

**COURSE TITLE**

Architecture

**LENGTH**

One Semester

**DEPARTMENT**

STEM Department

**SCHOOL**

Union Middle School

**DATE**

September 10, 2018

# Architecture

## I. Introduction/Overview/Philosophy

In math classes everywhere, students ask the question, “When will we ever use this?” Mathematics plays a critical role in the architectural process- from scale drawings and endless geometry involved to the cost analysis of the project. Students will learn to appreciate architecture and the historical and cultural significance of various structures from around the globe. Students will research structures, find interesting and historical facts, and understand the mathematics involved while building structures. Students will then become their own architects and use software to design and build their own structures.

## II. Objectives

### *Course Outline:*

1. Architectural Design and Scale Factor
  - a. Treehouse Project
2. 3D Printing and Exploration
  - a. TinkerCAD
3. Designing Floor Plans
  - a. TinkerCAD
  - b. Floor planner
4. Careers in Architecture
  - a. Research
  - b. Presentation
5. Architecture Around the World
  - a. Research and Present Google Slideshow
  - b. Scale Model of Famous Landmark or Building
6. Roadside Architecture
  - a. Design and build a unique architectural structure to house a particular business

### *Student Outcomes:*

After successfully completing this course, the student will:

- Compare and contrast real-life structures to the models
- Use scale factors to create models
- Read and interpret instructions
- Use diagrams to create models
- Use appropriate tools strategically
- Make sense of problems and persevere

### *New Jersey Student Learning Standards*

**CAREER READY PRACTICES****CRP1 Act as a responsible and contributing citizen and employee.**

Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.

**CRP2 Apply appropriate academic and technical skills.**

Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation

**CRP4 Communicate clearly and effectively and with reason.**

Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.

**CRP5. Consider the environmental, social and economic impacts of decisions.**

Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.

**CRP6. Demonstrate creativity and innovation.**

Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.

**CRP7. Employ valid and reliable research strategies.**

Career-ready individuals are discerning in accepting and using new information to make decisions, change practices or inform strategies. They use reliable research process to search for new information. They evaluate the validity of sources when considering the use and adoption of external information or practices in their workplace situation.

**CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.**

Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing

solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.

***CRP10. Plan education and career paths aligned to personal goals.***

Career-ready individuals take personal ownership of their own education and career goals, and they regularly act on a plan to attain these goals. They understand their own career interests, preferences, goals, and requirements. They have perspective regarding the pathways available to them and the time, effort, experience and other requirements to pursue each, including a path of entrepreneurship. They recognize the value of each step in the education and experiential process, and they recognize that nearly all career paths require ongoing education and experience. They seek counselors, mentors, and other experts to assist in the planning and execution of career and personal goals.

***CRP11. Use technology to enhance productivity.***

Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.

***TECHNOLOGY***

**Standard 8.1 Educational Technology:** All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.

**Strand A: Technology Operations and Concepts:** Students demonstrate a sound understanding of technology concepts, systems and operations.

8.1.8.A.4- Use and/or develop a simulation that provides an environment to solve a real world problem or theory.

**Strand E: Research and Information Fluency:** Students apply digital tools to gather, evaluate, and use information.

8.1.8.E.1- Effectively use a variety of search tools and filters in professional public databases to find information to solve a real world problem.

**Standard 8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming:** All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.

**Strand A. The Nature of Technology: Creativity and Innovation** Technology systems impact every aspect of the world in which we live.

8.2.8.A.2- Examine a system, consider how each part relates to other parts, and discuss a part to redesign to improve the system.

8.2.8.A.3- Investigate a malfunction in any part of a system and identify its impacts.

**Strand C. Design:** The design process is a systematic approach to solving problems.

8.2.8.C.4- Identify the steps in the design process that would be used to solve a designated problem.

**Strand D. Abilities for a Technological World:** The designed world is the product of a design process that provides the means to convert resources into products and systems.

8.2.8.D.3- Build a prototype that meets a STEM-based design challenge using science, engineering, and math principles that validate a solution.

***21ST CENTURY LIFE AND CAREERS***

***9.2 Career Awareness, Exploration, and Preparation***

**Strand B: Career Exploration**

9.2.8.B.1 Research careers within the 16 Career Clusters and determine attributes of career success.

9.2.8.B.3 Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.

