

Cedar Grove School District

Cedar Grove, NJ

2017 | Grade 9-12

Building and Engineering



Revised 2017
Approved by the Cedar Grove Board of Education

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Building & Engineering

Course Description

This semester course will afford students the opportunity to solve everyday building and engineering problems as well as unique ones. This is done with research followed by hands-on model building and prototyping. This course, which encompasses communication, transportation, engineering, and digital and manufacturing technologies, places an emphasis on student creativity and inventiveness. Students will do a variety of hands on projects which may include load tests on structures, boat hull design, and alternative methods of creating energy, to mention a few.

**This curriculum was written in accordance with the
2014 NEW JERSEY STUDENT LEARNING STANDARDS FOR
VISUAL AND PERFORMANING ARTS,
the 2014 NEW JERSEY STUDENT LEARNING STANDARDS
FOR 21ST CENTURY LIFE AND CAREERS,
and the
2014 NEW JERSEY STUDENT LEARNING STANDARDS FOR
TECHNOLOGY**

Building and Engineering

Unit 1 - Elements of Technology and Engineering

Course Objective(s)	Student Objectives
<p>Describe and explain the Technology Learning Activity Process. (TLA)</p>	<ul style="list-style-type: none"> • Define technology • Define Engineering • Describe the following design loop steps: <ol style="list-style-type: none"> 1. Develop a situation 2. Create design briefs 3. Gather research and information 4. Generate possible solutions 5. Choose a solution 6. Develop a drawing to scale 7. Build a prototype • Test and evaluate the product
2014 New Jersey Student Learning Standards for Visual and Performing Arts	
1.1.12.D.1 Distinguish innovative applications of the elements of art and principles of design in visual artworks from diverse cultural perspectives and identify specific cross-cultural themes.	
1.3.12.D.5 Identify the styles and artistic processes used in the creation of culturally and historically diverse two- and three-dimensional artworks, and emulate those styles by creating an original body of work.	
2014 New Jersey Student Learning Standards for 21st Century Life and Careers: Architecture & Construction Career Cluster	
9.3.12.AC-DES.1 Justify design solutions through the use of research documentation and analysis of data.	
2014 New Jersey Student Learning Standards for 21st Century Life and Careers: Arts, A/V technology & Communications Career Cluster	
9.3.12.AR-VIS.2 Analyze how the application of visual arts elements and principles of design communicate and express ideas.	
2014 New Jersey Student Learning Standards for 21st Century Life and Careers: Science, Technology, Engineering & Mathematics Career Cluster	
9.3.ST.1 Apply engineering skills in a project that requires project management, process control and quality assurance.	
9.3.ST-SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.	
2014 New Jersey Student Learning Standards for Technology	
8.1.12.C.1 Develop an innovative solution to a real world problem or issue in collaboration with peers and experts, and present ideas for feedback through social media or in an online community.	
8.1.12.E.1 Produce a position statement about a real world problem by developing a systematic plan of investigation with peers and experts synthesizing information from multiple sources.	
8.2.12.A.1 Propose an innovation to meet future demands supported by an analysis of the potential full costs, benefits, trade-offs and risks, related to the use of the innovation.	
8.2.12.B.1 Research and analyze the impact of the design constraints (specifications and limits) for a product or technology driven by a cultural, social, economic or political need and publish for review.	
8.2.12.C.2 Analyze a product and how it has changed or might change over time to meet human needs and wants.	

