Black Horse Pike Regional School District
580 Erial Road, Blackwood, NJ 08012

Design and Technology I

COURSE OF STUDY

Technology Department

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Date:
Summer 2020

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Approved by:
Matt Szuchy, Director of Curriculum and Instruction

DESIGN & TECH I

HIGH SCHOOL NAME

2020-2021 Course Syllabus

TEACHER

E-MAIL

PHONE #

REMIND CODE

CLASSROOM CODE

COMMON TIME AVAILABILITY

_ and _ days in _-___.

I am not available any other day, but can meet after school, if you schedule it with me in advance.

COURSE DESCRIPTION

9-12 Graders - No Pre-Requisite Required
5 Credits

Design & Tech 1 is the first level Technology Education course available to all students where you will plan, build, and test prototypes for fun, hands-on, and engaging design challenges. This class is equal parts design and building, which means that you spend just as much time planning, sketching and designing on the computer as you do building your designs in the lab.

UNITS COVERED

- Measurement
- Machine, Tool and Lab Safety
- 3D Modeling & Rapid Prototyping
- Simple Circuits and Basic Electricity
- Manufacturing and Materials Processing
- BHPRSD TECH CHALLENGE
- AutoCAD Basics
- Civil/Structural Challenge - Bridge Design
- Automotive Design Challenge - Egg Car
- Marine Design Challenge - Boat Hull
- Rocketry and Aeronautics

MATERIALS NEEDED

- Pencil (bring everyday)
- Two-Pocket Folder (keep in the classroom)

GRADING

CLASSWORK (65%): Anything you make or produce falls under this category including written assignments, quizzes, sketches and brainstorming activities, any computer-based work, and anything you build from your prototypes to your final designs.

PARTICIPATION (35%): You are expected to actively participate each and every day. Over a third of your grade is participation! Below are some pointers to help you succeed in class and earn full participation points every week:

LATE WORK

- Any classwork submitted late will be docked -15% points off of the total grade.
- You can earn some or all of these points back ONLY if you complete missed or late work during Common Time, but NOT during class time.

ABSENCES

- If you are absent, it is your responsibility to e-mail me and check Google Classroom.
- You will get extensions on assignments equal to the number of days you were out
- If you know you're going to be out, notify me ahead of time so I can help you with the classwork

TOP 10 WAYS TO EARN FULL PARTICIPATION POINTS

1. Keep phone and headphones away for the entire class period
2. Keep quiet and pay attention during lectures, lessons and demonstrations
3. Ask questions if you're not sure what to do. If I am busy with someone else, try and look up the answer on your own or ask a classmate or partner (but don't do nothing)
4. Each class we will have daily/weekly checkpoints. Make sure you know what they are and work to meet those checkpoints
5. When prompted to get to work, you should get to work within just a couple minutes. Any longer and you will lose participation points
6. Be productive and try your best. You should be working on your projects for this class for the majority of the period. Breaks are ok, but should be short and limited
7. Use school appropriate language and be mindful of your classmates
8. Arrive to class on time, prepared with all necessary materials and sit in your seat
9. Use tools, machinery, and classroom equipment correctly and safely
10. Have fun!

DESIGN & TECHNOLOGY DEPARTMENT

PERFORMANCE CHART

	ADVANCED	PROFICIENT	BELOW AVERAGE
GRADING GUIDE	A	B-C	D-F
EFFORT AND USE OF CLASS TIME (Group or Individual)	Extra effort during and after class time is put into project. Student(s) modeled exceptional behavior, were always on task, followed all safety rules, and helped others.	Consistent effort is put into the project during class time. Student(s) modeled good behavior, but was not always on task and misused equipment.	Inconsistent effort during class time. Student(s) did not use class time wisely, misused tools and machinery, and, as a result, missed checkpoints, deadlines and due dates.
ACCURACY AND NEATNESS	Project is prepared neatly and carefully. All measurements are accurate. Project is aesthetically pleasing and well built.	Project is fairly neat. Measuring is mostly accurate. Project is good. There is room for improvement.	Project is prepared with little care and lacks neatness. Project looks rushed and doesn't work as intended. Lots of room for improvement.
CREATIVITY	Project is original and imaginative. Design is unique, innovative and well thought out.	Project has some original elements. Design is somewhat clever but not entirely unique.	Project lacks creativity and thought. Design is not original and is more or less a copy of an existing one.
FOLLOWING INSTRUCTIONS, SPECIFICATIONS AND CONSTRAINTS	All project instructions have been followed. Every requirement has been met and exceeded.	Some project instructions and requirements met, but not all.	The majority of project instructions and requirements were not followed, have not been met, and project is incomplete.
DEMONSTRATES UNDERSTANDING	Student is extremely knowledgeable of project concepts and is able to help others.	Student displays knowledge of most concepts, methods and/or practices involved in the project.	Student lacks knowledge about project concepts, methods and practices.