**9.3 Career and Technical Education****Cluster: Science, Technology, Engineering & Mathematics Career Cluster**

9.3.ST-ET.1-Use STEM concepts and processes to solve problems involving design and/or production.

9.3.ST-ET.2-Display and communicate STEM information.

9.3.ST-ET.3-Apply processes and concepts for the use of technological tools in STEM.

9.3.ST-ET.4-Apply the elements of the design process.

9.3.ST-ET.5-Apply the knowledge learned in STEM to solve problems.

**NEW JERSEY STUDENT LEARNING STANDARDS- MATH**

7.G.A.1. Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

7.G.A.2. Draw (with technology, with ruler and protractor, as well as freehand) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.

7.G.A.3. Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.

7.G.B.4. Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.

7.G.B.6. Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.

8.G.A.1. Verify experimentally the properties of rotations, reflections, and translations:

8.G.A.2. Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.

8.G.A.3. Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.

8.G.A.4. Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.

8.G.B.6. Explain a proof of the Pythagorean Theorem and its converse.

8.G.B.7. Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.

8.G.C.9. Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

### **III. Proficiency Levels**

Architecture is a semester elective course appropriate for all grade 7 and 8 students.

### **IV. Methods of Assessment**

#### **Student Assessment**

The teacher will provide a variety of assessments during the course of the year. The assessment may include but is not limited to: projects, presentations, homework, and building challenges.

#### **Curriculum/Teacher Assessment**

The teacher will provide the subject area supervisor with suggestions for changes on an ongoing basis.

### **V. Grouping**

This is a middle school elective course offered to students in grade 7 and grade 8.

### **VI. Articulation/Scope & Sequence/Time Frame**

Course length is one semester.

### **VII. Resources**

#### ***Texts/Supplemental Reading/References***

Resources include but are not limited to:

1. Building materials
2. YouTube Videos
3. <http://www.shmoop.com/careers/architect/>

### **VIII. Suggested Activities**

Appropriate activities are listed in the curriculum map.

### **IX. Methodologies**

The following methods of instruction are suggested: lecture, group projects, demonstration, hands-on applications, and class presentations.

### **X. Interdisciplinary Connections**

The primary focus of this course is to allow students to connect concepts learned in the regular mathematics classroom to activities and situations in the real world. Applications to history, art, and economics will be made on a daily basis through a variety of projects and explorations.

## **XI. Differentiating Instruction for Students with Special Needs: Students with Disabilities, Students at Risk, English Language Learners, and Gifted & Talented Students**

Differentiating instruction is a flexible process that includes the planning and design of instruction, how that instruction is delivered, and how student progress is measured. Teachers recognize that students can learn in multiple ways as they celebrate students' prior knowledge. By providing appropriately challenging learning, teachers can maximize success for all students.

Differentiating in this course includes but is not limited to:

### *Differentiation for Support (ELL, Special Education, Students at Risk)*

- Peer mentoring on problems
- Differentiated teacher feedback on assignments
- Modeling out problems on whiteboard
- Visual aids as we project problems on whiteboard
- Study guides
- Tiered assignments
- Scaffolding of materials and assignments
- Re-teaching and review
- Guided note taking
- Exemplars of varied performance levels
- Multi-media approach to accommodating various learning styles

### *Differentiation for Enrichment*

- Supplemental reading material for independent study
- Flexible grouping
- Tiered assignments
- Topic selection by interest
- Enhanced expectations for independent study
- Elevated questioning techniques using Webb's Depth of Knowledge matrix

## **XII. Professional Development**

The teacher will continue to improve expertise through participation in a variety of professional development opportunities.

