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

Design and Technology III

COURSE OF STUDY

Technology Department

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Date:
Summer 2020

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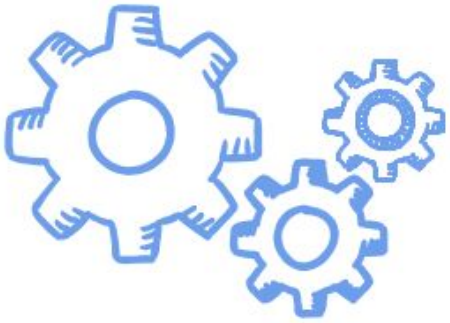
DESIGN & TECH III

HIGH SCHOOL NAME

2020-2021 Course Syllabus



TEACHER

E-MAIL ADDRESS

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

10-12 Graders - MUST HAVE PASSED PRE-ENGINEERING
5 Credits

Design & Tech 3 is the third class in a three-year sequence of Design and Tech classes. You will be presented with challenging activities and projects that build on skills learned in Pre-Engineering and will require additional research and higher level problem solving skills.

UNITS COVERED

- Advancing Manufacturing
- Advanced 3D Modeling and Rapid Prototyping
- How It's Made: Product Dissection
- Advanced Soldering
- Pneumatic Arm Design

MATERIALS NEEDED

- Pencil (bring everyday)
- Two-Pocket Folder (keep in the classroom)
- You may be required to get batteries for certain kits/electrical circuits

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 III

5 Credits
GRADES: 11-12
Prerequisite: Must have passed Pre-Engineering or Design and Tech II

Course Content

1. **Advanced Manufacturing (4 months):** This is an all-encompassing unit where students review machine and lab safety, as well as sketching and 3D modeling taught in previous Design & Tech courses. Students use their previous knowledge and skill sets to work together as a class, to design, build, finish, market, and sell a product manufactured entirely in the classroom.

2. **Engineering Design Process and BHPRSD Tech Challenge (1-2 months):** 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.

3. **Advanced 3D Modeling and Rapid Prototyping (1 month):** Students create a model on Onshape using advanced 3D modeling techniques like threads, tolerances, and section views, as well as higher level geometric concepts.

4. **Product Dissection/Reverse Engineering (3-4 weeks):** Students research, dissect and build a 3D display showing how a product works and what it's made of. This gives students an inside look at how products are mass produced, how engineers and designers make decisions regarding product manufacturing, and how parts are assembled to form completed, final products.

5. **Advanced Electronics and Soldering (2-4 weeks):** Design & Tech I and II guide students through basic circuitry and electronics, with easy to follow soldering kits and simple series circuits. Here, students take it a step further and use magnets and electromagnets to produce electricity and convert that electricity to motion.

6. **Fluid Power (3-5 weeks):** Students research hydraulic systems to gain an understanding of how they work and, in small groups, design and build a machine to perform a series of tasks.

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 III

Unit Title:
Advanced Manufacturing

Grade Level(s):
11-12

Unit Summary:

- Students will learn about the manufacturing engineering field as it pertains to our lives and the various career opportunities associated with manufacturing industries. Students will understand the importance of the systems approach and what it takes to develop a functional and effective product. Students will recognize how important safety is in a manufacturing environment, how it pertains to the classroom, and will be able to demonstrate the safe and effective use of tools and machinery. Students will use all of this knowledge to design a new product, from the brainstorming stages to sketching, design and manufacturing, quality control and finishing.

