

**TRUMBULL PUBLIC SCHOOLS
TRUMBULL, CONNECTICUT**

Architectural CAD

Technology Education Department

2016

CURRICULUM WRITING TEAM

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Architectural CAD
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The Trumbull Board of Education will continue to take Affirmative Action to ensure that no persons are discriminated against in its employment.

CORE VALUES AND BELIEFS

Trumbull High School community engages in an environment conducive to learning which believes that all students will **read** and **write effectively**, therefore communicating in an articulate and coherent manner. All students will participate in activities **that present problem-solving through critical thinking**. Student will use technology as a tool applying it to decision making. We believe that by fostering self-confidence, self-directed and student-centered activities, we will promote **independent thinkers and learners**. We believe **ethical conduct** to be paramount in sustaining the welcoming school climate that we presently enjoy.

Approved 8/26/2011

INTRODUCTION

Architectural CAD is designed for students who have not had prior experience with drafting and design. Students will be introduced to basics of drafting and architecture. Throughout the class students will work on projects from drawing their own houses to designing their dream houses. Students will begin with pencil and paper drafting and proceed to using the computers for their designs.

This course will provide students with a basic knowledge of how a home is designed and constructed. The various phases of home design will be covered with classroom discussions. This is an excellent course for who want to know what goes into making a house and for those wishing to pursue a career in architecture or construction.

Through hands-on learning experiences students will explore the process of designing a house, starting at the design phase and progressing all the way to the construction of a house.

PHILOSOPHY

Studies show that students understand and retain knowledge when they experience or apply it to relevant situations. It is important that we provide all students with an education that will help them succeed in the workplace and in life.

Citizens of the 21st Century will need to possess a variety of diverse skills. It is vital that students enter the global economy with the ability to apply what they learned in school to a variety of ever-changing situations that they could not foresee before graduating. This course will help students acclimate into the real world and to prepare them for further education, as well as high-skill and high-demand professions. As long as there is a need for shelter there will be architects and builders to design and construct, so there's a very strong sense of job security in such work.

COURSE SYLLABUS AND TEXTS

Course Name Architectural CAD

Level Grades 10 - 12

Prerequisites N/A

Materials Required Supplied *Architecture* textbook

General Description of the Course

This course is designed for students who have not had prior experience with drafting and design. Students will be introduced to basics of drafting and architecture. Students will progress from a rough sketch to a three-dimensional model of their dream homes, while learning about architectural style and design. Students will have the opportunity to create models of their houses using a state-of-the-art 3D printer. Students will use the latest architectural software to design their houses.

Major Projects

Famous Architects PowerPoint, House Design Style PowerPoint, Keeping up with the Jones (2,000 sq ft. house), Thinking outside of the Box, Tiny House Project, Dream House project, Cost of a Home, and Google Sketchup 3D Printed House.

Assessments

Written assessments. Course involvement/participation and effort.

Text

Architecture: Residential Drafting and Design, Clois E. Kicklighter, Tinley Park, IL: Goodheart-Willcox, 2008.

Recommended Supplemental Texts: N/A

GOALS

Upon completion of this course, students will:

- Have a basic understanding of house style and design
- Understand how parts of a house interact with each other
- Have a basic understanding of drafting techniques
- Understand how to create a house using various computer programs
- Be able to create a set of drawing for a house of their own design

STANDARDS

The Performance Standards align with the 2014 Connecticut Technology Education Standards:

- ARCH.01 Identify significant historical events and trends that have impacted architecture.
- ARCH.02 Demonstrate an understanding of socio-cultural and environmental impacts on architectural design.
- ARCH.03 Demonstrate an understanding of regulations in architectural design.
- ARCH.04 Apply principles of physics in selecting and working with materials and load applications.
- ARCH.05 Research, plan and design functional structure.
- ARCH.06 Develop technical drawings drafted by hand and computer aided drafting and design (CADD).
- ARCH.07 Employ appropriate media to communicated concepts and design.
- ARCH.08 Maintain a portfolio to document knowledge, skills and experience in architecture.

The Performance standards also align with the 2010 Connecticut Core Standards for Literacy in Technical Subjects and for Mathematics, including:

- CCS.MP.1 Make sense of problems and persevere in solving them.
- CCSS.MP2 Reason abstractly and quantitatively.