UNIT OUTLINE

Design & Technology I

5 Credits
GRADES: 9-12
Prerequisite: None

Course Content

1. **Machine, Tool and Lab Safety**: This unit is designed to increase literacy in technology and engineering through a series of hands-on activities that utilize the engineering design process by following general shop, tool and machine safety as well as reinforcing basic math, science, and communication skills.

2. **Measurement and Basic Orthographic**: This unit will introduce the students to the fundamentals of measurement and basic technical drawing. They will be working in both 2D and 3D space. They will start by creating hand drawings and sketches and then move on to computer generated drawings. The students will establish a basic foundation in CAD (Computer-Aided Drawing) during this time using AutoCAD and OnShape.

3. **Tech Challenge**: The BHPRSD Tech Challenge takes students through the Engineering Design Process where students begin by defining a problem, work in small groups to research and develop the best solution to that problem, and compete against the other two high schools in the district to see whose design worked the best.

4. **3D Modeling and Prototyping**: In this unit students will learn the importance of 3D modeling as it pertains to the design process, problem solving and 3D printing. Students will utilize a cloud-based modeling application (Onshape) to learn fundamental techniques necessary to create basic 3D models and apply these skills to course design projects/prototypes.

5. **Civil and Structural Engineering**: In this unit students will use math and science to discover the technological systems that are used when building a structure. They will begin by researching mechanical forces, structural loads, materials, and shapes. Then they will implement what they have learned, and experiment by testing bridge designs on the computer. After they have found a suitable bridge design, students will replicate the bridge using design software. Lastly, the students will build the bridge that they have created and then test the design.

6. **Rocketry and Aeronautics**: Students will learn to use the technological design process (TDP) to solve open ended problems involving space travel and flight related concepts. Students will solid model their solution using Autodesk Inventor to create their design that is aerodynamically sound. Students will learn to safely use tools and machines to extend human capabilities and build their solution to the aernatical challenge as designed. Students will use math to calculate the success and altitude of their flight.

Course Expectations and Skills:

1. Keep and maintain an Engineering notebook.
2. Apply and document the Engineering process while solving challenges.
3. Practice proper attitude and safe discipline.
4. Develop an acceptable degree of craftsmanship in each activity.
5. Participate and contribute equally to group generated solutions.
6. Apply and analyze science and math related concepts to the challenge.
7. Prepare students to be successful in high school and higher level technology courses.

Resources:

“Technology Education: Learning by Design” by Michael Hacker & David Burghardt, 2008.

Black Horse Pike Regional School District Curriculum

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course: Design and Technology I **Unit Title:** Machine, Tool and Lab Safety **Grade Level(s):** 9-12	**Unit Summary:** This course is designed to increase literacy in technology and engineering through a series of hands-on activities that utilize the engineering design process by following general shop, tool and machine safety as well as reinforcing basic math, science, and communication skills. ● Class procedures and expectations. ● General shop safety and procedures. ● Specific tool and machine safety rules and procedures.
Essential Questions: ● What are proper class procedures and rules? ● How to work safely with tools and machines? ● What is the proper procedure for using tools and machines located in the Technology lab? ● Why should you wear safety glasses? ● How to safely operate machinery/equipment and tools used in the Technology Lab?	**Enduring Understanding:** ● It is important to be aware of and follow organizational and safety procedures. ● Identifying and understanding unsafe conditions and practices. ● Equipment shall be used only as intended and within the specifications set forth by the manufacturer. ● Housekeeping is everyone's duty and includes cleaning up debris from machines and work areas. ● If you are in doubt as to a proper or safe procedure, stop work and ask for guidance. ● Use tools for intended purposes only.

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

After each target, identify the NJCCCS or Common Core Standards that are applicable.

Learning Target:	**NJCCCS or CCS:**
1. Understanding and observing classroom rules, requirements, emergency, and general procedures 2. How to work safely? 3. How to recognize an unsafe condition? 4. How to maintain safety conditions in the Technology Lab	1. Tech.9-12 2. STEM.9-12.9.4.12.O.38

Interdisciplinary Connections:

STEAM, English

Students will engage with the following text:

Technology Education: Learning by Design
Pearson Prentice Hall
ISBN 0133639894

Periodicals may include, but are not limited to, newspapers, magazine articles and web pages.

