STEAM Fabrication 3

The Technology and Engineering Education Department

Course Number: 6463

Course Level: High School

Grade: 10,11,12

Time/Credit: 90 Days (2 Marking Periods) 1.0 Credit

Development Date: 2025 - 2026

School Board Approval: TBD

Central Bucks School District
20 Welden Drive
Doylestown, PA 18901

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Central Bucks School District
Teaching and Learning Principles

1. **Learning is Active and Experiential-** Students learn by doing, making, and reflecting. Hands-on, minds-on project based learning connects ideas to real contexts.
2. **Design and Problem-Solving Thinking Drives Learning-** Design challenges build creativity, critical thinking, and persistence. Students apply the engineering design and problem-solving process: identify, design, build, test, improve.
3. **Learning is Integrated (STEAM Approach)**- Real-world problems cross disciplines. Curriculum blends science, technology, engineering, art, and math with an emphasis on TECHNOLOGY and ENGINEERING.
4. **Creativity and Innovation are Important**- Students are creators, inventors, and problem solvers. Emphasis is on idea generation, iteration, and supervised risk-taking.
5. **Learning is Collaborative and Social**- Teamwork mirrors real engineering and design practice. Students share ideas, give feedback, and build together.
6. **Technological Literacy is achieved through tools** - Students develop technological literacy through authentic use and creation. Tools include traditional hand tools and human operated machines and modern tools including CAD, coding, robotics, 3D printing, CNC, and laser systems.
7. **Learning is Inclusive and Equitable-** All learners deserve meaningful access to STEAM experiences. Curriculum reflects diverse cultures, needs, and perspectives.
8. **Assessment is Authentic and Reflective**- Teachers will evaluate process, creativity, and growth—not just outcomes. Portfolios, journals, and exhibitions measure understanding.
9. **Environments are Safe, Flexible, and Future-Focused-** Space and culture support exploration and innovation. Safe, organized, and adaptable Fabrication shops and prototyping labs foster creative problem-solving.
10. **Reflection and Lifelong Learning are Essential**- Students learn through reflection and iteration. Reflection documents and portfolios reinforce growth.

Documents Considered:

1. Experiential and Constructivist Learning
    - Bruner, J. (1966). *Toward a Theory of Instruction.* Harvard University Press.
    - Kolb, D. A. (1984). *Experiential Learning: Experience as the Source of Learning and Development.* Prentice-Hall.
2. Design Thinking and Engineering Design
    - IDEO. (2012). *Design Thinking for Educators Toolkit.* IDEO.
    - National Academy of Engineering. (2020). *Standards for Technological and Engineering Literacy: The Role of Technology and Engineering in STEM Education (STEL).* Washington, DC: National Academies Press.
3. Integrated STEAM Learning
    - Honey, M., Pearson, G., & Schweingruber, H. (Eds.). (2014). *STEM Integration in K–12 Education: Status, Prospects, and an Agenda for Research.* National Academies Press.
    - Yakman, G. (2008). *STEAM Education: An Overview of Creating a Model of Integrative Education.* In *PATT-19 Conference: Research on Technology Education.*
4. Creativity and Innovation in Education
    - Robinson, K. (2011). *Out of Our Minds: Learning to Be Creative.* Capstone Publishing.
    - International Technology and Engineering Educators Association (ITEEA). (2020). *Standards for Technological and Engineering Literacy: Defining the Role of Technology and Engineering in STEM Education.*
5. Collaborative and Social Learning
    - Johnson, D. W., & Johnson, R. T. (2009). *An Educational Psychology Success Story: Social Interdependence Theory and Cooperative Learning. Educational Researcher*, 38(5), 365–379.
    - Vygotsky, L. S. (1978). *Mind in Society: The Development of Higher Psychological Processes.* Harvard University Press.
6. Technological Literacy

- Mishra, P., & Koehler, M. J. (2006). *Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge. Teachers College Record*, 108(6), 1017–1054.
- ITEEA (2020). *Standards for Technological and Engineering Literacy (STEL).*