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Unit 2 – Applying Technology

Course Objective(s)	Student Objectives
Design and illustrate a structure that can hold a predetermined amount of weight	<ul style="list-style-type: none"> • Sketch ideas using graph paper • Draw a design to scale • Construct a model made of balsa wood that can hold a load force of at least ten pounds
Comprehend how load act upon an object.	<ul style="list-style-type: none"> • Explain how gravity affects our world • Identify forces as either internal or external • Identify loads as either static or dynamic
Interpret, through testing, how loads act upon an object.	<ul style="list-style-type: none"> • Test model to determine if it can hold load
Analyze and compare structural building materials.	<ul style="list-style-type: none"> • Recognize, identify, and explain their uses for cement, various types of lumber, composite decking, cinder blocks, sheetrock, paint, etc.
2014 New Jersey Student Learning Standards for Visual and Performing Arts	
1.3.12.D.4 Analyze the syntax and compositional and stylistic principles of two- and three-dimensional artworks in multiple art media (including computer-assisted artwork), and interpret themes and symbols suggested by the artworks.	
2014 New Jersey Student Learning Standards for 21st Century Life and Careers: Architecture & Construction Career Cluster	
9.3.12.AC-DES.1 Justify design solutions through the use of research documentation and analysis of data.	
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.	
2014 New Jersey Student Learning Standards for 21st Century Life and Careers: Arts, A/V technology & Communications Career Cluster	
9.3.12.AR-VIS.2 Analyze how the application of visual arts elements and principles of design communicate and express ideas.	
2014 New Jersey Student Learning Standards for 21st Century Life and Careers: Science, Technology, Engineering & Mathematics Career Cluster	
9.3.ST.1 Apply engineering skills in a project that requires project management, process control and quality assurance.	
9.3.ST-SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.	
2014 New Jersey Student Learning Standards for Technology	
8.1.12.C.1 Develop an innovative solution to a real world problem or issue in collaboration with peers and experts, and present ideas for feedback through social media or in an online community.	
8.1.12.E.1 Produce a position statement about a real world problem by developing a systematic plan of investigation with peers and experts synthesizing information from multiple sources.	

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Unit 3 – Communication Technology

Course Objective(s)	Student Objectives
Explore the communication process	<ul style="list-style-type: none"> • Differentiate between a transmitter and a receiver • Identify the reasons society communicates <ul style="list-style-type: none"> ▪ Provide information ▪ Influence people (elections) ▪ Educate • Evaluate and discuss various communication methods and equipment <ul style="list-style-type: none"> ▪ Photography ▪ Telephones ▪ Radio ▪ Television ▪ Computers ▪ Telegraph • Recognize the ways in which society communicates <ul style="list-style-type: none"> ▪ Paintings ▪ Non-verbal ▪ Morse code ▪ Flag system ▪ Light system ▪ Grades ▪ Print
Explore how technology has changed global communication	<ul style="list-style-type: none"> • Impact of the internet • Impact of telecommunications • Impact of cellular technology
2014 New Jersey Student Learning Standards for Visual and Performing Arts	
1.3.12.D.4 Analyze the syntax and compositional and stylistic principles of two- and three-dimensional artworks in multiple art media (including computer-assisted artwork), and interpret themes and symbols suggested by the artworks.	
2014 New Jersey Student Learning Standards for 21st Century Life and Careers: Architecture & Construction Career Cluster	
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.7 Employ appropriate representational media to communicate concepts and project design.	
2014 New Jersey Student Learning Standards for 21st Century Life and Careers: Arts, A/V technology & Communications Career Cluster	
9.3.12.AR-TEL.1 Demonstrate the use of telecommunications terminology, tools and test equipment.	
2014 New Jersey Student Learning Standards for 21st Century Life and Careers: Science, Technology, Engineering & Mathematics Career Cluster	
9.3.ST-ET.6 Apply the knowledge learned in the study of STEM to provide solutions to human and societal problems in an ethical and legal manner.	
9.3.ST-SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate,	

interpret and summarize research and statistical data.

2014 New Jersey Student Learning Standards for Technology

8.1.12.D.5 Analyze the capabilities and limitations of current and emerging technology resources and assess their potential to address personal, social, lifelong learning, and career needs.

8.1.12.F.1 Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs.