Students will write:

Students will keep an Engineering notebook, which will include daily and weekly journal entries, notes, research information, design briefs and other information regarding the Engineering Design challenges throughout the course, sketches, brainstorming activities, etc.

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE

How will students uncover content and build skills?.

- Classroom rules will be introduced and students will participate in classroom discussions and activities while following proper rules and procedures.

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF THE CONTENT AND THEIR ABILITY TO APPLY SKILLS. IDENTIFY BLOOM'S LEVELS

Formative Assessments:

- Safe work practice with hand tools as outlined in the lesson: direct teacher observation and guided practice.
- Students will follow classroom procedures as provided in teacher lecture and written in engineering notebook:
- Direct observation by teacher for safe working habit (see Class Participation Rubric)

Accommodations and Modifications:

- Provide students with safety rules and orally review them prior to the start of working with tools.
- Have an assessment method provided to the class before the assessment begins.
- Make sure all students are sitting in an area of least distractions.

Summative Assessments:

- Participate in safety test assessments for tools and machines used in the Technology Lab.
- Minimum grade must be obtained to participate in hands-on activities.

Accommodations and Modifications:

- Extra time to complete assignments and assessments as needed.

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PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course: Design and Technology I **Unit Title:** Measurement and Basic Orthographic **Grade Level(s):** 9-12	**Unit Summary:** This unit will introduce the students to the fundamentals of measurement and basic technical drawing. They will be working in both 2D and 3D space. They will start by creating hand drawings and sketches and then move on to computer generated drawings. The students will establish a basic foundation in CAD (Computer-Aided Drawing) during this time using AutoCAD and OnShape.
Essential Questions: ● Why do we create solid models? ● How can I use the views of an orthographic projection to create a 3D Model? ● What are parametric constraints? ● What are work planes and why are they important?	**Enduring Understanding:** ● Develop the ability to measure using the English and metric measurement system. ● CAD is used for detailed engineering of 2D drawings and 3D models of physical components ● Identify and use various drafting tools, aids, and equipment and their uses in graphic communication. ● Develop problem-solving skills in the use of equipment and in graphical representation and layout. ● Develop the ability to visualize and solve space problems graphically. ● Demonstrate an understanding of principles of sketching, geometric construction, orthographic projection, dimensioning, sectioning, pictorials, detail and assembly drawings, and conventional practice followed in graphical communication. ● Demonstrate a basic working understanding of a computer-aided drafting system. ● Determine when to use 2D and 3D modeling

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

After each target, identify the NJCCCS or Common Core Standards that are applicable.

Learning Target:	**NJCCCS or CCS:**
1. Develop the ability to measure using the English and metric measurement system. 2. Identify and use various drafting tools, aids, and equipment and their uses in graphic communication. 3. Develop problem-solving skills in the use of equipment and in graphical representation and layout. 4. Identify careers and opportunities in drafting due to technological advancement. 5. The student will learn the basic commands of 2D drawings in	• 9.3.12.ED.4 • 9.3.ST.3 • 8.1.12.f.1 • 8.1.12.f.2 • 9.3.ST-ET.1 • 9.3.ST-ET.3 • 9.3.ST-ET.5 • 9.3.ST-SM.4 • 8.2.2.C.1-6

AutoCAD which are: a. Line, Arc and Circle b. Trim, Extend and Erase c. A system of layering to establish line color, weight and types d. A system of basic dimensions and notes e. Set up of a new drawing using a template f. Use of Cut, Copy and Paste g. Basic plotting to a paper copy 6. The student will learn the basic commands of 3D drawings in OnShape: a. Sketching and Extruding	• 8.2.5.C.1-7 • 8.2.8.C.1-8 • 8.2.2.D • 8.2.8.D.3 • 8.2.12.D.3 • 8.2.12.D.1

Interdisciplinary Connections:

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Students will keep an Engineering notebook, which will include daily and weekly journal entries, notes, research information, design briefs and other information regarding the Engineering Design challenges throughout the course, sketches, brainstorming activities, etc.

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE

How will students uncover content and build skills?.

- Project based and self-exploration
- Real life engineering problems
- Examples of solutions will be given first then students will problem solve and explore to create their own solutions to the problems.
    1. Students will be completing sketches of models before they complete them on the computer.
    2. Students will use 3D models to create advanced orthographic projections
    3. Students will use two views to create a third view.
    4. Students will use real objects and take measurements to create a solid model.
    5. Students will use two views to create a solid model.

Students will need to have access to Autodesk AutoCAD and OnShape. Drawing will come from the text and other engineering drawings produced by the teacher.

