

**Glen Ridge Board of Education
Engineering Architecture - Honors
Semester
*Elective***

New Jersey Student Learning Standards

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 completion of Computer Aided Design & Drawings II, students develop their knowledge and skills for careers in architecture and construction. This is an advanced level course that continues the progression from previous CAD courses with an emphasis on architectural design. Basic principles of building codes, residential and commercial construction are reviewed. Floor plans, electrical plans, section plans, elevations, and site plans are essential. This experience will allow the students to be creative and explore new techniques while reinforcing CAD skills. Autodesk Revit software will be utilized during this course. Using Revit students learn to create professional architectural plans that meet industry standards. They will use interior and exterior renderings, and scale models create visual and tangible presentations of their designs. Students will explore college and career opportunities through site visits and guest speakers.

Engineering Architecture- Honors

Unit 1: Advanced Architecture & Survey Planning

Time Allotted (days of instruction): 45 days

New Jersey Student Learning Standards (NJSLS)

- **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).
- **9.3.12.AC.1:** Use vocabulary, symbols and formulas common to architecture and construction.
- **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.

Essential Questions	Student Learning Objectives	Activities
<ul style="list-style-type: none"> ● 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 can an architect design the best possible plan for a client while following national and local building codes? ● How do modern architects design for specific spaces and client's needs while 	<ul style="list-style-type: none"> ● Use an architectural designing program to draw and dimension a residential building from the foundation to the roof. (9.3.12.AC.2) ● Apply modern architectural 3D modeling equipment to design residential homes. (9.3.12.AC.6) ● Identify and draw local architectural styles and roof styles. (9.3.12.AC.4) ● Generate interior and exterior 	<ul style="list-style-type: none"> ● Students will design and produce a series of advanced architectural drawings. ● Students will complete exercises for developing design skills in architecture. ● Students will complete a bill of materials chart to determine the cost of lumber for their design. ● Students will construct a scale model following client or competition requirements. ● Students will complete classroom exercises on architectural details.

<p>limiting materials and cost?</p> <ul style="list-style-type: none"> ● Is it better to redesign existing spaces or rebuild existing spaces? ● What skills are necessary to be a professional surveyor? ● Why do you need a surveying drawing? ● Typical site plan drawings contain what features? ● What are the key items in an architectural portfolio? 	<p>elevation drawings. (9.3.12.AC-DES.6)</p> <ul style="list-style-type: none"> ● 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 spaces that allows for standard room appliances and furniture. (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 online resources. (9.3.12.AC-DES.8) ● Create interior and exterior renderings of spaces. (9.3.12.AR-VIS.3) ● Develop an understanding of career opportunities in architecture by producing plans for architectural CAD competitions. (9.3.12.AC.7) ● Create structures and models of high craftsmanship for architectural competitions. (9.3.12.AC-DES.7) 	<ul style="list-style-type: none"> ● Students will design residential structures for specific client needs. ● Students will redesign spaces for specific client needs. ● Students will design surveys and plot plans that follow clients and competition requirements. <p>STEAM Activity:</p> <ul style="list-style-type: none"> ● Green Architectural renovation: Given a basic residential model students will design and construct a scale model of “green” architectural renovation/additional feature to add to the house. Design and build a feature to make the home more energy efficient and reduce negative impacts on the environment. ● Scale Residential Model: Following rules from an architectural design competition, students will develop a set of architectural plans and related materials for an architectural design challenge and construct a physical, as well as a computer-generated model, to accurately depict their design. <p>Enrichment Activities:</p> <ul style="list-style-type: none"> ● Sample drawings for each assigned project and each assigned drawing. ● Sample model for the students to use as examples. ● Visual examples from past competition winners. ● 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). ● Design a one story restaurant with the following details: Entry, Reception area, Waiting area, Restrooms, Bar/lounge area (separate), Beverage area for wait staff, Dining room, Tables, chairs and/or booths, Kitchen, Food delivery
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		<p>area, Windows & doors.</p> <ul style="list-style-type: none"> ● Designing an electrical schematic system for a house that shows switches, outlets, GFCI outlets, lighting, wire, smoke detectors, phone jacks and the power panel. ● Architecture competition: See Synergis for current competition: http://www.synergis.com/industries/education ● NJTSA competition: http://njtsa.pages.tcnj.edu for current competition.
<p>Resources/Materials</p>	<ul style="list-style-type: none"> ● Digital Handouts of drawings and procedures. ● Textbooks: <i>Architecture Residential Drafting and Design</i> ● Computers with Autodesk Revit installed ● Plotter/Printers ● 3D printer ● Smartboard ● Calculator ● Rulers ● Foam core ● Balsa wood ● Modeling tools <p>Online Resources:</p> <ul style="list-style-type: none"> ● Mr. Shohen's page: http://www.glenridge.org/Page/3606 ● Revitcity: 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 <p>Foam Modeling:</p> <ul style="list-style-type: none"> ● https://www.pinterest.com/pin/188517934375114846/ ● https://www.youtube.com/channel/UCb5TRJQQDUFDbIVYbTGvh8w <p>TSA:</p> <ul style="list-style-type: none"> ● http://tsa.mountainview.groupfusion.net/modules/locker/files/get_group_file.phtml?gid=4786004&fid=29485514 <p>Green architecture:</p> <ul style="list-style-type: none"> ● http://science.howstuffworks.com/engineering/structural/5-elements-of-green-architecture.htm 	