7. Equity and Cultural Relevance in STEAM
    - Banks, J. A. (2008). *An Introduction to Multicultural Education.* Pearson Education.
    - Ladson-Billings, G. (1995). *Toward a Theory of Culturally Relevant Pedagogy. American Educational Research Journal*, 32(3), 465–491.
8. Assessment for Learning
    - Black, P., & Wiliam, D. (1998). *Assessment and Classroom Learning. Assessment in Education: Principles, Policy & Practice*, 5(1), 7–74.
    - Wiggins, G. (1998). *Educative Assessment: Designing Assessments to Inform and Improve Student Performance.* Jossey-Bass.
9. Learning Environments and Pedagogy
    - Dewey, J. (1938). *Experience and Education.* Macmillan.
    - Marzano, R. J. (2007). *The Art and Science of Teaching: A Comprehensive Framework for Effective Instruction.* ASCD.
10. Reflection and Lifelong Learning
    - Hattie, J. (2012). *Visible Learning for Teachers: Maximizing Impact on Learning.* Routledge.
    - Schön, D. A. (1983). *The Reflective Practitioner: How Professionals Think in Action.* Basic Books.

Central Bucks School District
Enduring Understandings

Students will understand that:

Applying, Maintaining, and Assessing Technological Products and Systems

- Engineering and design are human processes. The products and systems created by technology and engineering are meant to extend human capabilities to meet specific needs.
- All technological systems require maintenance. These systems must be monitored, maintained, and assessed to ensure they continue to operate as intended.
- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.

Impacts of Technology

- All technology has intended and unintended consequences. The introduction of new technologies can create both positive and negative impacts on individuals, society, and the environment.
- Technology shapes society, and society shapes technology. Societal priorities, beliefs, and values influence which technologies are developed, and in turn, new technologies change human behavior and cultures.
- The total impact of a technology is not always foreseeable. A full evaluation of a technology's effects requires considering its social, cultural, environmental, and economic impacts over time.

Influence of Society on Technological Development

- Technological development is driven by a variety of factors. The needs and wants of a society, economic considerations, political forces, and ethical issues all influence which technological innovations are prioritized.
- Not all technological problems have a perfect solution. Decision-making in engineering involves trade-offs and considering a range of constraints, including cost, safety, reliability, and aesthetics.

Design in Technology and Engineering Education

- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- There is no single correct path for a design solution**.** The engineering design process allows for multiple approaches to solving a problem, and the best solution is often a combination of the strongest features from several ideas.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.

Integration of Knowledge, Technologies, and Practices

- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.

Central Bucks School District
Essential Questions

Applying, maintaining, and assessing technological products and systems

- How do technological systems work together to achieve a desired goal?
- What is the importance of maintaining and repairing a product, system, or process?
- How does the analysis of information aid in the evaluation of technological products and systems?
- Why is it important for people to be technologically literate?

Impacts of technology

- How has technology both created and solved problems throughout history?
- How does technology influence individuals, cultures, and the environment?
- Why is it important to consider ethical implications when developing and using technology?
- What are the trade-offs involved in using different kinds of technology?

Influence of society on technological development

- How do a society's values and beliefs influence its attitude toward technology?
- How do the needs and wants of a society shape new technological developments?
- How can societies sustainably manage resources related to technological creation and use?

Design in Technology and Engineering Education

- What is the value of iteration (repetition) in the design process?
- Why is there no single, best solution to a design problem?
- How do criteria and constraints drive the optimization of a design?
- How are universal principles and elements of design used in the creation of a technological product or system?

Integration of knowledge, technologies, and practices

- How do advancements in technology influence other fields, such as science, environmental literacy, and sustainability?
- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- What happens when technologies from different disciplines are combined or integrated?

Central Bucks School District – Course of Study Overview
STEAM Fabrication 3

Desired Results

Course Description: STEAM Fabrication 3 is the highest-level class students can take to conclude their high school project-based learning experience in fabrication and engineering knowledge. Opportunities include more independent and collaborative design, challenges and projects. Utilizing machines, tools and equipment in STEAM Fabrication 2, students will focus on advanced techniques, precision crafting, and application of creative engineering design and problem-solving processes. Emphasis is placed on designing and producing original, high-quality projects from concept through completion, with expectations to incorporate digital design, prototyping, small and industrial robotics and iterative improvement. STEAM Fabrication 3 encourages innovation, leadership, and portfolio-ready project development to prepare students for after school real world experiences in STEAM career and higher education pathways.

Prerequisite: STEAM Fabrication 2

<u>Committee Members</u>**: Mick Marmor, Travis Jovais, Trent Errett, Jon Taylor**

Acceptable Evidence.