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF THE CONTENT AND THEIR ABILITY TO APPLY SKILLS. IDENTIFY BLOOM'S LEVELS

Formative Assessments:

Observation of student progress and skill development, checkpoints of understanding at:

- Measurement
- Orthographic projections
- Isometrics
- Set-up of program, layers, and workspace
- Sketching of models
- Parts created coping another model
- Models created by looking at the three views of an orthographic projection
- Create using two views
- Extrude
- Measure and create part from looking at a real object.
- Using constraints to complete assembling drawings.

Do-now's and checkpoint quizzes will be given during and at the conclusion of these topics

Accommodations and Modifications:

- Students have guided packets with questions that outline the research, and brainstorming. The students will have an adjusted writing and mathematics packet to suit particular needs. Students will receive extra one on one instruction to ensure safety and understanding.

- Alternative assignments, additional time for assignments, preferential seating arrangements one on one interaction, after school help, and assistance for organization. Check frequently for student understanding.

Summative Assessments:

- Final evaluation of the project based on a rubric.
- Final grade of design journal as it is re-graded in its entirety
- Reflection paper about the entire project

Accommodations and Modifications:

- Alternative assignments, additional time for assignments, preferential seating arrangements one on one interaction, after school help, and assistance for organization. Check frequently for student understanding.
- Allow students to get their work checked frequently as the assessments are build-ups.

Performance Assessments:

- Construction of a solution to the challenge
- Safely utilizing computer, shop tools, and machines

Accommodations and Modifications:

- Alternative assignments, additional time for assignments, preferential seating arrangements one on one interaction, after school help, and assistance for organization. Check frequently for student understanding.
- Allow students to get their work checked frequently as the assessments are build-ups.

Black Horse Pike Regional School District Curriculum

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PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course: Design and Technology I **Unit Title:** Tech Challenge **Grade Level(s):** 9-12	**Unit Summary:** ● Students will work in teams and implement the design process to solve an open-ended design challenge. During this process, they will learn to safely use tools and machines to extend human capabilities for the purpose of solving a problem. Design & Technology students from Triton, Highland and Timber Creek will compete in a district-wide competition with a goal of finding the most successful solution to the problem presented.
Essential Questions: ● How can technological problems be solved in an organized and systematic fashion? ● How is technology used to extend human capabilities? ● Why are proper safety precautions necessary in the workplace? ● What are the benefits and concerns involved with working on a team?	**Enduring Understanding:** ● The major emphasis of this unit is centered on applying the design process to solve a design challenge. This process will be implemented to help students systematically solve challenges throughout all Design and Technology courses. Students will gain understanding as to why the design process is meant to be cyclical in nature. They will learn to solve open ended problems by designing, building and testing their own solutions and projects. The Tech Challenge unit will help increase student confidence in using tools and machines to process multiple types of materials while working cooperatively with team members in a friendly competition environment.

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

After each target, identify the NJCCCS or Common Core Standards that are applicable.

Learning Target:	**NJCCCS or CCS:**
1. Explain and apply the technological design process to a real design challenge 2. Design and create a working set of technical drawings 3. Safely and responsibly operate tools and machines to process a variety of different materials 4. Write a creative fictional story that applies to the designated	1. TEC.9-12.8.1 2. TEC.9-12.8.2.12 B.3 3. TEC.9-12.8.2.12.E.1 4. TEC.9-12.8.1.12 B.9 5. ELL.9-12.S.B.3 6. ELL.9-12.R.E.6

challenge 5. Solve project - related geometric, algebraic, and statistical math problems 6. Display professionalism, sportsmanship and team-based accountability throughout a competition 7. Constructively reflect upon the technological design process, challenge and teamwork	7. MA.9-12.4.2.12 D.2 8. MA.9-12.4.5 9. MA.9-12.4.5.12 E

Interdisciplinary Connections:

STEAM, English

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Students will write:

Students will keep an Engineering notebook, which will include daily and weekly journal entries, notes, research information, design briefs and other information regarding the Engineering Design challenges throughout the course, sketches, brainstorming activities, etc.

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE

How will students uncover content and build skills?.

- Students will read and follow a Technological Design Challenge design packet. This documentation will include all of the information related to the challenge including the rules, constraints, materials, design journal components, timeline, and project rubric.
- Students will maintain a digital journal as they document the process in which they solve the problem presented by the challenge. Students will write a design brief statement showing comprehension and understanding of the challenge and project at hand.
- Students will design and sketch a team logo and cover page.
- Students will write a creative fictional story related to the design challenge.
- Students will brainstorm and sketch multiple solutions to the challenge using only the approved and allotted materials.
- Students will list positive and negative aspects of each design and choose the best solution

to create a detailed rough sketch.

