Commons to an original work.
- **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.
- **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.

21st Century Life and Careers

- **9.2.12.C.3:** Identify transferable career skills and design alternate career plans.

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.
- **9.3.12.AR-VIS.3:** Analyze and create two and three-dimensional visual art forms using various media.
- **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:

- Students will review procedures for creating a CAD drawing.
- Students will apply shortcuts and specific operations to enhance their skills and efficiency when producing a CAD drawing.
- Students will use geometric concepts and constraints when producing advanced two-dimensional drawings.
- Students will extrude two-dimensional drawings into three-dimensional models.

STEAM Activity:

- Ear bud holder: Design a simple ear bud holder that allows for portability, secure connections with ear buds, the entire cord to wind and unwind quickly and the ability to be fastened to ones clothing.

Enrichment Activities:

- Sample drawings for each assigned drawing will be used.
- Drawings will be use to enhance student's knowledge of CAD operations.
- Drawings should use layers for centerlines, hidden lines, extension lines and dimensioning.
- Sample real life objects will be used to that the students are drawing.
- Athletic field: Students will draw a one-point perspective view of an athletic field. Students will design an original team logo for the field.
- Tessellation: Students will design an original tessellation. This drawing will use the linear array function.

Methods of Assessments/Evaluation:

- Quizzes on measuring, dividing and decimal equivalencies.
- 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 proper use of dimensions in 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*, & *Technical Drawing*
- 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/3606>
- Ear bud holder:
 - <http://www.instructables.com/id/3D-Printed-Earbud-Compact/>
 - <http://www.businesswire.com/news/home/20160127006412/en/Stratasys-Announces-3D-Printing-Education-Modules-Middle>
 - <http://www.shapeways.com/marketplace/?tag=earphones>

- <http://www.core77.com/posts/27946/Designing-for-Earbud-Cord-Control>

Course Name

CAD II

Topic/Unit:

Design Fundamentals

Approximate # Of Weeks: 5-6 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?
- 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 should you delete unused sketches when using a 3D modeling program?
- How do multi-views of a 3D model help in the manufacturing process?
- How can a 3D modeling program produce an isometric view drawing?
- How can a section view drawing be used to show internal details of parts?
- How does 3D modeling effect the ability to create an auxiliary view for a layout?

Upon completion of this unit students will be able to:

- Create and extrude 3D mechanical parts and edit parametric dimensions. (8.2.12.C.5)
- Assemble parts by aligning planes mating surfaces and inserting. (8.2.12.C.4)
- Produce mechanical motion and part interaction by creating surface contacts. (9.3.ST.1)
- Use parametric modeling software to transfer drawing from the textbook to the computer program. (8.2.12.D.3)
- Build technical vocabulary by understanding key terms used in CAD and geometry. (M.G-MG.A.1)
- Draw and dimension mechanical parts and assembled parts. (8.2.12.C.5)
- Design and manufacture a prototype of a product and provide a description of how the product could be manufactured. (8.2.12.D.1)
- Draw real life objects that can be full and half sectioned by using cut planes. (M.G-GMD.B.4)
- Draw real life technical objects that are on non-perpendicular angles. (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-MG.A.1:** Use geometric shapes, their measures, and their properties to describe objects.

Technology

- **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.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.
- **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.

Activities:

- Draw a two-dimensional sketch using the draw and modify tool bars.
- Apply dimensions, and geometrical constraints to the sketch.
- Finish the sketch and extrude to a three-dimensional object.
- Add hole by extruding circles as a cut through the object.
- Draw practice parts (i.e. Soma Cube, Lego Brick, 6 sided die and caterpillar gears)
- Open the drawing in a tile block showing orthographic and isometric projections and assign dimensions.
- Students will use parametric modeling software to draw sectional views of objects with increasing difficulties.
- Students will use parametric modeling software to draw auxiliary projections of objects with increasing difficulties.
- Multi-View CAD Drawings: Students will recreate multi-view drawings from a drafting textbook to include in their portfolio. Each drawing will be dimensioned using proper dimensioning rules.

STEAM Activities:

- Car Design: The students will design a detailed drawing of a car using multi view projection and dimensioning.
- Pull toy: Students will design and create a prototype of a pull toy that produces a mechanical motion using the 3D printer or CNC machine. Then provide a description of how the product could be manufactured in a state-of-the-art American manufacturing facility.

Enrichment Activities:

- Sample drawings for each assigned project and each assigned drawing.
- Sample real life objects for the students to draw.
- The Paramedic Modeling text can be used for basic tutorials of how to draw three- dimensional parts.
- Pats can be drawn from the Parametric Modeling Text or the Engineering Drawing and design Text.
- Each drawing should be dimensioned using proper dimensioning rules.
- 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.