Common Summative Assessment 1 Title: Advanced Fabrication Project
Common Summative Assessment 1 Grading Criteria: Common Engineering Rubric

Common Summative Assessment 2 Title: Portfolio
Common Summative Assessment 2 Grading Criteria: Common Portfolio Rubric

Course Grading: 90% Summative, 10% Formative

STEAM Fabrication 3– Pacing Guide

Content	Days
Unit 1 – STEAM Fabrication 3	**2**
Course Overview, Syllabus	1
Career and College	1
Unit 2 – Measuring	**2**
Ruler	1
Measurement Activities	1
Unit 3 – Advanced Conventional Fabrication Tools and Machines	**10**
Machine and Tool Safety	7
Machine Tests	3
Unit 4 -Advanced Digital and Robotic Fabrication Tools and Machines	**20**
Subtractive Manufacturing: CNC Router	4
Subtractive Manufacturing: Laser Engraver	4
Subtractive Manufacturing: Vinyl Cutter	4
Additive Manufacturing: 3D Printer	4
CAD/CAM Software	4
Unit 5- Advanced STEAM Engineering and Fabrication Project Process	**50**
Engineering Project Loop- Ongoing throughout course	#
Plan- Sketching and designing, Reading drawings and specifications, selecting materials, creating Bill of Materials and cost estimating	5
Build- Material processing, cutting, assembling, and gluing	37
Finish- Sanding, staining, painting, Clear Coat Finishing	5
Evaluate	3
Unit 6- STEAM Fabrication Portfolio	**6**
Data/photo collection	2
Desktop Publishing	4
Total Days	90

Required Texts and Software Corel Draw/Adobe, OnShape, Bambu Labs, Aspire/Vetric, AutoDesk FUSION, Vinyl Master, Laser, CNC, Vinyl Cutter, WoodShop tools and equipment

Desired Results:

Essential Questions:

- How do a society's values and beliefs influence its attitude toward technology?
- How do the needs and wants of a society shape new technological developments?
- How can societies sustainably manage resources related to technological creation and use?
- How has technology both created and solved problems throughout history?
- How does technology influence individuals, cultures, and the environment?
- Why is it important to consider ethical implications when developing and using technology?
- What are the trade-offs involved in using different kinds of technology?
- Why is it important for people to be technologically literate?

Enduring Understandings:

Students will understand that…

- All technology has intended and unintended consequences. The introduction of new technologies can create both positive and negative impacts on individuals, society, and the environment.
- Engineering and design are human processes. The products and systems created by technology and engineering are meant to extend human capabilities to meet specific needs.
- Technology shapes society, and society shapes technology. Societal priorities, beliefs, and values influence which technologies are developed, and in turn, new technologies change human behavior and cultures.
- Technological development is driven by a variety of factors. The needs and wants of a society, economic considerations, political forces, and ethical issues all influence which technological innovations are prioritized.

Knowledge:

Students will know…

- Vocabulary: Technological and Engineering Literacy, STEAM

Skills:

Students will be able to…

- identify the importance of technological and engineering literacy and the many different ways it affects the world and its citizens.
- explore different careers and college/trade school options.

Standards:

Priority:

3.5.9-12.H Evaluate ways that technology and engineering can impact individuals, society, and the environment.
3.5.9-12.E Evaluate how technology and engineering advancements alter human health and capabilities.
3.5.9-12.A Use various approaches to communicate processes and procedures for using, maintaining, and assessing technological products and systems.
3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.
3.5.9-12.KK Relate how technological and engineering developments have been evolutionary, often the result of a series of refinements to basic inventions or technological knowledge.
3.5.9-12.OO Use project management tools, strategies, and processes in planning, organizing, and controlling work.

Supporting:

3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.
3.5.9-12.HH Analyze how the Industrial Revolution resulted in the development of mass production, sophisticated transportation and communication systems, advanced construction practices, and improved education and leisure time.
3.5.9-12.FF Evaluate how technology enhances opportunities for new products and services through globalization.