- Students will develop their best solution into a working mechanical drawing with an included bill of materials.
- Students will complete a challenge related engineering math worksheet.
- Students will maintain a daily activity log detailing their accomplishments during class time.
- Students will safely utilize classroom tools and equipment to construct their designs and test them when their prototypes are completed.
- Students will write a reflection essay that focuses on the evaluation of their design and performance of their team overall.

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF THE CONTENT AND THEIR ABILITY TO APPLY SKILLS. IDENTIFY BLOOM'S LEVELS

Formative Assessments:

- Students will read and understand the timeline, direction and constraints of the project as per the information provided in the design brief.
- Students will display proper safety procedures and practices during the construction phase of the project.
- Student teams will store their materials in an organized manner.
- Students will collaborate with their teammates in a positive, productive and respectful manner.

Accommodations and Modifications:

- Students will be accommodated on a case by case basis.
- Alternative assignments, additional time for assignments, preferential seating arrangements, one on one interaction, after school help, and assistance for organization may be required.
- Check frequently for student understanding.
- Allow students to get their work checked frequently.
- Extra help is available for students who need more time or more clarification.

Summative Assessments:

- Daily Activity Log

- Team Logo Design
- Journal Cover Design
- Problem Statement
- Fictional Story
- Research Topics
- Thumbnail Sketches
- Detailed Sketches
- Working Technical Drawing
- Materials/Parts List
- Reflection Essay

Accommodations and Modifications:

- Students will be accommodated on a case by case basis.
- Alternative assignments, additional time for assignments, preferential seating arrangements, one on one interaction, after school help, and assistance for organization may be required.
- Check frequently for student understanding.
- Allow students to get their work checked frequently.
- Extra help is available for students who need more time or more clarification.

Performance Assessments:

- Final Tech Challenge device

Accommodations and Modifications:

- Students will be accommodated on a case by case basis.
- Students with physical needs will be accommodated by use of custom and specialized tools, equipment and/or workspace.
- Check frequently for student understanding.
- Allow students to get their work checked frequently.
- Extra help is available for students who need more time or more clarification.

Black Horse Pike Regional School District Curriculum

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

<table>
<tr>
<td>Course:
Design and Technology I

Unit Title:
3D Modeling and Prototyping

Grade Level(s):
9-12</td>
<td>Unit Summary:
● In this unit students will learn the importance of 3D modeling as it pertains to the design process, problem solving and 3D printing. Students will utilize a cloud-based modeling application (Onshape) to learn fundamental techniques necessary to create basic 3D models and apply these skills to course design projects/prototypes.</td>
</tr>
<tr>
<td>Essential Questions:
● How can technological problems be solved in an organized and systematic fashion?

● How is technology used to extend human capabilities?

● Why is object visualization/orientation so important for the creation of solid models?

● What is a parametric model? How does it compare to a 2D CAD drawing?

● What elements are involved in creating a solid model?

● Why is solid modeling vital to 3D printing?</td>
<td>Enduring Understanding:
● When practiced properly, the design process provides an organized, step by step guide to creating a solution to a design challenge.

● Technology extends human capabilities through inventions and innovations that help to convert resources into goods and services for our society.

● Solid models are created in a virtual 3D environment. A designer must be proficient in visualizing and identifying an object in an orthographic fashion (Top, Front, Right Side).

● Unlike a 2D CAD drawing which might require several separate drawings to describe it, a parametric model contains all the dimensional information and details associated with the object within itself.

● The creation of solid shape must begin with a 2 dimensional sketch. After creation, solid shapes can be edited or manipulated with feature tools.

● 3D models cannot be printed from 2 dimensional sketches or CAD drawing files. They can only be printed from virtual solid models exported in the proper format.</td>
</tr>
</table>

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

After each target, identify the NJCCCS or Common Core Standards that are applicable.

Learning Target:	**NJCCCS or CCS:**
1. Properly identify and visualize the work planes of an object in isometric orientation. 2. Create, dimension and edit sketches and sketch planes using Onshape 3D modeling software application 3. Access, organize, edit and export files in a cloud-based application 4. Use 3D extruding methods and feature-based tools to create basic solid models 5. Edit/revise an existing parametric solid model for design intent or challenge constraints 6. Use solid modeling to design and 3D print a prototype	• TEC.9-12.8.2.12 B.6 MA.9-12.4.2.12 A.2 MA.9-12.4.2.12 A.1 • TEC.9-12.8.1.12.B.1 TEC.9-12.8.2.12.F.3 • TEC.9-12.8.1.12.B.10 TEC.9-12.8.1.12.B.11 • TEC.9-12.8.2.12 B.3 TEC.9-12.8.2.12.F.3 MA.9-12.4.2.12 A.1 • TECH.8.1.12.A.2 • TECH.8.1.12.F.CS4 12.9.3.ST-SM.2

Interdisciplinary Connections:

STEAM, English

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Students will keep an Engineering notebook, which will include daily and weekly journal entries, notes, research information, design briefs and other information regarding the Engineering Design challenges throughout the course, sketches, brainstorming activities, etc.