Methods of Assessments/Evaluation:

- Applying parametric modeling for an original design.
- Quizzes on technical drawings form the Parametric Modeling Text.
- Questions from each chapter of the Parametric Modeling text.
- Peer evaluation of drawings.
- Assessment rubrics to ensure drawings meet the requirements specified.
- Students will be assessed on the accuracy and proper use of dimensions in 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 drawings and procedures.
- Parametric Modeling Textbook.
- Textbooks: *Mechanical Drafting*, *Technical Drawing: Engineering Drafting And Design*.
- 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/3606>

Pull Toy:

- http://tsa.mountainview.groupfusion.net/modules/locker/files/get_group_file.php?gid=4786004&fid=29485527
- <http://www.instructables.com/id/3D-printed-pullback-toy-car/>

Puzzle:

- <https://www.youtube.com/watch?v=9ngzN2RQEtM>
- <http://www.instructables.com/id/3d-printed-puzzle/>

Course Name

CAD II

Topic/Unit:

3D Modeling and Layouts

Approximate # Of Weeks: 4-5 Weeks

Essential Questions:

- What would happen if there were no way to set up a drawing?
- Why are assembly drawings so useful to the manufacturing process?
- What are the advantages to prototyping assembly models?
- Why is communication during the manufacturing process so important?
- What would happen if the world didn't have standard threads?
- How can one use 3D CAD to create a surface development for sheet metal parts?
- What kinds of projects are made from surface development drawings?

Upon completion of this unit students will be able to:

- Draw advanced 3D solid models using sweeps, lofts and arrays to produce accurate representations of objects. (9.3.12.AR-VIS.3)
- Create sheet metal parts through the use of surface development. (M.G-MG.A.1)
- Create treads by applying bitmap surfaces to holes and shafts. (9.3.MN.6)
- Create threads by using the coil cut command to create screws, bolts and other hardware or assembly of parts. (9.3.MN.6)
- Design and prototype products that use threads and coils. (8.2.12.D.3)
- Draw and assemble 3D solid models from several smaller parts. (8.2.12.C.4)
- Import hardware into assembled drawings using the content browser. (9.3.12.AC-DES.8)
- Dimension assembled drawings and use callout notes to identify thread sizes. (8.2.12.C.5)
- Communicate with peers to design an original mechanical device or re-create an existing mechanical device. (8.2.12.D.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.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.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.
- **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.
- **9.3.12.AC-DES.8:** Apply standards, applications and restrictions pertaining to the selection and use of construction materials, components and assemblies in the project design.
- **9.3.MN.6:** Demonstrate workplace knowledge and skills common to manufacturing.

Activities:

- Students will use modeling software to create advanced 3D parts of increasing difficulty.
- Students will use 3D CAD to produce sheet metal parts and layouts for fabrication.
- Students will create parts with threads using ANSI standards.
- Students will use surface and geometric constraints to bring together 3D parts in to an assembled drawing.

STEAM Activity:

- Draw it: Students will use calipers to measure and draw a remote calculator or other technology to produce a properly dimensioned orthographic layout of a technical object.
- Bottle design: Students will design a bottle with a screw cap to reinforce concepts of threading for precise fit. This can be any design with the objective of creating two threaded parts that screw together.

Enrichment Activities:

- The *Paramedic Modeling* text can be used for basic tutorials of how to draw advanced three-dimensional parts using the loft, revolve and sweep commands. Parts include: Hair Dryer, and Cooling Fan Cover.
- Pats can be drawn from the *Parametric Modeling* Text or the *Engineering Drawing and Design* Text.
- Students can recreate parts from the *Parametric Modeling* Text or the *Engineering Drawing and Design* text to be assembled and include in their

digital portfolio. Each drawing should be dimensioned using proper dimensioning rules.

- Product Re-Design: The students will re-design an existing product to enhance its capabilities. Students can also invent a new product. Students may participate in the Stratasys Extreme Re-design Challenge.