Essential Questions:	**Enduring Understanding:**
• What is technology and how does it relate to manufacturing?	• Technology is anything humans use to extend their capabilities. Manufacturing encompasses all aspects of technology and engineering.
• What is a systems approach, as it relates to manufacturing?	• The systems approach is the relation between the input of information, the process of reaching a goal, the output of work, and the feedback and impacts to help make the process better.
• How has the history of manufacturing affected the future trends of manufacturing?	• Humans have been making items to meet their needs since the beginning of time. Those needs are ever changing but always end up using a similar process to reach the end goal.
• What important factors are there to consider when choosing a manufacturing system?	• There are many important factors to consider when choosing a manufacturing system: volume of products to be produced, availability of necessary inputs, types of products made, life cycle or durability of a product, and production philosophy of the company/organization.
• What are the various career opportunities in the field of manufacturing?	• There are many career opportunities in the field of manufacturing, some of which include: Management, engineering, production, tooling, marketing, finances and human resources, to name a few.
• Why is the development of the Occupational Safety and Health Administration (OSHA)	• Workers have the right to a safe workplace. OSHA makes sure that companies comply with the development, implementation, and following of such regulations.

so important?	
• What is the importance of using tooling in a manufacturing setting?	• Jigs and fixtures greatly improve the accuracy, safety, and speed up manufacturing times as materials are processed.
• What is the importance of creative problem solving?	• Creative problem solving skills can be learned and are the most sought after skill employers look for. This can save companies time and in manufacturing, time is money.
• What are the different sketching, drawing and modeling processes that product designers go through?	• Designers create thumbnail sketches, working drawings, detail drawings, assembly drawings, and prototypes before creating a final product ready for mass production.
• What is the difference between production engineering processes and methods engineering processes?	• Production engineering focuses mainly on improving productivity while lowering costs. Methods engineering focuses on planning the sequence of processes needed to make parts and assemble a finished product.
• What is the importance of quality control?	• Quality control ensures the final product matches the design in the final working drawings. Inspection stations should be set up throughout the manufacturing process.
• What is the difference between material forming, separating, and combining processes?	• Materials forming takes solid raw stock and turns them into one-piece products. Materials separating is a type of forming that creates one piece products through cutting or separating. Combining forming is the opposite of that.

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. Describe and discuss the impacts of technology and how they have affected people, the environment, and further developments or uses of technology.	**1. TEC.9-12.8.1 ELL.9-12.L.A.3**
2. Explain the systems model and apply the model to something used in daily life.	**2. TEC.9-12.8.2.12 B.4 ELL.9-12.S.B.3**
3. Compare and contrast the manufacturing materials, processes, and evolution of a product that we use today.	**3. TEC.9-12.8.12.E.1**
4. Describe and discuss the advantages and disadvantages of the various types of manufacturing systems.	**4. MANU.9-12.9.4.12.M.29**

5. Recognize the kind of work, educational requirements, and job outlook for skilled, semiskilled, and unskilled manufacturing workers.	**5. TECH..1.12.D.5**
6. Identify safety awareness and explain the improvements that have been made to the workplace because of OSHA.	**6. MANU.9-12.9.4.12.M.33 12.9.3.MN-PRO.2**
7. Differentiate between materials that are candidates for recycling, and justify why recycling and repurposing is a good idea.	**7. TECH.8.2.12.D.4**
8. Identify the different materials processing tools and explain why and how computers, robots, and lasers have helped make these processes easier and safer for workers.	**8. TECH.8.2.12.D.3**
9. Describe how important it is for manufacturing engineers and workers to be creative problem solvers.	**9. TECH.8.1.12.C.C S3**
10. Compose and organize sketches for a proposed product idea.	**10. TECH.8.2.12.C.5**
11. Compare and contrast the charts and roles of a production and a methods engineer in the manufacturing world.	**11. 12.9.3.MN-PRO.4**
12. Demonstrate the inspection of parts and creation of quality control gauges during the manufacturing process.	**12. MANU.9-12.9.4.12.M.30**
13. Recognize and identify the major purposes for material forming, separating, and combining processes.	**13. TECH.8.2.12.D.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. In this unit, students will take notes on the manufacturing process and must read and interpret a variety of engineering drawings needed for the manufacturing process of this product.

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE

<u>How</u> will students uncover content and build skills?.