## XII. Curriculum Map/Pacing Guide

Unit Topic	Time Allocated	Differentiating Instruction for Students with Disabilities, Students at Risk, English Language Learners, & Gifted & Talented Students	Standards	Assessments
Architectural Design and Scale Factor <ul style="list-style-type: none"> <li>• Treehouse Project</li> </ul>	6 weeks	<p><i>For support:</i></p> <ul style="list-style-type: none"> <li>• Option to use various materials to build – ex: blocks, Legos, foam construction material</li> <li>• Pairing students with beginning English language skills with students who have more advanced</li> <li>• English language skills</li> </ul> <p><i>For Enhancement:</i></p> <ul style="list-style-type: none"> <li>• Adjusting pace of the lesson</li> <li>• Higher Order thinking skills</li> <li>• Interest-based content</li> <li>• Select embellishments to add: swing, slide, pool, etc</li> </ul>	7.G.A.1-3 7.G.B.4,6 8.G.A.1-4 8.G.B.6,7 8.G.C.9 MS-ETS1.1 MS-ETS1.2 MS-ETS1.3 CRP1,2,4,6,7,8,11,12 8.1.8.E.1 8.2.8.A.2,3 8.2.8.C.4 8.2.8.D.3 9.2.8.B.3 9.3.ST-ET.1-5	<p><i>Formative Assessment:</i></p> <ul style="list-style-type: none"> <li>• Teacher Observation</li> <li>• Class work</li> <li>• Peer Review Forms</li> <li>• Journal Entries</li> </ul> <p><i>Summative Assessment:</i></p> <ul style="list-style-type: none"> <li>• Final Project: Tree House</li> </ul>
3D Printing and Exploration <ul style="list-style-type: none"> <li>• TinkerCAD</li> </ul>	4 weeks	<p><i>For support:</i></p> <ul style="list-style-type: none"> <li>• Option to import and modify objects from the TinkerCAD community</li> <li>• Manipulation of 3D printed objects</li> <li>• Scaffolding (begin with simple objects and add detail in specific increments)</li> <li>• Pairing students with beginning English language skills with students who have more advanced</li> <li>• English language skills</li> </ul> <p><i>For Enhancement:</i></p> <ul style="list-style-type: none"> <li>• Adjusting pace of the lesson</li> <li>• Option to lead a lesson in 3D printing and object</li> </ul>	7.G.A.1-3 7.G.B.4,6 8.G.A.1-4 8.G.B.6,7 8.G.C.9 MS-ETS1.1 MS-ETS1.2 MS-ETS1.3 CRP1,2,4,6,7,8,11,12 8.1.8.E.1 8.2.8.A.2,3 8.2.8.C.4 8.2.8.D.3 9.2.8.B.3	<p><i>Formative Assessment:</i></p> <ul style="list-style-type: none"> <li>• Teacher Observation</li> <li>• Class work</li> <li>• Object Sketches</li> </ul> <p><i>Summative Assessment:</i></p> <ul style="list-style-type: none"> <li>• Final 3D printed objects: (Key chain; Floor Plan, House)</li> </ul>



Unit Topic	Time Allocated	Differentiating Instruction for Students with Disabilities, Students at Risk, English Language Learners, & Gifted & Talented Students	Standards	Assessments
		creation <ul style="list-style-type: none"> <li>• Higher Order thinking skills</li> <li>• Interest-based content</li> </ul>	9.3.ST-ET.1-5	
Designing Floor Plans <ul style="list-style-type: none"> <li>• TinkerCAD</li> <li>• Floor planner</li> </ul>	1 Week	<i>For support:</i> <ul style="list-style-type: none"> <li>• Manipulation of 3D printed floorplans</li> <li>• Scaffolding (begin with basic structure and add detail in specific increments)</li> <li>• Option to use graph paper and sketch 2D model of floorplan</li> <li>• Pairing students with beginning English language skills with students who have more advanced</li> <li>• English language skills</li> </ul> <i>For Enhancement:</i> <ul style="list-style-type: none"> <li>• Adjusting pace of the lesson</li> <li>• Designing a second floor</li> <li>• Higher Order thinking skills</li> <li>• Interest-based content</li> </ul>	7.G.A.1-3 7.G.B.4,6 8.G.A.1-4 8.G.B.6,7 8.G.C.9 MS-ETS1.1 MS-ETS1.2 MS-ETS1.3 CRP1,2,4,6,7,8,11,12 8.1.8.E.1 8.2.8.A.2,3 8.2.8.C.4 8.2.8.D.3 9.2.8.B.3 9.3.ST-ET.1-5	<i>Formative Assessment:</i> <ul style="list-style-type: none"> <li>• Teacher Observation</li> <li>• Class work</li> <li>• Questioning</li> </ul> <i>Summative Assessment:</i> <ul style="list-style-type: none"> <li>• Floor planner 2D and 3D Models</li> </ul>
Careers in Architecture <ul style="list-style-type: none"> <li>• Research and Present Google Slideshow</li> </ul>	1 Week	<i>For support:</i> <ul style="list-style-type: none"> <li>• Scaffolding (fill in provided outline of slideshow and research points to be addressed)</li> <li>• Option to work in pairs</li> <li>• Small group presentation</li> <li>• Pairing students with beginning English language skills with students who have more advanced</li> <li>• English language skills</li> </ul> <i>For Enhancement:</i> <ul style="list-style-type: none"> <li>• Adjusting pace of the lesson</li> <li>• Option to interview career person of interest</li> <li>• Higher Order thinking skills</li> <li>• Interest-based content</li> </ul>	CRP1,2,4,6,7,8,11,12 8.1.8.E.1 8.2.8.A.2,3 8.2.8.C.4 8.2.8.D.3 9.2.8.B.1 9.2.8.B.3 9.3.ST-ET.1-5	<i>Formative Assessment:</i> <ul style="list-style-type: none"> <li>• Teacher Observation</li> <li>• Class work</li> <li>• Teacher/student discussion</li> </ul> <i>Summative Assessment:</i> <ul style="list-style-type: none"> <li>• Slideshow presentation</li> </ul>