Acceptable Evidence:
Performance Tasks – Introduce course, excite students about STEAM Fabrication 1, syllabus
Define STEAM as it relates to Fabrication
Future Trends in Manufacturing and Engineering
Advanced Fabrication examples

Acceptable evidence of learning other than Performance Tasks:
Formative Assessment- Engineers' Notebook/Portfolio

Suggested Learning Experiences and Instruction
Learning Experiences:
- learn about the engineering profession and manufacturing careers
- learn about owning your own business
- define STEAM

Instructional Strategies:
- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:
- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:
- Presentation is available in native language when needed

Desired Results:

Essential Questions:
- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- How are universal principles and elements of design used in the creation of a technological product or system?
- How does the analysis of information aid in the evaluation of technological products and systems?

Enduring Understandings:
Students will understand that…
- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.

Knowledge:
Students will know…
- Vocabulary: English and Metric measuring systems

Skills:
Students will be able to measure accurately using a ruler and tape measure

Standards:
Priority:
3.5.9-12.OO Use project management tools, strategies, and processes in planning, organizing, and controlling work.
3.5.9-12.J Synthesize data and analyze trends to make decisions about technological products, systems, or processes.
3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.
3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.

Supporting:
3.5.9-12.BB Assess how similarities and differences among scientific, technological, engineering, and mathematical knowledge and skills contributed to the design of a product or system.

Acceptable Evidence:

Performance Tasks – satisfactory score on ruler game

Acceptable evidence of learning other than Performance Tasks:
Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Rubric

Suggested Learning Experiences and Instruction

Learning Experiences:

- Complete ruler game
- Practice measuring utilizing a variety of real-world items and worksheets

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed

Desired Results:
Essential Questions:
- How do technological systems work together to achieve a desired goal?
- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- What happens when technologies from different disciplines are combined or integrated?

Enduring Understandings:
Students will understand that…
- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.
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- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.

Knowledge:
Students will know…
- how to use drafting tools and hand tools using tutorials
- Vocabulary: pencil, paper, Radial Arm Saw, Jointer, Planer, Miter Saw, Steps to square a board

Skills:
Students will be able to learn about safety to safely use the machines and tools of the shop.

Standards:
Priority:
3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.
3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.
3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.
3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process.
3.5.9-12.Y (ETS) Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Supporting:

3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.
3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

Acceptable Evidence:
Performance Tasks – Advanced fabrication project, safety tests

Acceptable evidence of learning other than Performance Tasks:
Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Project Rubric, Common Safety Tests

Suggested Learning Experiences and Instruction
Learning Experiences:

- using pencil/paper and approved tools and machines following all safety protocols to make a level 1 project

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed

Desired Results:

Essential Questions:

- How do technological systems work together to achieve a desired goal?
- How do scientists and engineers use different types of tools, models, and practices to understand and innovate in the world?
- What happens when technologies from different disciplines are combined or integrated?

Enduring Understandings:

Students will understand that…

- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.
- Design is a systematic and iterative process. Successful design follows a methodical process that includes defining the problem, developing models, testing, evaluating, and refining solutions.
- There is no single correct path for a design solution. The engineering design process allows for multiple approaches to solving a problem, and the best solution is often a combination of the strongest features from several ideas.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.

Knowledge:

Students will know…

- how to use a computer to design, modify and create raster to vector images to be used on an industrial robotic machine called a Computer Numerical Control machine using either subtractive or additive manufacturing, also known as Computer Aided Manufacturing- CAM
- Vocabulary: CAD, CAM, Vector, Raster, laser cut, vinyl cut, 3D print, CNC

Skills:

Students will be able to… use CAD/CAM tools to create a digitally made project and upload it to a robotic machine using a tutorial.

Standards:

Priority:

3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process.

3.5.9-12.Y (ETS) Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Supporting:
3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.
3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

Acceptable Evidence:
Performance Tasks – Digitally Created Advanced Fabrication Project

Acceptable evidence of learning other than Performance Tasks:
Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Project Rubric

Suggested Learning Experiences and Instruction
Learning Experiences:
- Utilize CAD, Bambu Labs, Vinyl Cutter, Corel Draw, Adobe, Aspire/Vetric, slicing, toolpath creation, Fusion, and CNC products to complete project
- Move from raster to vector creation

Instructional Strategies:
- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:
- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:
- Presentation is available in native language when needed

Desired Results:

Essential Questions:

- How do technological systems work together to achieve a desired goal?
- What is the importance of maintaining and repairing a product, system, or process?
- How does the analysis of information aid in the evaluation of technological products and systems?
- What is the value of iteration (repetition) in the design process?
- Why is there no single, best solution to a design problem?
- How do criteria and constraints drive the optimization of a design?
- How are universal principles and elements of design used in the creation of a technological product or system?