- Students will research the developments of a certain technology and explain in essay form how this technology has developed over the years.
- Students will bring in an object from home and verbally explain how the systems model relates to the construction and functionality of that object or product.
- Students will disassemble and reverse engineer an object from home.
- Students will determine which manufacturing system will work best for their manufacturing project.
- Students will delegate positions for each student on their manufacturing team. Each person will have a job to keep the team running and ensure checkpoints and deadlines are met.
- Students will ensure that every process in their manufacturing sequence is safe.
- Students will research different materials that can be recycled and also develop a project out of repurposed material.
- Students will use our CNC equipment to develop templates, jigs, and fixtures for the manufacturing project.
- Throughout the design and manufacturing process students will use creative problem solving skills to develop their project.
- Students will design and develop a product through various sketches and sketching techniques. They will develop final plans using Onshape.
- Students will practice the role of a production engineer and manufacturing methods engineer.
- Students will develop quality control checkpoints and go no go gages for their manufacturing 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

<u>Formative Assessments:</u>

- 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

- Checkpoints of understanding:
- Knowledge of machines
- Set-up CNC machines
- Sketching models
- Exporting parts
- 3-View Orthographic projection of sketched models
- Engineering Design Process
- Measure and create a part from looking at a real world object

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.
- 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:

- Manufacturing Notes and Research
- Rough sketch design ideas
- Group design sketches
- Working Drawings
- Flow process charts
- Operation analysis sheets
- Operation process charts
- Operation sheets
- Proper tooling design and function
- Quality control gages and systems

Accommodations and Modifications:

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Performance Assessments:

- Completion of a fully finished manufactured product

Accommodations and Modifications:

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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 III **Unit Title:** Engineering Design Process and BHPRSD Tech Challenge **Grade Level(s):** 10-12	**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**	1. **TEC.9-12.8.1**
2. **Design and create a working set of technical drawings**	2. **TEC.9-12.8.2.12 B.3**
3. **Safely and responsibly operate tools and machines to process a variety of different materials**	3. **TEC.9-12.8.2.12.E.1** **TEC.9-12.8.1.12 B.9**
4. **Write a creative fictional story that applies to the designated challenge**	4. **ELL.9-12.S.B.3**

5. Solve project - related geometric, algebraic, and statistical math problems	**5. MA.9-12.4.5.12 E**
6. Display professionalism, sportsmanship and team-based accountability throughout a competition	**6. MA.9-12.4.2.12 D.2**
7. Constructively reflect upon the technological design process, challenge and teamwork	**7. ELL.9-12.R.E.6**

Interdisciplinary Connections:

STEAM, English

Students will engage with the following text:

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Pearson Prentice Hall
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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?.

- 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.

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PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course:
Design and Technology III

Unit Title:
Advanced 3D Modeling and Rapid Prototyping

Grade Level(s):
11-12

Unit Summary:

- Students will create a model on Onshape using advanced 3D modeling techniques like threads, tolerances, and section views, as well as higher level geometric concepts. Students will assemble all parts together into a full assembly and document each part using industry standards. This unit will prepare students for the CAD NOCTI Exam.

Essential Questions:	Enduring Understanding:
• How do you decide what to include in a set of working drawings?	• Most technical drawings require at least three views and dimensions for all geometries of the design. Notes, annotations, and additional views may be necessary.
• Is it always necessary to indicate a tolerance for every dimension on a technical drawing?	• Engineers follow strict dimensioning and tolerance standards so that drawings are informative but not overcrowded.
• What is needed to make a set of drawings sufficient to adequately represent the design's intent?	• For a product that is made up of multiple parts, a working drawing is needed for each part as well as a completed assembly and an exploded view of those parts. These working drawings should include a variety of isometric, orthographic projection, oblique, perspective, auxiliary, and section views. A bill of materials is also ideal, but not always necessary.
• How can assembly models, exploded assemblies, and animated assemblies of an object or a proposed design be used in and beyond the design process?	• Engineering is iterative. Even when a product is thought to be complete or finished, new technologies and building techniques can make that product more efficient, cheaper, safer or easier to build. Assembly models can help others in the future, as newer technologies emerge, but remember, even after plans for a design are made, someone still has to build it. Having these exploded assemblies helps the builder visualize how all the parts are supposed to fit together. Imagine building a table from IKEA without the instructions.
• How has 3D printing and rapid prototyping changed the way Engineers work?	• 3D printing and rapid prototyping allow Engineers to quickly model their design solutions in physical form before spending lots of time, money and resources mass producing a part that might have errors or not fit within the larger system it is designed for.