	<ul style="list-style-type: none"> • http://architecture.about.com/od/greenconcepts/g/green.htm
Interdisciplinary Connections	<ul style="list-style-type: none"> • 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).*
21st Century Life and Careers	<ul style="list-style-type: none"> • 9.2.12.C.7: Examine the professional, legal, and ethical responsibilities for both employers and employees in the global workplace.
Technology Standards	<ul style="list-style-type: none"> • 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.7: Describe career opportunities and means to achieve those opportunities in each of the Architecture & Construction Career Pathways. • 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.

Assessments			
Formative	Summative	Benchmarks	Alternative
<ul style="list-style-type: none"> • Performance-based assessment on architectural standards as used in industry. • Peer evaluation of drawings. • Assessment rubrics to ensure drawings meet the requirements specified. 	<ul style="list-style-type: none"> • Assessment on the creation of detailed drawings in the following areas: <ol style="list-style-type: none"> 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 	<ul style="list-style-type: none"> • Students will be assessed on the proper use of building codes and dimensions in their drawings. • Students will complete assigned drawing by the determined due date. 	<ul style="list-style-type: none"> • 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.

	<p>9. Building to be placed on Civil Engineering/Survey plot plan assignment.</p> <p>10. Detailed rooms</p> <p>11. Render drawing of building</p> <ul style="list-style-type: none"> • Quizzes —Architectural styles, Kitchens, Bathrooms and electrical codes. 		
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Modifications		
English Language Learners	Special Education/504	Gifted and Talented
<ul style="list-style-type: none"> • Step by step instructions with pictures are provided for learning how to use the architectural program. 	<ul style="list-style-type: none"> • Step by step instructions with pictures are provided for learning how to draw each plan. • Extended time and reduced work • One on one instructions and review of drawing procedures. 	<ul style="list-style-type: none"> • Additional advanced plans are available for extra credit. • Students can create original instructions for other students to use in the future. • Students can participate in class and real life competitions.

Engineering Graphics - Honors		
Unit 2: Commercial & Structural Design		
Time Allotted (days of instruction): 45 days		
New Jersey Student Learning Standards (NJSLs)		
<ul style="list-style-type: none"> • 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. 		
<ul style="list-style-type: none"> • 9.3.12.AC.6: Read, interpret and use technical drawings, documents and specifications to plan a project. 		
<ul style="list-style-type: none"> • 9.3.12.AC-DES.6: Apply the techniques and skills of modern drafting, design, engineering and construction to projects. 		
<ul style="list-style-type: none"> • 9.3.12.AC-DES.7: Employ appropriate representational media to communicate concepts and project design. 		
<ul style="list-style-type: none"> • 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. 		
Essential Questions	Student Learning Objectives	Activities
<ul style="list-style-type: none"> • Is building with steel a valid alternative to conventional stick framing? • What legal obligations must one consider when designing commercial and community spaces? 	<ul style="list-style-type: none"> • Apply design elements for commercial architecture through conceptualization, planning and drawing structures. (M.G-MG.A.3). 	<ul style="list-style-type: none"> • Students will create a series of commercial & structural drawings using an architectural modeling program. • Students will calculate loads and determine proper support for the weight of the structure.