Methods of Assessments/Evaluation:

- Assembly quiz, quizzes on terminology use assembly views, and questions from text.
- ANSI quiz on threads.
- Assessment rubrics to ensure drawings meet the requirements specified.
- Students will be assessed on the accuracy and proper use of dimensions in 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 drawings and procedures.
- Parametric Modeling Textbook: *Parametric Modeling with Autodesk Inventor*
- Textbooks: *Mechanical Drafting, Technical Drawing: Engineering Drafting And Design.*
- 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/3606>
- Bottle Cap: <http://www.fastcoexist.com/3029643/high-school-students-come-up-with-a-genius-plan-for-getting-ketchup-out-of-the-bottle>
- Screws: https://www.youtube.com/watch?v=uc2Z-_zzIA8
- Re-Design: <http://www.stratasys.com/extremeredesign>

Course Name

CAD II

Topic/Unit:

Mechanical Design

Approximate # Of Weeks: 4-5 Weeks

Essential Questions:

- What skills are needed for a mechanical engineer or industrial designer?
- What would happen if the world didn't have the American Design Drafting Association (ADDA)?
- Why is communication with peers during the manufacturing process so important?
- Why are presentations used to show the interactions between parts?
- Should one understand the importance of an exploded view, parts list and a bill of material?
- What is the purpose of creating an engineering change notices (ECN)?

Upon completion of this unit students will be able to:

- Create appropriate views, exploded views and a parts list for assembly drawings and produce balloons for individual parts for presentation purposes. (8.2.12.C.5)
- Determine what notes are necessary for an industrial drawing and identify the method for completing engineering change notices (ECN). (9.3.MN.6)
- Draw real-life mechanical devices and group parts together on an assembly drawing with an identification numbering system. (8.2.12.C.6)
- Design devices that use mechanical motion to prototype working design. (8.2.12.D.3)
- Design devices that have both form and a function. (9.3.12.AR-VIS.3)
- Demonstrate mathematics knowledge and skills required to produce a mechanical motion through an assembly working drawing. (M.G-MG.A.3)
- Develop and deliver a presentations using CAD software to engage and inform audiences. (9.3.ST.1)
- Work with a team to establish goal and set a timeline to complete the assigned drawings and project. (8.2.12.D.1)

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).*

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.6:** Research an existing product, reverse engineer and redesign it to improve form and function.
- **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.
- **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.MN.6:** Demonstrate workplace knowledge and skills common to manufacturing.

Activities:

- Students will work in groups to create an assembly working drawing of a mechanical part.
- Students will use CAD software to assemble each part and create working drawings.
- Students will use CAD software to produce an exploded assembly view of the device. Each part should be numbered with balloons.
- Students will create a parts list on the final drawing.
- Students will present the drawing through animation of the working parts and a final print using the dimension three-dimensional printer.
- Students will create parts with threads using ANSI standards.

STEAM Activities:

- **Marble Machine:** Students will create a continuous motion device for a marble mover that uses a track and retrieving device with gears.
- **Assembly Modeling:** As part of a team the students will choose a mechanical device that can produce motion. The device can be recreated by using calipers or existing dimensions from a textbook or handouts. The students will use 3D modeling software to draw parts individually to be assembled as a team. The final presentations should include orthographic views, Sectional or auxiliary views, an Isometric view, exploded assembled view with a parts list and an animation with a presentation of the working device. The device can be printed using the

three-dimensional printer as a fully functional part or to be assembled using hardware.

- Mechanical devices can incorporate an electric motor to show motion for the prototype.

Enrichment Activities:

- Sample drawings for each assigned project and each assigned drawing.
- Sample real life objects for the students to draw.
- Drawings should allow students to become familiar with assembling parts and creating presentation of animation and exploded views.
- Drawings should allow students to become familiar with the process of creating a mechanical part with motion
- Wind Turbine Parts: The students can use the parts drawn from the previous unit to be assembled in order to create a wind turbine. The wind turbines can be placed in a presentation in order show basic motion of parts.

Methods of Assessments/Evaluation:

- Working drawing quiz, quizzes on terminology use in working drawings and questions from text.
- Assessment rubrics to ensure drawings and projects meet the requirements specified.
- Students will be assessed on the accuracy and proper use of dimensions in their drawings analog with the creation of parts lists and balloons.
- 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 drawings and procedures.
- Parametric Modeling Textbook: *Parametric Modeling with Autodesk Inventor*
- Textbooks: *Mechanical Drafting, Technical Drawing: Engineering Drafting And Design.*
- 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/3606>

- Assembly Drawing:
<https://knowledge.autodesk.com/support/inventor-products/getting-started/caas/CloudHelp/cloudhelp/2015/ENU/Inventor-Tutorial/files/GUID-D50A28EC-D62A-4FEA-9D01-C131B499357C-htm.html>
- Marble Mover:
<https://www.youtube.com/watch?v=zhVQzKZB72Q>
https://www.youtube.com/watch?v=xprwGhcB_T8
<https://www.youtube.com/watch?v=yLUop-sodKQ>

Course Name

CAD II

Topic/Unit:

Architectural Design

Approximate # Of Weeks: 9-10 Weeks

Essential Questions:

- How have modern CAD systems and the use of Building Information Modeling (BIM) allowed the client to be more influential in the design process of the building?
- How do modern architecture programs allow for more efficiency in the creation of floor plans, elevations, 3D renderings, and section views?
- What career opportunities may this course lead someone?
- How does an architect start a drawing?
- How do national and local building codes affect an architectural plan?
- Are there many standards in the architectural field?
- What types of designs/details are necessary on an architectural plan?
- What is the advantage of using existing house plans when designing your own home?