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. **Use solid modeling (Onshape) as an engineering and product development tool.**	1. **TEC.9-12.8.2.12 B.4 TEC.9-12.8.2.12 B.6 TEC.9-12.8.2.12.B.3 MA.9-12.4.2.12 A.1 SCI.9-12.5.4.12 A.1**
2. **Construct parts using parametric constraints including, parallel, horizontal, perpendicular, vertical, tangent, coincident, and equal constraints and troubleshoot over-constrained sketches.**	2. **TEC.9-12.8.1.12.B.2 TEC.9-12.8.2.12.F.3**
3. **Demonstrate the ability to modify and reengineer sketches after they are transformed into 3d models that can be 3D printed.**	3. **TEC.9-12.8.2.12 B.3 TEC.9-12.8.2.12 B.1 MA.9-12.4.2.12 A.2**
4. **Demonstrate the ability to use constraints to position parts within a complex assembly drawing.**	4. **TEC.9-12.8.2.12 B.3 TEC.9-12.8.2.12.F.3 MA.9-12.4.2.12 A.1**
5. **Create a set of working drawings with at least three views, that follow industry-standard dimension standards.**	5. **TEC.9-12.8.2.12 B.4 TEC.9-12.8.2.12.F.3**
6. **Explain 3D printing and rapid prototyping's impact on the Engineering profession, with specific regard on the impact they have made on how Engineers work through the Engineering Design Process.**	6. **TECH.8.1.12.E.2 ELL.9-12.L.A.3**

Interdisciplinary Connections:

STEAM, English

Students will engage with the following text:

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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 interpret a series of technical drawings for various parts of a train. These drawings will include section, detail, auxiliary, orthographic and isometric views.
- Students will use the revolve tool to create round objects.
- Students will use the sweep tool to create a profile that will be extruded and a path that will follow to create parts.
- Students will use the loft tool to create complex parts that include tapers.
- Students will use advanced work plane tools to offset, angle and duplicate planes for more technical part creation.
- Students will use modifying tools like fillet, chamfer, shell, split and join to refine their part designs and achieve greater accuracy as they reverse engineer their designs.
- Students will assemble all the parts drawn to make an assembly using Onshape, synthesizing material taught in Design and Technology I, II and III.
- Students will dimension and annotate their drawings to match industry standards, synthesizing material taught in Design and Technology I, II and III.

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:
  - Logging in and getting set up with layers and workspace settings
  - Sketching of parts
  - Revolving
  - Sweeping
  - Lofting
  - Assemblies
    - Mates
    - Revolutions
    - Exploded Views
  - Sheets and Documentation
    - Placing views
    - Dimension standards and placement

    - Annotations
    - Tolerances
    - Prep for exporting and submitting designs for approval
- Do-now's and checkpoint quizzes will be given during and at the conclusion of these topics

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.
- Video tutorials for each new tool
- Printed instructions and tutorials, as needed

Summative Assessments:

- Completed drawing files for each part
- Design journal
- Test after each mini-unit listed in Part III

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:

- Create a model train based on prints given by the instructor using Onshape. Each part must be drawn and a full assembly of the entire design solution must be present, with effective documentation for each part and the assembly as a whole.