- CCSS.HSA-CED.A.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
- CCSS.HSA-CED.A.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.
- CCSS.HSA-CED.A.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.
- CCSS.HSA-REI.A.2 Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

UNIT ONE

Introduction To Traditional Drafting

PERFORMANCE STANDARDS

ARCH.05.02	Produce preliminary designs, final sketches and presentation drawings.
ARCH.06.02	Draw and sketch by hand to communicate ideas effectively.
ARCH.07.01	Convey information using multi-dimensional drawings.
CCSS.HSA-CED.A.1	Create equations and inequalities in one variable including ones with absolute value and use them to solve problems in and out of context, including equations arising from linear functions.

ESSENTIAL QUESTION

- What tools and processes do professional design engineers utilize when constructing drawings?

FOCUS QUESTIONS

Following completion of this unit, students will be able to answer the following questions:

- How is drafting equipment used?
- Why is lettering in architecture so important?
- What is the difference between a regular ruler and an architecture scale?
- Why does one need different projection in drafting?
- What is the difference between size and scale?

SCOPE AND SEQUENCE

- Equipment and procedures
 - Equipment and proper use
 - Layout
 - Lettering and line weight

- Projections
 - Orthographic
 - Single-view
 - Multi-view
- Construction
 - Geometric shapes
 - Line types

INSTRUCTIONAL/TEACHING STRATEGIES

- Provide note-taking sheets
- Demonstrate the proper uses and techniques for drafting equipment
- Provide visual aids

ASSESSMENTS

- Students will use the drafting equipment to create original drawings.
- Students will complete two quizzes on drafting equipment and drafting techniques.

TIME ALLOCATION

- 2 weeks

UNIT TWO

Architectural Styles and House Design

PERFORMANCE STANDARDS

ARCH.01.01	Discuss current trends in commercial and residential architecture.
ARCH.01.02	Research and differentiate between design periods that shaped today's structures.
ARCH.02.04	Apply culture, community and diversity needs to project design.
CCSS.RST.11-12.1	Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.
CCSS.RST.11-12.2	Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
CCSS.RST.11-12.4	Determine the meaning of symbols, key terms and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
CCSS.RST.11-12.5	Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.
CCSS.RST.11-12.6	Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unsolved.
CCSS.RST.11-12.7	Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

CCSS.RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

CCSS.RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

ESSENTIAL QUESTION

- What is involved in the planning and design process as it relates to incorporating individual components into a final product?

FOCUS QUESTIONS

- What are the historical influences that helped shape today's home design?
- What are the current trends in architecture?
- What are the necessary parts to a house?
- What are the four basic house designs?
- What are the advantages and disadvantages of each of the four basic house designs?

SCOPE AND SEQUENCE

- House design styles
 - Influences
 - Design factors
- House design
 - Green construction
 - Alternatives
- Basic house design
 - One-story ranch
 - One-and-one-half story
 - Two-story
 - Split-level

INSTRUCTIONAL/TEACHING STRATEGIES

- Show PowerPoint of different house styles and designs
- Provide visuals and models of different house styles
- Provide guided notes

ASSESSMENTS

- Students will identify the style and design of their houses. Using traditional drafting equipment, students will draft their houses.
- Students will be assigned a particular type of house style and create a PowerPoint presentation explaining the key concepts.
- Students will complete a quiz on house style and design.

TIME ALLOCATION

- 4 weeks

UNIT THREE

Introduction to Computer-Aided Drafting

PERFORMANCE STANDARDS

- ARCH.06.03 Utilize CADD software to produce technical drawings and architectural proposals.
- ARCH.07.02 Create effective working drawings and presentation drawings.

ESSENTIAL QUESTIONS

- How do professional design engineers utilize technology when constructing three-dimensional models?
- How is three-dimensional modeling incorporated into the planning and design of a component?

FOCUS QUESTIONS

- Why is Computer-Aided Drafting important to the fields of architecture?
- What are the processes for producing an Architectural CAD drawing?
- What are some typical tools used in Graphisoft ARCHICAD?

SCOPE AND SEQUENCE

- Introduction to Graphisoft ARCHICAD
- Graphisoft ARCHICAD tools
 - Walls
 - Windows/doors
 - Slabs
 - Roofs
 - Objects
 - Mesh

INSTRUCTIONAL/TEACHING STRATEGIES

- Show tutorial that guides students on how to build a simple structure using ARCHICAD
- Show PowerPoint explaining ARCHICAD interface and how to use the program
- Provide note-taking sheet

ASSESSMENTS

- Students will complete a simple architectural drawing using ARCHICAD.
- Students will complete a quiz on ARCHICAD tools and functions.