Upon completion of this unit students will be able to:

- Use an architectural designing program to draw and dimension a residential building from the foundation to the roof. (9.3.12.AC.2)
- Understand how modern architectural 3D modeling equipment is used to design residential homes. (9.3.12.AC.6)
- Identify and draw various architectural styles and roof styles. (9.3.12.AC.4)
- Generate interior and exterior elevation drawings. (9.3.12.AC-DES.6)
- Construct a table for window and door schedules. (9.3.12.AC-CST.4)
- Draw an electrical schematic plan for a residential house. (9.3.12.AC.1)
- Create a ledger for the electrical schematic plan. (9.3.12.AC.1)
- Construct a plot and survey plan by manually entering in elevations. (M.G-MG.A.3)
- Import terrain from Google earth GPS elevations. (9.3.12.AC.2)
- Design a working kitchen plan with appliances, task lighting and electrical required needs. (8.2.12.C.3)
- Follow local and national building codes when designing a residential floor plan. (9.3.12.AC-DES.4) & (9.3.12.AC.3)
- Import components into the plan from inside the program and from on line resources. (9.3.12.AC-DES.8)
- Create interior and exterior renderings of spaces. (9.3.12.AR-VIS.3)
- Use appropriate building materials and common architectural themes when designing and building interior and exterior spaces. (9.3.12.AC-DES.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).★

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.4:** Apply building codes, laws and rules in the project design.
- **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.
- **9.3.12.AR-VIS.3:** Analyze and create two and three-dimensional visual art forms using various media.

Activities:

- Students will create a series of architectural drawings to become failure with using a specific architecture program.
- Students will complete exercises for developing design skills in architecture.
- Students will complete classroom exercises on architectural details.
- Students will design residential structures for specific client needs.

- Students will redesign spaces for specific client needs.
- Students will design and draw architectural plans and construct models from the plans.

STEAM Activity:

- Architectural feature: Given a basic residential model students will design and construct a scale model of an architectural feature to add on to the house. The feature should follow the same design theme for the home.
- Scale Residential Model: Following a theme, students will develop a set of architectural plans and related materials for an architectural renovation design challenge and construct a physical, as well as a computer-generated model, to accurately depict their design.

Enrichment Activities:

- Sample drawings for each assigned project and each assigned drawing.
- Sample model for the students to use as examples.
- Real life architectural plans may be shown to display working architectural drawings.
- Design a house showing – (floor plans, elevations, section views, detail views and window and door schedules)
- Designing an electrical schematic system for a house that shows switches, outlets, GFCI outlets, lighting, wire, smoke detectors, phone jacks and the power panel.
- Creating a scale model of the house that utilizes the plotted floor plan in the construction.

Methods of Assessments/Evaluation:

- Performance-based assessment on architectural standards as used in industry.
- Assessment on the creation of detailed drawings in the following areas:
 1. Foundation
 2. Footing and floor plan
 3. Electrical Plans and ledges.
 4. Kitchen Plans incorporating the work triangle
 5. Bathroom design following building codes for minimum distances.
 6. Detailed wall section with building materials
 7. Roof structure plan showing slope
 8. Elevations
 9. Building to be placed on Civil Engineering/Survey plot plan assignment.
 10. Detailed rooms
 11. Render drawing of building
- 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/3606>
- 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
- Kitchens Design and Codes:
http://starcraftcustombuilders.com/kitchen.design.rules.htm#.V6t-2CMrK_E

Foam Modeling:

- <https://www.pinterest.com/pin/188517934375114846/>
- <https://www.youtube.com/channel/UCb5TRJQQDUFDbIVYbTGvh8w>

TSA:

- http://tsa.mountainview.groupfusion.net/modules/locker/files/get_group_file.php?gid=4786004&fid=29485514

Course Name

CAD II

Topic/Unit:

Commercial Architecture

Approximate # Of Weeks: 9-10 Weeks

Essential Questions:

- How is the design of commercial structures affected by societies' needs?
- What is it important when designing efficient living spaces and community spaces?
- How will the renovation and beautification of community-shared spaces positively impact the residents of the communities?
- How should you balance form and function when designing commercial architecture?
- Is it important to be equitable when designing spaces for multiple residences?
- How are public venues designed to maximize the experience for all patrons?