Accommodations and Modifications:

- Students will be accommodated on a case by case basis.
- Allow students to get their work checked frequently.
- Extra help is available for students who need more time or more clarification.
- Video tutorials for each new tool
- Printed instructions and tutorials, as needed
- Work in Tech Challenge groups (small groups)
- Modified rubrics

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 III

Unit Title:
Product Dissection/Reverse Engineering

Grade Level(s):
11-12

Unit Summary:

- Students will learn about consumer products, and how these products are mass-produced. Students will learn about production processes, such as plastic injection molding, circuit board manufacturing, metal stamping and die cutting, among other manufacturing techniques. Students will reverse engineer a mass produced product, in the form of an autopsy, and investigate which techniques were used, how, and why.

Essential Questions:	**Enduring Understanding:**
• What is mass production, and why is it important to today's society?	• Technology is anything humans use to extend their capabilities. Manufacturing encompasses all aspects of technology and engineering. • Mass production has enabled access to products more than ever before.
• What is injection molding, and why is it an important manufacturing technique?	• Different methods of manufacturing are intended to be used in different situations and applications, whether a product is high volume or low volume production.
• What considerations must an engineer have when designing a new product, in relation to which manufacturing techniques will be applied?	• Some products are made to be inexpensive, without consideration for recycling or disassembly. • Designers and engineers must consider the cost and purpose of a product and choose the proper manufacturing technique that is appropriate for the product, and the production size of the product order.
• How does product function and its intended use relate to how a product is manufactured?	• Even small and simple products can have very intricate design, and several parts. The importance of good design must be considered when mass producing consumer goods meant for the mass market.
• What is a Printed Circuit Board, and how is it used in mass produced electronics?	• Electronic products are generally difficult to be serviced without great knowledge of PCBs and electronic components.

● What is an exploded view, and why is it an important representation of a product, in relation to manufacturing?	● Interpret existing engineering drawings and use exploded views to communicate a product's design effectively.
● How does design impact the recyclability and sustainability of mass produced products?	● Know how products function makes it possible for us to become better consumers of technology, and aid in decision making when purchasing and consuming technological mass produced goods.

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. Describe and discuss the impacts of technology and how they have affected people, the environment, and further developments or uses of technology	**1. TEC.9-12.8.1**
2. Explain the systems model and apply the model to something used in daily life.	**2. TEC.9-12.8.2.12 B.4**
3. Compare and contrast the manufacturing materials, processes, purpose, and evolution of a product that we use today.	**3. TEC.9-12.8.2.12.E.1 TECH.8.1.12.E.2**
4. Describe and discuss the advantages and disadvantages of the various types of manufacturing systems.	**4. ELL.9-12.L.A.3 TECH.8.1.12.E.2**
5. Differentiate between materials that are candidates for recycling, and justify why recycling and repurposing is a good idea.	**5. ELL.9-12.S.B.3**
6. Identify the different materials processing tools and explain why and how computers, robots,and lasers have helped make these processes easier and safer for workers.	**6. ELL.9-12.R.E.6**
7. Describe how important it is for manufacturing engineers and workers to be creative problem solvers.	**7. NJCCS 8.2.12.B.2**
8. Compose and organize sketches for a proposed product idea.	**8. NJCCS 8.2.2.D.2**
9. Recognize and identify the major purposes for material forming, separating, and combining processes.	**9. NJCCS 8.2.8.D.6 TEC.9-12.8.2.12 B.3 TEC.9-12.8.2.12.F.3**

10. Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation and maintenance of a chosen product.	**10. TEC.9-12.8.2.12 B.3 TEC.9-12.8.2.12.F.3**
11. Discover how a product works by taking it apart, sketching how parts fit, and putting it back together.	**11. TECH.8.1.12.E.2**
12. Identify and explain how the resources and processes used in the production of a current technological product can be modified to have a more positive impact on the environment.	**12. NJCCS 8.2.12.B.2**

Interdisciplinary Connections:

STEAM, MATH - fractional inch, fractions, measurement, geometric principles. Percentages, and projections. Engineering processes, and production Technology.