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE

How will students uncover content and build skills?.

- Students will partake in teacher-lead demonstrations as well as instructional videos to learn new skills within the Onshape software platform.
- Students will actively collaborate with classmates while working in a CAD lab environment.
- Students will complete applicable 3D model exercises to reinforce newly introduced skills/methods.
- Students will apply 3D modeling skills learned in this unit of study to D&T1 design challenges.
- Students will be assisted by the instructor in a “one on one” fashion during class lab time.
- Throughout the design process students will use creative problem solving skills to develop solutions for design challenges.
- Students will become familiar with reading and interpreting Engineering drawings with industry-standard annotations.
- Students will learn to revise and edit parametric models as a part of the design process.

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF THE CONTENT AND THEIR ABILITY TO APPLY SKILLS.
IDENTIFY BLOOM’S LEVELS

Formative Assessments:

- Warm-Up Activities
- Daily activities will be based on either student exploration of the content area or a reflection of a prior lesson, to help reinforce concepts already taught
- Knowledge of Onshape software platform
- Daily file management & organization
- Basic technical drawing visualization
- Understanding of object dimensions and detailing
- Proficiency with fractional and decimal measurement/oonversion

Accommodations and Modifications:

- Students will be accommodated on a case by case basis.
- Students with physical needs will be accommodated by use of custom and specialized computer hardware or workstations.
- Alternative assignments, additional time for assignments, preferential seating

arrangements, one on one interaction, after school help, and assistance for organization may be required.
- Check frequently for student understanding.
- Allow students to get their work checked frequently.
- Extra help is available for students who need more time or more clarification.

Summative Assessments:

- Daily Activity Log
- Solid modeling exercises/assignments

Accommodations and Modifications:

- Students will be accommodated on a case by case basis.
- Alternative assignments, additional time for assignments, preferential seating arrangements, one on one interaction, after school help, and assistance for organization may be required.
- Check frequently for student understanding.
- Allow students to get their work checked frequently.
- Extra help is available for students who need more time or more clarification.

Performance Assessments:

- 3D printed prototypes created for class design projects

Accommodations and Modifications:

- Students will be accommodated on a case by case basis.
- Students with physical needs will be accommodated by use of custom and specialized computer hardware or workstations
- Check frequently for student understanding.
- Allow students to get their work checked frequently.
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PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course: Design and Technology I **Unit Title:** Civil and Structural Engineering **Grade Level(s):** 9-12	**Unit Summary:** ● In this unit students will use math and science to discover the technological systems that are used when building a structure. They will begin by researching mechanical forces, structural loads, materials, and shapes. Then they will implement what they have learned, and experiment by testing bridge designs on the computer. After they have found a suitable bridge design, students will replicate the bridge using design software. Lastly, the students will build the bridge that they have created and then test the design.
Essential Questions: ● How do science and math relate to structural engineering? ● What is the importance of research when developing a technological product or system? ● What is the importance of many technological systems working together as a whole? ● What is the importance of prototyping before building a final product. ● What is the advantage of a CAD system? ● Why are the shop procedures and safety so important? ●	**Enduring Understanding:** ● Understand the concepts of technological systems, communication technology, and building technology. ● Identify and describe the uses of structures in everyday life. ● Describe and demonstrate structural forces and how they act on a structure. ● Create and understand the reasoning behind testable models and prototypes. ● Create working drawings in 2D AutoCAD ● Review shop safety and procedures. ● Build a structural model from those drawings ● Test the model they built. ● Reflect on the Technological Design Process.

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

After each target, identify the NJCCCS or Common Core Standards that are applicable.