Upon completion of this unit students will be able to:

- Apply basic elements of design for commercial architecture through conceptualization, planning and drawing structures. (M.G-MG.A.3)
- Develop a creative approach to designing architecture for public spaces. (9.3.12.AC.2) & (9.3.12.AC-DES.5)
- Design spaces for clients' needs while adding their own influence to the structure. (9.3.12.AC-DES.3)
- Work independently to research, plan, and develop solutions for community and shared spaces. (9.3.12.AC-DES.8)
- Work cooperatively with a partner to design separate spaces that will later be attached in the completion of a larger project. (9.3.12.AC-DES.2)
- Draw, and dimension floor plans for community buildings. (9.3.12.AC.1)
- Use architectural software to generate exterior elevation drawings. (9.3.12.AC-DES.6)
- Use architectural software to generate renderings of walkthroughs. (9.3.12.AC-DES.7) & (9.3.12.AR-VIS.2)
- Create interior and exterior renderings of spaces. (9.3.12.AR-VIS.3)
- Complete a professional series of drawings to display buildings for clients. (9.3.12.AC.6)
- Develop an understanding of Green building materials and designing for environmental sustainability. (8.2.12.B.2)
- Research the LEED and design and create a "green" model of an architectural structure. (HS-ETS1-3)

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).*

Science

- **HS-ETS1-3:** Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

Technology

- **8.2.12.B.2:** Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation and maintenance of a chosen product.

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.6:** Read, interpret and use technical drawings, documents and specifications to plan a project.
- **9.3.12.AC-DES.2:** Use effective communication skills and strategies (listening, speaking, reading, writing and graphic communications) to work with clients and colleagues.
- **9.3.12.AC-DES.3:** Describe the requirements of the integral systems that impact the design of buildings.
- **9.3.12.AC-DES. 5:** Identify the diversity of needs, values and social patterns in project design, including accessibility standards.
- **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.
- **9.3.12.AR-VIS.2** Analyze how the application of visual arts elements and principles of design communicate and express ideas.
- **9.3.12.AR-VIS.3:** Analyze and create two and three-dimensional visual art forms using various media.

Activities:

- Students will create a series of Architectural drawings using an architectural modeling program.
- Students will complete architectural details exercises including renderings of interior and exterior spaces.
- Students will work independently and with partners to design structures with given client requirements.
- Students will develop a model presentation with, drawings, renderings and a site plan.

STEAM Activities:

- Leadership in Energy and Environmental Design (LEED): Students will demonstrate an understanding of green construction and develop an aptitude for architectural design in the development of plans, for sustainable design. Students will create a model a “green” structure.

Enrichment Activities:

- Commercial Building: Design a 50' x 150' Building with the following specifications:
 - Retail space
 - Office space
 - Public Bathrooms
- Townhouse:
 - Two car garage
 - Basement with utilities
 - 3 Bedrooms and 2.5 bathrooms
 - Parking areas and walkways
 - Exterior Lighting
 - Trees and shrubs
- Community Pool:
 - Parking
 - Lock rooms with restroom (male and female) handicapped stalls
 - Picnic tables and umbrellas
 - Recreational courts
 - Play Ground
 - Kids Pool
 - Main Pool – swimming lanes – concrete desk around pool (diving boards & slides optional)
- Movie Theater:

- o Large foyer Entry
- o Ticket sales area
- o Public restrooms (male and female) Handicapped stalls
- o Concession stand
- o Public ticket sale machines
- o 8 – 16 theater areas with stadium seating
- o Projection Room full length of building

Methods of Assessments/Evaluation:

- Performance-based assessment on architectural standards as used in industry.
- Assessment on the creation of detailed drawings in the following areas:
 1. Floor plans properly dimensioned exterior walls
 2. Room tags filled in correctly
 3. Elevations produced
 4. Detailed wall section with specifications of materials
 5. Roof structure plan showing slope
 6. Survey and plot with specified exterior elements
 7. Detailed rooms with furnishings and fixtures
 8. Render drawing of building interior and exterior spaces.
- Quizzes — General knowledge quiz on construction vocabulary.

Resources:

- Digital Handouts of drawings and procedures.
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 - House Plans: <https://www.houseplans.com/>
- LEED/Green
- <http://www.lead.net/>
 - http://www.greenhomebuilding.com/sustainable_architecture.htm
 - http://curriculum.autodesk.com/student/public/Level2/overview/project_id/19