English - Creating a design journal of the solutions requires students to write in each step of the process.

Social Studies – Relate manufacturing to the environment, and how it impacts it. Relate the design of products to recyclability, repair, and reuse of mass produced products.

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?.

- Students will research about the evolution of manufacturing, and the prominence of mass produced products in today's society.
- Students will bring in an object from home and dissect it, by taking it apart.
- Students will document the dissection process with photo evidence, and note how different parts interact with one another, and how they are put together.
- Students will determine which manufacturing technique was used to produce the different

parts of their object, and research how each technique is applied, and what are each techniques advantages and disadvantages.

- Students will create a 3D display of their dissected product, by reassembling it in an exploded view format, to represent how the parts of the object come together. The parts will be named and labeled accordingly.

- Students will create a research document which will include descriptions and photos of different parts and how they are made, and describe the manufacturing techniques for each part.

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:

- Knowledge of manufacturing techniques.
- Tool usage and handling.
- Product disassembly and cataloguing of parts
- Creating of 3D display
- Written research of manufacturing techniques.

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:

- Manufacturing Notes and Research
- 3D Product Display
- Environmental Impact assessment
- Research Document

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:

- Completion of a 3D Display of a manufactured product, and a research document about the manufacturing techniques used on said product.

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.
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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 III **Unit Title:** Advanced Electronics and Soldering **Grade Level(s):** 11-12	**Unit Summary:** ● This unit is designed to introduce students to electricity, electronics, and basic electrical engineering. Students will learn what electricity is, how it is created, transmitted, altered and used. Students will learn about DC and AC electrical systems, series and parallel circuits, electrical motor function, ohm's law, and electronic components. Students will learn to read and draw electrical schematics. Students will apply the electrical concepts with three hands on projects. Students will build simple DC and light bulb circuits, solve circuit challenges, and complete AC electrical circuits.
Essential Questions: ● How does electricity impact the way in which we live our lives? ● How do technological systems work together to accomplish goals and extend human capabilities?	**Enduring Understanding:** ● Modern living depends on electricity. From the electricity in our homes to handheld devices, it powers our day to day. While electricity is significant and helpful, it can also pose some health, environmental, societal and political problems. ● Technological systems are designed to solve problems and extend human capabilities. ● Most of our mechanical systems are all reliant on the successful utilization of the electrical systems. ● Plans are used to ensure correct placement of components in a complicated electrical system.

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. **Students will distinguish between a series and parallel circuit.**	1. **TEC.9-12.8.1**
2. **Students will calculate current, voltage, and resistance in a circuit.**	2. **MA.9-12.4.2.12 D.2**
3. **Students will identify various electronic components based on their appearance.**	3. **TEC.9-12.8.2.12.E.1**
4. **Students will discuss the advantages of using electromagnets in mechanical systems.**	4. **ELL.9-12.L.A.3**

5. Students will wire a single pole switch to include a light, a light receptacle, and wall receptacle.	**5. SCI.9-12.5.7 TECH.8.1.12.A.CS1**
6. Students will wire three way switches and a light, install a dimmer switch, and GFCI	**6. SCI.9-12.5.7**
7. Students will safely use all electrical tools and equipment	**7. TEC.9-12.8.2**
8. Students will complete assembly of an electronic kit that makes use of the most common electronic components, such as transistors, resistors, LEDs, and more.	**8. TECH.8.1.12.A.CS1**

Interdisciplinary Connections:

Math - Fractional inch, fractions, measurement, geometric principles,
English - An engineering notebook including written documentation of the technological design process
Science – Understanding the relationship between positive and negative charges

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?.

- Students will begin by learning the importance and significance of electricity in the modern world by analyzing the frequency in which the average person uses electricity and products made with electricity.

- Students will engage in a presentation and watch videos that will explain where electricity comes from, how it is transmitted, how it is converted into AC and DC current and how that can be converted into mechanical energy. Students will learn about series and parallel circuits, voltage, amperage, resistance, and ohm's law in electric circuits. Students will take notes and fill out worksheets during these presentations, and solve math equations and conversions with an ohm's law worksheet.