Learning Target:	**NJCCCS or CCS:**
1. Identify and explain the difference between a live load and a dead load. 2. Understand the mathematics and physics related to structural engineering. 3. Describe the various forces that act on a structure.	● TEC.9-12.8.2 ● LA.9-12.3.1 ● EC.9-12.8.2 ● SCI.9-12.5.4 ● TEC.9-12.8.2 ● LA.9-12.3.1

4. Understand the loads that a structure must withstand. 5. Identify and explain various building materials used in construction. 6. Analyze different shapes used when developing structures. 7. Develop a computerized model of a structure and test its efficiency. 8. Create a working design of a structure that can be used as a blueprint. 9. Construct a working model of a structure that can be tested for efficiency.	• TEC.9-12.8.2 • TEC.9-12.8.2 • TEC.9-12.8.2 • MA.9-12.4.2.12 A.1 • TEC.9-12.8.2.12 B.1 • TEC.9-12.8.2.12 B.4 • TEC.9-12.8.1 • TEC.9-12.8.2.12.E.1

Interdisciplinary Connections:

STEAM, English

Students will engage with the following text:

Technology Education: Learning by Design
Pearson Prentice Hall
ISBN 0133639894

Periodicals may include, but are not limited to, newspapers, magazine articles and web pages.

Students will write:

Students will keep an Engineering notebook, which will include daily and weekly journal entries, notes, research information, design briefs and other information regarding the Engineering Design challenges throughout the course, sketches, brainstorming activities, etc.

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE

How will students uncover content and build skills?.

1. Students will begin by watching and taking notes on a lesson created by the instructor.
2. The students will research mechanical forces, structural loads, materials, and shapes using PBS Building Big online and other online resources.
3. The students will be engaged with research and exploration of structural engineering through this Web-based Activity. A packet is available that students can use to follow along with the WebQuest.
4. The students will be introduced to “West Point Bridge Designer”, a computer bridge modeling program. They must develop the strongest, yet most inexpensive, bridge possible using the given scenarios set forth by the instructor. The first few days of this program will be geared towards exploration and learning the software. The final days will be geared toward the development of a bridge model that the student will create and test in the classroom.
5. Autodesk AutoCAD will be used to develop a 2-D or 3-D model of the students’ working bridge design developed through West Point Bridge Designer.
6. After completion of this model, they will plot the drawing and use this as a template to build their bridge. Balsa wood sticks and wood glue will be used in the construction of the student’s bridge model. First the student will take their printed bridge model, attach it to a

piece of foam core board and cover the design with wax paper. Using easy cutters or a Pitsco Timber Cutter the students will cut out the necessary bridge members and shape them accordingly using sand paper. The students will then glue their pieces to one another using proper joinery techniques. The sticks will be held down to the foam core using pins. After both sides of the bridge are completed, they may be installed to the bridge base, and braces may be added.

7. The final stage is testing. Before the student's bridge is tested, it is weighed on a digital scale and recorded. Placed on a structure testing device, weight is then added to the structure until the structure fails. Once the structure fails, the amount of force applied to that structure is recorded. The student will then take the weight of the bridge divide that by the pounds of force applied before failure to get an efficiency number. This number will be compared with the rest of the class in order to determine who had the most efficient bridge design.
8. Following testing, a discussion outlining the merits and faults of the different designs will be undertaken. A one page reflective essay will be written to include a picture of their bridge, what was learned during the unit and an explanation in their own words as to how math and science are necessary in structural engineering.

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF THE CONTENT AND THEIR ABILITY TO APPLY SKILLS. IDENTIFY BLOOM'S LEVELS

Formative Assessments:

- All activities will be based on either student exploration of content area, or reflection of prior lessons.
- CHECKPOINTS OF UNDERSTANDING
  - Structure analysis – (PBS Building Big, WebQuest worksheet)
  - West Point Bridge Designer progress (daily constraint worksheet)
  - Inventor bridge drawing
  - Balsa bridge completion
  - Efficiency calculation

Accommodations and Modifications:

- Alternative assignments, additional time for assignments, preferential seating arrangements, one on one interaction, after school help, and assistance for organization. Check frequently for student understanding.
- Allow students to get their work checked frequently as the assessments are build-ups.

Summative Assessments:

- Structures Test is the actual testing of the bridge model to determine the total weight held at structural failure..
- Students will write an end of unit reflective essay explaining what students learned from this TLA.

Accommodations and Modifications:

- Alternative assignments, additional time for assignments, preferential seating arrangements, one on one interaction, after school help, and assistance for organization. Check frequently for student understanding.
- Allow students to get their work checked frequently as the assessments are build-ups.

Performance Assessments:

- Balsawood bridge - (Culmination of all activities learned during this unit should be displayed in this model.)

Accommodations and Modifications:

- Alternative assignments, additional time for assignments, preferential seating arrangements, one on one interaction, after school help, and assistance for organization. Check frequently for student understanding.
- Allow students to get their work checked frequently as the assessments are build-ups.