8.2.12.B.4 Investigate a technology used in a given period of history, e.g., stone age, industrial revolution or information age, and identify their impact and how they may have changed to meet human needs and wants.

8.2.12.C.2 Analyze a product and how it has changed or might change over time to meet human needs and wants.

8.2.12.E.1 Demonstrate an understanding of the problem-solving capacity of computers in our world.

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Unit 4 – Principles of Building and Engineering

Course Objective(s)	Student Objectives
Calculate and demonstrate velocity	<ul style="list-style-type: none"> Distinguish the differences between feet per second and miles per hour Design a catamaran to achieve maximum performance
Comprehend the differences in hull designs	<ul style="list-style-type: none"> Identify hulls as flat or deep Recognize a catamaran and pontoon boat by the shape of its hull Classify and categorize boats by their design styles
Illustrate, build, and test a hull design	<ul style="list-style-type: none"> Build a model of a catamaran Integrate the design styles of a catamaran into the model Validate the model's functionality through testing
Describe and discuss buoyancy	<ul style="list-style-type: none"> Demonstrate water displacement by testing models Illustrate and execute a design concept

2014 New Jersey Student Learning Standards for Visual and Performing Arts

1.1.12.D.1 Distinguish innovative applications of the elements of art and principles of design in visual artworks from diverse cultural perspectives and identify specific cross-cultural themes.

1.3.12.D.1 Synthesize the elements of art and principles of design in an original portfolio of two- and three-dimensional artworks that reflects personal style and a high degree of technical proficiency and expressivity.

2014 New Jersey Student Learning Standards for 21st Century Life and Careers: Architecture & Construction Career Cluster

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.6 Read, interpret and use technical drawings, documents and specifications to plan a project.

9.3.12.AC-DES.6 Apply the techniques and skills of modern drafting, design, engineering and construction to projects.

9.3.12.AC-DES.7 Employ appropriate representational media to communicate concepts and project design.

2014 New Jersey Student Learning Standards for 21st Century Life and Careers: Arts, A/V technology & Communications Career Cluster

9.3.12.AR-TEL.1 Demonstrate the use of telecommunications terminology, tools and test equipment.

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

2014 New Jersey Student Learning Standards for 21st Century Life and Careers: 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.4 Apply the elements of the design process.

9.3.ST-SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.

2014 New Jersey Student Learning Standards for Technology

8.2.12.E.1 Demonstrate an understanding of the problem-solving capacity of computers in our world.

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Unit 5 – Environmental Technology

Course Objective(s)	Student Objectives
Analyze current technology issues as they affect individuals, society, and the environment	<ul style="list-style-type: none"> Research and analyze technology issues as they affect individuals, society and the environment Express, in writing, opposing views on technology issues Explore the pros and cons of each issue in a debate format
Research and explore the possibilities of using alternative energy sources	<ul style="list-style-type: none"> Recognize, research and articulate the differences and importance of: <ul style="list-style-type: none"> Ethanol Biofuels Solar energy Wind energy Geothermal energy Other
Discuss the pros and cons of using alternative propulsion for our automotive needs.	<ul style="list-style-type: none"> Explore the feasibility of the following alternative propulsions systems: <ul style="list-style-type: none"> Hydrogen Electric Hybrid E-85 Flex fuel vehicles

2014 New Jersey Student Learning Standards for Visual and Performing Arts

1.3.12.D.1 Synthesize the elements of art and principles of design in an original portfolio of two- and three-dimensional artworks that reflects personal style and a high degree of technical proficiency and expressivity.

2014 New Jersey Student Learning Standards for 21st Century Life and Careers: Architecture & Construction Career Cluster

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.7 Employ appropriate representational media to communicate concepts and project design.

2014 New Jersey Student Learning Standards for 21st Century Life and Careers: Arts, A/V technology & Communications Career Cluster

9.3.12.AR-TEL.1 Demonstrate the use of telecommunications terminology, tools and test equipment.