TIME ALLOCATION

- 4 weeks

UNIT FOUR

Floor Plans

PERFORMANCE STANDARDS

ARCH.02.02	Differentiate between human wants and needs.
ARCH.03.03	Differentiate between residential and commercial building codes/standards.
ARCH.03.04	Develop an understanding of the Americans with Disabilities Act.
ARCH.05.01	Apply prior knowledge to discuss daily needs and influences identified in their environments.
ARCH.05.02	Produce preliminary designs, final sketches and presentation drawings.
ARCH.05.03	Utilize commercial and residential suggestions to specifications to create functional floor plans.

ESSENTIAL QUESTION

- What is involved in the planning and design process as it relates to incorporating individual components into a final product?

FOCUS QUESTIONS

- What factors are important in designing a floor plan?
- Why is square footage so important in a floor plan?
- What are the rooms and area that comprise a living area?
- What does a well-designed bedroom need?
- What does a well-designed bathroom need?
- What are good design principles for a living room and dining room?
- What are the service areas of a home?
- What is a work triangle?
- What are the six basic kitchen designs?
- What are the appropriate sizes for one-car and two-car garages?

SCOPE AND SEQUENCE

- Traffic circulation
 - Influence on layout
- Three basic areas of a floor plan
 - Sleeping area
 - Living area
 - Service area
- Interior design considerations
 - Bedrooms
 - Bathrooms
 - Living rooms
 - Dining rooms
 - Special-purpose rooms
 - Kitchens
 - Garages

INSTRUCTIONAL/TEACHING STRATEGIES

- Show PowerPoint on three basic areas of a house and interior design considerations
- Provide tutorial on how to place objects accurately in ARCHICAD
- Provide guided notes
- Provide visuals
- Show examples of good house plans and bad floor plans

ASSESSMENTS

- Students will design a floor plan of a house that includes bedrooms, bathrooms, a living room, a dining room, and a kitchen. Students may include a special-purpose room in their designs.
- Students will complete three quizzes on floor plans and areas of a house.

TIME ALLOCATION

- 4 weeks

UNIT FIVE

Doors and Windows

PERFORMANCE STANDARDS

- ARCH.02.01 Identify how location, resources, and materials influence design.
- ARCH02.02 Differentiate between human wants and needs.
- ARCH.05.01 Apply prior knowledge to discuss daily needs and influences identified in their environments.
- ARCH.05.02 Produce preliminary designs, final sketches and presentation drawings.

ESSENTIAL QUESTION

- How do windows and doors influence the functional design of a house?

FOCUS QUESTIONS

- Why do we need doors and windows?
- What are the types of doors used in a house?
- What are the different types of windows used in a house?
- How would one list the doors and windows on an architectural drawing?

SCOPE AND SEQUENCE

- Function of door and windows
 - Shielding an opening
 - Providing light and ventilation
 - Design elements
- Doors
 - Interior
 - Exterior
 - Garage
 - Size
 - Door schedule

- Windows
 - Types
 - Sizes
 - Window schedule

INSTRUCTIONAL/TEACHING STRATEGIES

- Show PowerPoint on doors and windows
- Provide guided notes and handouts
- Provide tutorial on how to place door and windows in ARCHICAD
- Show examples of door and window schedules

ASSESSMENTS

- Students will take their floor plans and decide on window and door placement and size.
- Students will make window and door schedules for their house designs.
- Students will complete quiz on doors and windows.

TIME ALLOCATION

- 3 weeks

UNIT SIX

Electrical Planning

PERFORMANCE STANDARDS

- ARCH.03.01 Research and identify regulations and codes that are needed to establish a legal and safe design.
- ARCH.03.03 Differentiate between residential and commercial building codes/standards.
- ARCH.05.01 Apply prior knowledge to discuss daily needs and influences identified in their environments.
- ARCH.05.02 Produce preliminary designs, final sketches and presentation drawings.

ESSENTIAL QUESTION

- What is happening when one turns on a light or plugs something into an outlet in one's house?

FOCUS QUESTION

- Why is an electrical plan important in home construction?
- What is a service entrance?
- What are some of the symbols on an electrical plan?
- Why are different symbols used on an electrical plan?

SCOPE AND SEQUENCE

- Electrical plan
 - Purpose
 - Features
 - Required information
- Service Entrance
 - Code
 - Location
 - Symbols

- Switches
 - Types
 - Number and placement
 - Symbols
- Convenience outlets
 - Types
 - Number and placement
 - Symbols
- Lighting
 - Types
 - Placement

INSTRUCTIONAL/TEACHING STRATEGIES

- Show PowerPoint on electrical plans and how to create an electrical plan
- Provide guided notes
- Provide handouts on how to create an electrical plan and electrical plan symbols
- Show examples of good and bad electrical plans

ASSESSMENTS

- Students will take their floor plans and determine the location for lights, switches, outlets, and appliances.
- Students will complete quiz on electrical plans.