<ul style="list-style-type: none"> • How will the renovation and beautification of community-shared spaces positively impact the residents of the communities? • What environmental, and size constraints do engineers face when design commercial structures? • Why would planned structures never get built? • How are public stadiums designed to maximize the experience for all patrons? 	<ul style="list-style-type: none"> • Implement a creative approach to designing architecture for public spaces. (9.3.12.AC.2) & (9.3.12.AC-DES.5) • Design public 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) • Create a Title page and Design Criteria, abbreviations & General Structural Notes page. (W.11-12.4) • Develop an understanding of Green building materials and designing for environmental sustainability. (8.2.12.B.2) 	<ul style="list-style-type: none"> • Students will complete structural 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 create advanced survey drawings. • Students will develop a model presentation with, drawings, renderings and a site plan. <p>STEAM Activities:</p> <ul style="list-style-type: none"> • 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 choose one commercial architecture project from the list below and create a "green" model of the structure. • Green architecture may have many of these features: <ul style="list-style-type: none"> o Ventilation systems designed for efficient heating and cooling o Energy-efficient lighting and appliances o Water-saving plumbing fixtures o Landscapes planned to maximize passive solar energy o Alternate power sources such as solar power or wind power o Efficient use of space o Optimal location on the land, maximizing sunlight, winds, and natural sheltering <p>Enrichment Activities:</p> <ul style="list-style-type: none"> • Convenience Store / Gas Station: <ul style="list-style-type: none"> <u>Outside:</u> <ul style="list-style-type: none"> o Parking Area o Gas Pumps (6-10) o Gas signs
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- Research the LEED and design and create a “green” model of an architectural structure. (HS-ETS1-3)

Inside:

- o Food and Beverage isles
- o Offices
- o Public restrooms (male and female)
Handicapped stalls
- o 2 Exterior Exits
- Modern Condo: (Modern or Craftsman style)
 - o One car garage
 - o Basement with utilities
 - o 2 Bedrooms and 2.5 bathrooms
 - o Parking areas and walkways
 - o Exterior Lighting
 - o Trees and shrubs
- Community Center:
 - o Entry foyer
 - o Offices (2 or 3)
 - o Public restrooms
 - o Handicapped accessibility
 - o Party rooms (1 large banquet hall & 2 small party rooms)
 - o Dance Floor
 - o Gymnasium
 - o Lock rooms (male and female)
 - o Bathrooms & showers for each
 - o Official's locker room
 - o Game room
 - o Exercise room (with equipment)
- Stadium:
 - o Field of your choice
 - o Locker rooms for each team
 - o Stadium seating
 - o Parking lot
 - o Grand entrance
 - o Public restrooms (male and female)
Handicapped stalls
- College Dorm:
 - o Entry foyer (Desk)
 - o Offices (2 or 3)
 - o Public restrooms

		<ul style="list-style-type: none"> o Handicapped accessibility o Game room o Exercise room (with equipment) o Dorm suite (With bedrooms and living spaces) o Shared Kitchen and Bathroom
Resources/Materials	<ul style="list-style-type: none"> ● Digital Handouts of drawings and procedures. ● Textbooks: <i>Architecture Residential Drafting and Design</i> ● Computers with AutoDesk Revit installed ● Plotter/Printers ● 3D printer ● Projector and screen ● Calculator ● Rulers ● Foam core ● Balsa wood ● Modeling tools <p>Online Resources:</p> <ul style="list-style-type: none"> ● Mr. Shohen's page: http://www.glenridge.org/Page/3606 ● Revitcity: http://www.revitcity.com/index.php ● Autodesk Seek: http://seek.autodesk.com/ ● House Plans: https://www.houseplans.com/ <p>LEED/Green</p> <ul style="list-style-type: none"> ● http://www.lead.net/ ● http://www.greenhomebuilding.com/sustainable_architecture.htm ● http://curriculum.autodesk.com/student/public/Level2/overview/project_id/19 <p>Title Sheet</p> <ul style="list-style-type: none"> ● http://www.nist.gov/el/nzertf/upload/NZERTF-Architectural-Plans1-June2011.pdf <p>Green Condo</p> <ul style="list-style-type: none"> ● http://www.gerdingeden.com/ge-news/press-releases/article/controller/News/action/detail/item/the-casey-is-the-nations-first-lead-platinum-high-rise-condominium/ <p>LEED Stadium</p> <ul style="list-style-type: none"> ● http://www.levisstadium.com/2014/07/stadium-becomes-first-us-venue-kind-earn-lead-gold-certification/ 	
Interdisciplinary Connections	<p>Math</p> <ul style="list-style-type: none"> ● 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).* <p>English Language Arts</p>	