Black Horse Pike Regional School District Curriculum

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course: Design and Technology I **Unit Title:** Rocketry and Aeronautics **Grade Level(s):** 9-12	**Unit Summary:** ● Students will learn to use the technological design process (TDP) to solve open ended problems involving space travel and flight related concepts. Students will solid model their solution using Autodesk Inventor to create their design that is aerodynamically sound. Students will learn to safely use tools and machines to extend human capabilities and build their solution to the aernatical challenge as designed. Students will use math to calculate the success and altitude of their flight.
Essential Questions: ● How can we strategically solve problems? ● Why is safety important and what precautions can we take to ensure safety? ● How are rockets propelled into space? ● What physical forces act upon an object in flight?	**Enduring Understanding:** ● This unit is designed to introduce and reinforce the technology Design Process. The students will learn to solve open ended problems and to design and build their design solution or project. Students will walk away with a new attitude towards problem solving, the ability to use tools and machines to process multiple types of materials, to work cooperatively with others, understand physics related to objects in flight and use Trigonometry to understand the relationship between angle and distance to determine altitude.

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

After each target, identify the NJCCCS or Common Core Standards that are applicable.

Learning Target:	**NJCCCS or CCS:**
7. Apply the Technological design process to solve problems and design challenges. 8. Understand and identify the different parts of an aircraft and their function. 9. Integrate basic aerodynamics pertaining to aeronautical engineering. 10. Understand math concepts that pertain to aircraft flight. 11. Design a solid model rocket using Autodesk Inventor. 12. Construct a model rocket or other Flight vehicle by safely using tools and machines. 13. Launch a rocket or other flight vehicle following a strict launching safety protocol. 14. Calculate the altitude of an object in flight.	● TECH.8.1.12.A.CS1 ● TECH.9-12.8.2.12.B.4 ● TECH.9-12.8.2.12.E.1 ● TEC.9-12.8.2.12.E.1 ● ELL.9-12.L.A.3 ● ELL.9-12.S.B.3 ● ELL.9-12.R.E.6 ● MA.9-12.4.2.12 D.2 ● MA.9-12.4.5 ● MA.9-12.4.5.12 B.2 ● MA.9-12.4.5.12 E.2

Interdisciplinary Connections:

STEAM, English

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PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE

How will students uncover content and build skills?.

- Students will learn basic aeronautical engineering principles through presentations, videos, and demonstrations. Students will take notes during these presentations.
- Students will now complete guided research on the different components of a model rocket.
- Students will follow along a TLA design packet as they work through the technological design process. The students will document research, brainstorming, design sketches, and mechanical drawings. Students will then solid model their rocket on Autodesk Inventor.
- Students will then follow safety rules and procedures while constructing their vehicle using tools, machines, and efficient procedures.
- Next, students will research and write the proper rocket launching safety protocol.
- Students will launch their rockets and use trigonometry to calculate the altitude of the flight.
- Students will critically and constructively reflect upon aeronautical concepts, aeronautical engineering as a career, and the technological design process used to design, build, and safely launch a rocket.

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF THE CONTENT AND THEIR ABILITY TO APPLY SKILLS.
IDENTIFY BLOOM'S LEVELS

Formative Assessments:

- WARM UP ACTIVITIES
- All activities will be based on either student exploration of the content area, or reflection of prior lessons.
- CHECKPOINTS OF UNDERSTANDING.
- Notes on presentations.
- Research on rocket components.
- Solid Modeling parts completion checkpoints.

Accommodations and Modifications:

- Students will be accommodated on a case by case basis. Students with physical needs will be accommodated by use of custom and specialized jigs, guards and fixtures to ensure complete safety and to maximize ability. Students will also be given extra time on tests and projects when necessary.
- Extra help is available for questions and clarification.as needed.

Summative Assessments:

- Aeronautical engineering test.
- Aeronautical engineering reflection paper.
- Hands on activity.

Accommodations and Modifications:

- Alternative assignments, additional time for assignments, preferential seating arrangements one on one interaction, after school help, and assistance for organization. Check frequently for student understanding.
- Allow students to get their work checked frequently as the assessments are build-ups. Students will be given extra time, and also reminders (oral and written) of how physics concepts affected their rocket.

Performance Assessments:

- Students will design a solid model rocket on Autodesk Inventor or other 3D modeling program.
- Construct a solid fuel rocket model or other flight device.

Accommodations and Modifications:

- Students will be accommodated on a case by case basis. Students with physical needs will be accommodated by use of custom and specialized jigs, guards and fixtures to ensure complete safety and to maximize ability. Students will also be given extra time on tests and projects when necessary.
- Extra help is available for questions and clarification.