Unit Topic	Time Allocated	Differentiating Instruction for Students with Disabilities, Students at Risk, English Language Learners, & Gifted & Talented Students	Standards	Assessments
Architecture Around the World <ul style="list-style-type: none"> <li>• Research and Present Google Slideshow</li> <li>• Scale Model of Famous Landmark or Building</li> </ul>	4 Weeks	<p><i>For support:</i></p> <ul style="list-style-type: none"> <li>• Option to use various materials to build – ex: blocks, Legos, foam construction material</li> <li>• Scaffolding (fill in provided outline of slideshow and research points to be addressed)</li> <li>• Small group presentation</li> <li>• Option to work in pairs</li> <li>• Pairing students with beginning English language skills with students who have more advanced</li> <li>• English language skills</li> </ul> <p><i>For Enhancement:</i></p> <ul style="list-style-type: none"> <li>• Adjusting pace of the lesson</li> <li>• Scale model using TinkerCAD and construction materials</li> <li>• Higher Order thinking skills</li> <li>• Interest-based content</li> </ul>	7.G.A.1-3 7.G.B.4,6 8.G.A.1-4 8.G.B.6,7 8.G.C.9 MS-ETS1.1 MS-ETS1.2 MS-ETS1.3 CRP1,2,4,6,7,8,11,12 8.1.8.E.1 8.2.8.A.2,3 8.2.8.C.4 8.2.8.D.3 9.2.8.B.3 9.3.ST-ET.1-5	<p><i>Formative Assessment:</i></p> <ul style="list-style-type: none"> <li>Teacher Observation</li> <li>class work</li> <li>Teacher/student discussion</li> </ul> <p><i>Summative Assessment:</i></p> <ul style="list-style-type: none"> <li>Slideshow presentation</li> <li>3D Model</li> </ul>
Roadside Architecture <ul style="list-style-type: none"> <li>• Design and build a unique architectural structure to house a particular business</li> </ul>	4 Weeks	<p><i>For support:</i></p> <ul style="list-style-type: none"> <li>• Option to use various materials to build – ex: blocks, Legos, foam construction material</li> <li>• Select an existing Roadside Structure to sketch and build</li> <li>• Pairing students with beginning English language skills with students who have more advanced</li> <li>• English language skills</li> </ul> <p><i>For Enhancement:</i></p> <ul style="list-style-type: none"> <li>• Adjusting pace of the lesson</li> <li>• Higher Order thinking skills</li> <li>• Interest-based content</li> <li>• Design a roadway surrounding structure</li> </ul>	7.G.A.1-3 7.G.B.4,6 8.G.A.1-4 8.G.B.6,7 8.G.C.9 MS-ETS1.1 MS-ETS1.2 MS-ETS1.3 CRP1,2,4,6,7,8,11,12 8.1.8.E.1 8.2.8.A.2,3 8.2.8.C.4 8.2.8.D.3 9.2.8.B.3 9.3.ST-ET.1-5	<p><i>Formative Assessment:</i></p> <ul style="list-style-type: none"> <li>• Teacher Observation</li> <li>• Class work</li> <li>• Peer Review Forms</li> <li>• Journal Entries</li> </ul> <p><i>Summative Assessment:</i></p> <ul style="list-style-type: none"> <li>• Final Project: Roadside Architecture Structure</li> </ul>