- Students will build series and parallel circuits.
- Students will learn about AC electric circuitry and components through presentations and examples. Students will learn to identify different electronic components. Students will learn safe residential house wiring techniques through demonstration, and then students will practice by building their own
- Students will take an electronics test to test knowledge of concepts, vocabulary, and electrical schematics.

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:

- Ohm's Law worksheet
- Electronic Component worksheet
- Soldering safety worksheet
- Soldering practice circuit
- Electronic kit quiz and worksheet

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:

- Electronics Test
- AC house wiring test

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:

- DC electronics circuits
- AC wiring circuits
- Electronic Kit

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.

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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 III **Unit Title:** Fluid Power **Grade Level(s):** 11-12	**Unit Summary:** ● This unit is designed to introduce students to Hydraulics, the study of the motion of fluids, and to apply a project based approach to apply the knowledge acquired of hydraulic systems and machines, by having students design and build a machine that performs a specific task, and is powered by a hydraulic system.
Essential Questions: ● How does the science of Hydraulics impact current technology? ● What current human developments are made possible by the practical application of hydraulics? ● What are some common examples of hydraulic technologies that are used around us? Which ones do you interact with daily? ● How does transfer of power work to create motion? ● What is the importance of planning when designing a technological system, such as a hydraulic crane?	**Enduring Understanding:** ● Technological systems are designed to solve problems and extend human capabilities. ● Many of our mechanical systems are all reliant on the successful utilization of hydraulics systems. ● Hydraulics is an essential technology in all manufacturing and construction fields, and without it, a lot of contemporary technology would not be possible. ● Hydraulics allows for efficient transfer of power, and for an easy way to produce great force with a relatively low input. ● We are surrounded by systems that use hydraulics, from car breaks, to construction equipment, as well as machines used for production of mass produced goods.

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. **Design and create a prototype to solve a real world problem using a design process, identify constraints addressed during the creation of the prototype, identify trade-offs made, and present the solution for peer review.**	1. **NJCCCS 8.2.12.D.1**
2. **Explain and identify interdependent systems and their functions.**	2. **NJCCCS 8.2.12.C.4**
3. **Analyze a current technology and the resources used, to identify the trade-offs in terms of availability, cost, desirability and waste.**	3. **NJCCCS 8.2.12.A.2**
4. **Build a prototype that meets a STEM-based design challenge using science, engineering, and math principles that validate a solution**	4. **NJCCCS 8.2.8.D.3**
5. **Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.**	5. **NJCCCS 8.2.12.C.5**

Interdisciplinary Connections:

Math - Fractional inch, fractions, measurement, geometric principles.
English - An engineering notebook including written documentation of the technological design process.
Physics – Understanding transfer of force and Hydraulic principles.

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?.

- Students will begin by learning the importance and significance of hydraulic systems, and the frequency in which they come in contact with technologies and goods that are only made possible by the use of hydraulic systems.
- Students will engage in a presentation and watch videos that will explain the physics principles of fluid dynamics, and how hydraulics are used in different technological systems, such as construction equipment (e.g. Cranes, excavators, backhoes), manufacturing equipment (metal stamping machines, injection molding machines), and technologies they use on a frequent basis (car breaks, elevators).
- Students will take notes and fill out worksheets during these presentations.
- Students apply previous knowledge of the Engineering Design Process to design, plan, draw, and build a hydraulics machine, with syringes and rubber tubing. This machine will be built to perform a specific task.
- Students will then participate in a competition in which they will use their built machines to try to best their peers on a predetermined task.

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:

- Hydraulics worksheet
- Hydraulics quiz
- Design drawings
- Project construction

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:

- Hydraulic Arm Competition and design prototype.

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:

- Hydraulics System
- Working Prototype
- Design Completion
- Engineering Drawing Completion

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.
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