TIME ALLOCATION

- 3 weeks

UNIT SEVEN

Non-Structural Components

PERFORMANCE STANDARDS

- ARCH.03.01 Research and identify regulations and codes that are needed to establish a legal and safe design.
- ARCH.03.03 Differentiate between residential and commercial building codes/standards.
- ARCH.05.01 Apply prior knowledge to discuss daily needs and influences identified in their environments.

ESSENTIAL QUESTION

- How do the non-structural components of a house affect the design?

FOCUS QUESTIONS

- What are non-structural components of a house?
- What are the types of fireplaces that can be installed in a home?
- What are the components of residential plumbing?
- What is the purpose of each component?
- How does one control the climate of a house?

SCOPE AND SEQUENCE

- Fireplaces
 - Types
 - Parts
 - Codes
- Plumbing
 - Water supply
 - Water and waste removal
 - Fixtures and fixture schedule
- Climate control

- Temperature control
- Humidity control
- Air circulation
- Air cleaning
- Symbols

INSTRUCTIONAL/TEACHING STRATEGIES

- Show PowerPoint on non-structural components
- Provide handouts on how to create a plumbing plan and plumbing plan symbols
- Provide handouts on fireplace design

ASSESSMENTS

- Students will take their floor plans and incorporate non-structural components into their designs.
- Students will complete quiz on non-structural components of a house.

TIME ALLOCATION

- 4 weeks

UNIT EIGHT

Plot Planning

PERFORMANCE STANDARDS

- ARCH.02.01 Identify how location, resources and materials influence design.
- ARCH.03.02 Evaluate a site that takes into consideration local, state and national restrictions, zoning and codes.
- ARCH.05.02 Reduce preliminary designs, final sketches and presentation drawings.

ESSENTIAL QUESTION

- How does one's house placement on one's property affect one's design?

FOCUS QUESTIONS

- What is the difference between a site plan and a plot plan?
- What is the purpose of a plot plan?
- What should be included in a plot plan?
- How do the sun's movements affect one's house placement?

SCOPE AND SEQUENCE

- Site plan
 - Features
- Plot Plan
 - Property lines
 - Contour lines
 - Topographical features
 - Location of structure
- Drawing a plot plan
 - Procedure
 - Scale
 - Landscape schedule

INSTRUCTIONAL/TEACHING STRATEGIES

- Show PowerPoint on plot plans and site plans
- Show different examples of plot and site plans
- Provide guided notes for plot plans and site plans
- Show examples of good and bad plot plans

ASSESSMENTS

- Students will create plot plans for their house designs and locate their houses on pre-determined plots of land.
- Students will complete quiz on plot plans and site plans.

TIME ALLOCATION

- 4 weeks

UNIT NINE

Elevations

PERFORMANCE STANDARDS

- ARCH.02.01 Identify how location, resources and materials influence design.
- ARCH.02.02 Differentiate between human wants and needs.
- ARCH.05.01 Apply prior knowledge to discuss daily needs and influences identified in their environments.
- ARCH.05.02 Produce preliminary designs, final sketches and presentation drawings.

ESSENTIAL QUESTION

- Why are elevations an important part in house design?

FOCUS QUESTIONS

- How can one show the exterior design of a house?
- Why are elevations important in the construction of a house?

SCOPE AND SEQUENCE

- Elevation
 - Required information
 - Identification
 - Procedure for drawing
- Wall sections
 - Features
 - Building materials
 - Importance
 - Procedure for drawing
- Roof
 - Types
 - Pitch

- Procedures for drawing

INSTRUCTIONAL/TEACHING STRATEGIES

- Show PowerPoint on elevations, wall sections, and roof design
- Provide handouts on how to create elevations and wall designs
- Show examples of different types of roof design and elevation marking

ASSESSMENTS

- Students will create four elevations and a sections view for their house designs, making sure to include all important information.
- Students will complete quiz on elevations and roof design.

TIME ALLOCATION

- 4 weeks

UNIT TEN

Models

PERFORMANCE STANDARDS

ARCH.07.02 Create effective working drawings and presentation drawings.

ARCH.07.03 Employ basic model building techniques.