Enduring Understandings:

Students will understand that…

- All technological systems require maintenance. These systems must be monitored, maintained, and assessed to ensure they continue to operate as intended.
- Technological systems are interdependent. Technological products, processes, and systems do not exist in isolation; they are interconnected and interact with each other in complex ways.
- Not all technological problems have a perfect solution. Decision-making in engineering involves trade-offs and considering a range of constraints, including cost, safety, reliability, and aesthetics.
- Effective engineering draws on diverse knowledge. Solving complex problems requires integrating knowledge from science, mathematics, and other subjects.
- Collaboration is essential for effective innovation. Engineering and technological development are not solitary pursuits. They require teamwork, communication, and leadership skills to develop successful solutions.
- Systems thinking is critical for understanding complexity. Technology and engineering education should cultivate systems reasoning, allowing students to understand how different components interact within larger systems.
- Design solutions must account for various constraints. The success of a design is evaluated by how well it meets specific criteria while operating within constraints, such as available resources and potential environmental impact.

Knowledge:

Students will know…

- how to use the Engineering Design and Problem Solving Loop to make STEAM Fabrication projects to solve a problem.
- Vocabulary: CAD, CAM, 3D slicing and printing, Vinyl Cutting, fabrication project planning, raster and vector

Skills:

Students will be able to use the tools and machines to make STEAM Fabrication projects.

Standards:

Priority:

3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.
3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.
3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.
3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process.

3.5.9-12.Y (ETS) Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Supporting:
3.5.9-12.EE Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa.
3.5.9-12.MM Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system.

Acceptable Evidence:
Performance Tasks – Product Design, Vinyl Sticker, 3D printer, CNC project

Acceptable evidence of learning other than Performance Tasks:
Formative Assessment- Engineers' Notebook/Portfolio

Summative Assessment- Common Engineering Project Rubric

Suggested Learning Experiences and Instruction
Learning Experiences:
- Utilize CAD, Bambu Labs, Vinyl Cutter, Corel Draw, Adobe, Fusion, and CNC products to complete project

Instructional Strategies:
- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:
- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:
- Presentation is available in native language when needed

Desired Results:

Essential Questions:

- How do technological systems work together to achieve a desired goal?
- What is the importance of maintaining and repairing a product, system, or process?
- How does the analysis of information aid in the evaluation of technological products and systems?
- Why is it important for people to be technologically literate?

Enduring Understandings:

Students will understand that…

- Technology shapes society, and society shapes technology. Societal priorities, beliefs, and values influence which technologies are developed, and in turn, new technologies change human behavior and cultures.
- The total impact of a technology is not always foreseeable. A full evaluation of a technology's effects requires considering its social, cultural, environmental, and economic impacts over time.

Knowledge:

Students will know…

- how to document and organize all of their classwork and projects through the creation of a project portfolio.
- Vocabulary: Engineers' Notebook/Portfolio

Skills:

Students will be able to select classwork and projects to create a portfolio that highlights what they have learned within the course.

Standards:

Priority:

3.5.9-12.A Use various approaches to communicate processes and procedures for using, maintaining, and assessing technological products and systems.

3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems.

3.5.9-12.OO Use project management tools, strategies, and processes in planning, organizing, and controlling work.

Supporting:

3.5.9-12.NN Analyze the rate of technological and engineering development and predict future diffusion and adoption of new innovations and technologies.

3.5.9-12.LL Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

Acceptable Evidence:

Performance Tasks – Engineers' Notebook/Portfolio

Acceptable evidence of learning other than Performance Tasks:

Formative Assessment- N/A

Summative Assessment- Project Portfolio Rubric

Suggested Learning Experiences and Instruction

Learning Experiences:

- PowerPoint or another district approved technology to create a portfolio of work

Instructional Strategies:

- Direct instruction
- Teacher Demonstration
- Problem-Solving and Critical Thinking
- Self-check and evaluation

Differentiation/Intervention/Enrichment Options:

- Project Choice when appropriate
- One on One Instruction
- Time for extra project work when requested
- Lunch and Learn when needed

For Language Development:

- Presentation is available in native language when needed