2014 New Jersey Student Learning Standards for 21st Century Life and Careers: 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-SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.

2014 New Jersey Student Learning Standards for 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.

8.2.12.B.4 Investigate a technology used in a given period of history, e.g., stone age, industrial revolution or information age, and identify their impact and how they may have changed to meet human needs and wants.

8.2.12.B.5 Research the historical tensions between environmental and economic considerations as driven by

human needs and wants in the development of a technological product, and present the competing viewpoints to peers for review.

8.2.12.C.2 Analyze a product and how it has changed or might change over time to meet human needs and wants.

8.2.12.D.6 Synthesize data, analyze trends and draw conclusions regarding the effect of a technology on the individual, society, or the environment and publish conclusions

8.2.12.E.1 Demonstrate an understanding of the problem-solving capacity of computers in our world.

Building and Engineering

Unit 6 – Automotive Engineering and Design

Course Objective(s)	Student Objectives
Explore how the automobile has shaped our society	<ul style="list-style-type: none"> • Interpret how each of the following forces acts upon an automobile: <ul style="list-style-type: none"> ▪ Gravity ▪ Drag ▪ Thrust ▪ Friction ▪ Lift ▪ Wind resistance
Differentiate and interpret forces that act upon an automobile	<ul style="list-style-type: none"> • Examine its impact on: <ul style="list-style-type: none"> ▪ History ▪ Business ▪ Jobs ▪ The economy ▪ Other modes of transportation
Demonstrate an understanding of automotive technology through construction of a race car	<ul style="list-style-type: none"> • Illustrate an automobile design • Build an automobile utilizing the design • Test the automobile in order to demonstrate an understanding of the following: <ul style="list-style-type: none"> ▪ Designing and construction ▪ Modeling/shaping ▪ Propulsion ▪ Understanding speed ▪ Calculating MPH

2014 New Jersey Student Learning Standards for Visual and Performing Arts

1.1.12.D.1 Distinguish innovative applications of the elements of art and principles of design in visual artworks from diverse cultural perspectives and identify specific cross-cultural themes.

1.3.12.D.1 Synthesize the elements of art and principles of design in an original portfolio of two- and three-dimensional artworks that reflects personal style and a high degree of technical proficiency and expressivity.

2014 New Jersey Student Learning Standards for 21st Century Life and Careers: Architecture & Construction Career Cluster

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.6 Read, interpret and use technical drawings, documents and specifications to plan a project.

9.3.12.AC-DES.6 Apply the techniques and skills of modern drafting, design, engineering and construction to projects.

9.3.12.AC-DES.7 Employ appropriate representational media to communicate concepts and project design.

2014 New Jersey Student Learning Standards for 21st Century Life and Careers: Arts, A/V technology & Communications Career Cluster

9.3.12.AR-TEL.1 Demonstrate the use of telecommunications terminology, tools and test equipment.

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

2014 New Jersey Student Learning for 21st Century Life and Careers: 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.4 Apply the elements of the design process.

9.3.ST-SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.

2014 New Jersey Student Learning Standards for Technology

8.2.12.E.1 Demonstrate an understanding of the problem-solving capacity of computers in our world.

Suggested Resources

Textbook:

- *Technology*, R. Thomas Wright, McGraw Hill, 2008
- *Technology & Engineering*, McGraw Hill, 2008
- *Technology Interpretations*, McGraw Hill, 2008
- *Introduction to Technology*, McGraw Hill, 2007

Supplementary Materials:

- Videos/DVDs
- *How a Car is Made*, Media Presentations, 2000
- *Renewable Energy: Modern Marvels*, The History Channel, 2007
- *The Story of Henry Ford*, Questar, 2005

Websites:

- <http://www.historychannel.com>
- <http://www.discoverychannel.com>

Computer Work Stations

- Software
- Pro-E Engineering

Equipment

- Drills
- Sanders
- Dremel
- Band saw
- Sanders