ESSENTIAL QUESTION

- How are the components of a design incorporated into the final model?

FOCUS QUESTIONS

- What are the types of architectural models?
- What is the process for building 3D models?
- Why are models important to an architect?
- What types of materials are used in a model?

SCOPE AND SEQUENCE

- Models
 - Purpose
 - Types
 - Scale
 - Material
- Model Construction
 - Model
 - First floor
 - Additional floors
 - Roof
 - Details

INSTRUCTIONAL/TEACHING STRATEGIES

- Show PowerPoint on models and model - making techniques
- Provide tutorials on how to make models
- Show examples of models and good and bad model - making techniques

ASSESSMENTS

- Students will construct a scale model of their original house designs.
- Students will design a small - scale model of a house to 3D print.
- Students will complete quiz on different model - making techniques.

TIME ALLOCATION

- 6 weeks

UNIT ELEVEN

Cost

PERFORMANCE STANDARDS

ARCH.05.04 Utilize an architectural drawing to estimate the cost and the materials necessary for a project.

ESSENTIAL QUESTION

- How does one's design affect the cost of construction of one's house?

FOCUS QUESTIONS

- How does the shape of one's house influence the cost?
- How does the type of materials one uses in design and construction matter in building a house?
- To what extent does it cost more to build a house in one town than in another?

SCOPE AND SEQUENCE

- Factors that influence cost of building
 - Shape
 - Square footage
 - Locations
 - Quality

INSTRUCTIONAL/TEACHING STRATEGIES

- Show PowerPoint on factors that influence cost of building a house
- Provide handouts explaining quality of materials and cost
- Show examples of differences in quality of materials and low - cost to high - cost homes

ASSESSMENTS

- Students will complete a cost analysis of what it will cost to construct their houses using the website www.building-cost.net.
- Students will complete a worksheet looking at the different costs of houses in different regions of Connecticut and the United States.

TIME ALLOCATION

- 2 weeks

COURSE CREDIT

One credit in Technology Education

One class period daily for a full year

PREREQUISITES

There are no prerequisites for this course.

TEXTS

Architecture: Residential Drafting and Design, Clois E. Kicklighter, Tinley Park, IL:
Goodheart-Willcox, 2008.

SUPPLEMENTARY MATERIALS / RESOURCES / TECHNOLOGY

www.howstuffworks.com

www.cost-building.net

www.youtube.com

www.realtor.com

APPENDIX A SCHOOL WIDE RUBRICS

NEASC Rubric 6

Demonstrate Responsibility for Self

Exemplary

Student demonstrates an independent, industrious work ethic. He/She sets goals and completes them with detail and on time. The student consistently prepares for classes daily. The student works exceptionally well cooperatively with peers and the staff. He/She participates and contributes in a co-curricular capacity within the total school community.

Proficient

Student demonstrates a positive work ethic. He/She sets goals and completes them within a reasonable amount of time. The student is frequently prepared for daily classes. Student works adequately both cooperatively and independently with peers and staff. He/She participates in co-curricular activities.

Needs Improvement

Student possesses a lackadaisical approach to work. He/She needs constant reminders to follow the goal setting process. When goals are established, they are rarely completed within a reasonable amount of time. Daily class preparation is sporadic. The student can work cooperatively and at times participation in activities with peers and staff. The student explores co-curricular opportunities.

Unacceptable

Student lacks a strong work ethic. No goals are evident. The student is not prepared for classes. He/She prefers to work cooperatively so others can do his/her work. The student selects a co-curricular; however, does not choose to participate actively when presented with the opportunity.

NEASC Rubric 7

Respects themselves and others and practices interpersonal skills

Exemplary

Student demonstrates a high level of cultural understanding and respect for the uniqueness of others, their practices, and perspectives. The student champions discussions to resolve differences through active listening and offers opinions in a positive and rational manner.

Proficient

Student demonstrates an appreciation and respect for cultural understanding of the uniqueness of others, their practices and perspectives. He/She actively discusses avenues to resolve differences when appropriate. The student presents encouraging opinions upon request.

Needs Improvement

Student demonstrates a limited appreciation and respect for the uniqueness of cultural understanding of others, their practices and perspectives. At times, he/she appears indifferent to the ordeals of others. The student supports his/her own opinions, but appears inflexible to resolve differences and remains tied to his/her own beliefs.

Unacceptable

Student demonstrates little or no appreciation and respect for the uniqueness of cultural understanding of others, their practices and perspectives. He/She demonstrates intolerance and lacks social interaction skills.