	<ul style="list-style-type: none"> ● W.11-12.4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. <p>Science</p> <ul style="list-style-type: none"> ● 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.
21st Century Life and Careers	<ul style="list-style-type: none"> ● 9.2.12.C.6: Investigate entrepreneurship opportunities as options for career planning and identify the knowledge, skills, abilities, and resources required for owning and managing a business.
Technology Standards	<ul style="list-style-type: none"> ● 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-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.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.

Assessments			
Formative	Summative	Benchmarks	Alternative
<ul style="list-style-type: none"> ● Performance-based assessment on architectural standards as used in industry. ● Peer evaluation of drawings. ● Assessment rubrics to ensure drawings meet the requirements specified. 	<ul style="list-style-type: none"> ● Assessment on the creation of detailed drawings in the following areas: <ol style="list-style-type: none"> 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 	<ul style="list-style-type: none"> ● Students will be assessed on the proper use of building codes and dimensions in their drawings. ● Students will complete assigned drawing by the determined due date. 	<ul style="list-style-type: none"> ● 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.

	<ul style="list-style-type: none"> 7. Detailed rooms with furnishings and fixtures 8. Render drawing of building interior and exterior spaces. • Quizzes — General knowledge quiz on structural vocabulary. 		
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Modifications

English Language Learners	Special Education/504	Gifted and Talented
<ul style="list-style-type: none"> • Step by step instructions with pictures are provided for learning how to use the architectural program. 	<ul style="list-style-type: none"> • Step by step instructions with pictures are provided for learning how to draw each plan. • Extended time and reduced work • One on one instructions and review of drawing procedures. 	<ul style="list-style-type: none"> • Additional advanced plans are available for extra credit. • Students can create original instructions for other students to use in the future. • Students can participate in class and real life competitions.

Name of Course

Unit 3:

Time Allotted (days of instruction):

New Jersey Student Learning Standards (NJSL)

(TO ADD MORE ROWS, RIGHT CLICK AND CHOOSE INSERT ROW BELOW)

Essential Questions Student Learning Objectives Activities

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Resources/Materials

Interdisciplinary Connections

21st Century Life and Careers

Technology Standards

Assessments

Formative	Summative	Benchmarks	Alternative
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Modifications		
English Language Learners	Special Education/504	Gifted and Talented
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Name of Course
Unit 4:
Time Allotted (days of instruction):
New Jersey Student Learning Standards (NJSLs)
(TO ADD MORE ROWS, RIGHT CLICK AND CHOOSE INSERT ROW BELOW)

Essential Questions		
•	Student Learning Objectives	Activities
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Resources/Materials		
Interdisciplinary Connections		
21st Century Life and Careers		
Technology Standards		

Assessments			
Formative	Summative	Benchmarks	Alternative
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Modifications		
English Language Learners	Special Education/504	Gifted and Talented
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Name of Course
Unit 5:
Time Allotted (days of instruction):
New Jersey Student Learning Standards (NJSLs)

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Essential Questions		
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Essential Questions	Student Learning Objectives	Activities
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Resources/Materials		
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Interdisciplinary Connections		
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21st Century Life and Careers		
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Technology Standards		
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Assessments			
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Formative	Summative	Benchmarks	Alternative
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Modifications		
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English Language Learners	Special Education/504	Gifted and Talented
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