HILLSBOROUGH TOWNSHIP SCHOOL DISTRICT

HILLSBOROUGH HIGH SCHOOL

APPLIED TECHNOLOGY CURRICULUM

INTEGRATIVE STEM

AUGUST 2020

This curriculum was approved by the Hillsborough Township Public Schools Board of Education on September 21, 2020.

Integrative STEM
Course Overview

Science, Technology, Engineering and Math are all integrated tightly into the modern society. In Integrative STEM, students will be focusing on the multiple types of Industry; Transportation, Construction, Manufacturing, Medical Technologies, Agriculture, Biotechnology, Robotics & Computation. By studying these industries, students will learn how the products and services effects their lives. By following the Engineering Design Process, students will also practice systematic thinking which will provide students with a structured way of generating ideas. The history of technology is another topic analyzed in this course where students reflect on past technologies and current technologies such as information / communication technology. With such a great impact on the society, computer technology requires student to understand computational thinking processes. Overall, this course will integrate all the knowledge students learned in school and apply it to solve real world problems.

***Integrative STEM is the prerequisite to Integrative STEM II.*

Unit of Study	Pacing	NJ Student Learning Standards	Essential Questions	Enduring Understandings	Learning Targets	Assessment: Formative & Summative	Interdisciplinary Connections	Career Readiness, Life Literacies, & Key Skills Standards
Unit 1 – Engineering Design Process	1 Week & Recurring Throughout Semester	*NJ-Career & Technical Education (CTE) Standards* 9.3. ST.1 Apply engineering skills in a project that requires project management, process control and quality assurance. 9.3. ST.2 Use technology to acquire, manipulate, analyze, and report data. 9.3. ST.3 Describe and follow safety, health and environmental standards related to science, technology, engineering, and mathematics (STEM) workplaces. 9.3. ST.4 Understand the nature and scope of the Science, Technology, Engineering & Mathematics Career Cluster, and the role of	What is the main thought process that is natural to the human mind? What is the benefit of a cyclical design process?	The design process is a systematic approach to solving problems. The design process is a cyclical process that allows ideas to be revisited along with allowing multiple solutions to a problem.	The students will be able to discuss the attributes of design. The students will be able to discuss the application of engineering design. The students will be able to explain the role of troubleshooting, research and development, invention and innovation and experimentation in problem solving. The students will be able to identify the steps of the Engineering Design Process. The students will be able to	***Formative*** Observations Student Progress Reports Electronic portfolio of completed assignments and projects. Rubrics will be used to assess projects. Exit Tickets ***Summative*** Teacher created assessments on terminology and procedures. Engineering Notebook Quiz (es)	HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account	*Career Awareness & Planning* 9.2.12.CAP.6: Identify transferable skills in career choices and design alternative career plans based on those skills. *Creativity & Innovation* 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1. 12prof.CR3a). 9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4. 12prof.CR2b, 2.2.12.LF.8). 9.4.12.CI.3: Investigate new challenges and opportunities for personal growth,

		STEM in society and the economy. 9.3. ST.5 Demonstrate an understanding of the breadth of career opportunities and means to those opportunities in each of the Science, Technology, Engineering & Mathematics Career Pathways. 9.3. ST.6 Demonstrate technical skills needed in a chosen STEM field. 9.3.12.AG-PST.1 Apply physical science principles and engineering applications to solve problems and improve performance in AFNR power, structural and technical systems. 9.3.ST-ET.1 Use STEM concepts and processes to solve problems involving design and/or production.			define the problem, do background research, specify requirements, brainstorm solutions, choose the best solution, do development work, build a prototype, test and redesign, and communicate solutions The students will be able to advocate, practice safe, legal, and responsible use of information and technology. The students will be able to demonstrate personal responsibility for lifelong learning. The students will be able to exhibit leadership for	Unit Test(s) Unit Project	for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts. HS-ETS1-4 Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.	advancement, and transition (e.g., 2.1.12.PGD.1).

		9.3.ST-ET.2 Display and communicate STEM information. 9.3.ST-ET.3 Apply processes and concepts for the use of technological tools in STEM. 9.3.ST-ET.4 Apply the elements of the design process. 9.3.ST-ET.5 Apply the knowledge learned in STEM to solve problems. 9.3.ST-ET.6 Apply the knowledge learned in the study of STEM to provide solutions to human and societal problems in an ethical and legal manner. 9.3.ST-SM.1 Apply science and mathematics to provide results, answers, and algorithms for engineering and technological activities. 9.3.ST-SM.2 Apply science and mathematics concepts to the development of			digital citizenship.			

		plans, processes and projects that address real world problems. 9.3.ST-SM.3 Analyze the impact that science and mathematics has on society. *Computer Science & Design Thinking* *Engineering Design* 8.2.12. ED.1: Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers. 8.2.12. ED.2: Create scaled engineering drawings for a new product or system and make modification to increase optimization based on feedback. 8.2.12. ED.3: Evaluate several models of the same type of product and make recommendations for a new design based on a cost benefit analysis. 8.2.12. ED.4: Design a product or system that addresses a global						

		problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience. 8.2.12. ED.5: Evaluate the effectiveness of a product or system based on factors that are related to its requirements, specifications, and constraints (e.g., safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, ergonomics). 8.2.12. ED.6: Analyze the effects of changing resources when designing a specific product or system (e.g., materials, energy, tools, capital, labor). *Interaction of Technology & Humans* 8.2.12.ITH.1: Analyze a product to determine the impact that economic, political,						

		social, and/or cultural factors have had on its design, including its design constraints. 8.2.12.ITH.2: Propose an innovation to meet future demands supported by an analysis of the potential costs, benefits, trade-offs, and risks related to the use of the innovation. 8.2.12.ITH.3: Analyze the impact that globalization, social media, and access to open source technologies has had on innovation and on a society's economy, politics, and culture.						

Unit of Study	Pacing	NJ Student Learning Standards	Essential Questions	Enduring Understandings	Learning Targets	Assessment: Formative & Summative	Interdisciplinary Connections	Career Readiness, Life Literacies, & Key Skills Standards
Unit 2 – Transportation	2-4 weeks	*NJ-Career & Technical Education (CTE) Standards* 9.3.12.TD-SYS.1 Develop plans to maintain and/or improve the transportation infrastructure. 9.3.12.TD-SYS.2 Assess, plan, and manage the implementation of transportation services. 9.3.12.TD-SYS.3 Describe ways to improve the system utilization, flow, safety, and environmental performance of transportation systems. *Computer Science & Design Thinking Nature of Technology*	What are current modes of transportation for moving people and/or goods? Identify the strengths and weaknesses of transportation systems? How do you apply transportation concepts to vehicle engineering? What are some innovations in transportation throughout history? How can engineering design and modern materials help improve transportation?	The four modes of transportation, land, water, air, and space each provide benefits to society. Transportation technology is extremely important to the world economy. Transportation includes both transportation infrastructure and vehicles.	Students will develop an understanding of and be able to select and use transportation technologies. The students will be able to list the four modes of transportation. -land -water -air -space The students will be able to discuss how transportation infrastructure increases efficiency of vehicles and processes. The students will be able to utilize basic skills to develop and	***Formative*** Observations Student Progress Reports Electronic portfolio of completed assignments and projects. Rubrics will be used to assess projects. Exit Tickets ***Summative*** Teacher created assessments on terminology and procedures. Engineering Notebook Quiz (es) Unit Test(s) Unit Project	*From Molecules to Organisms: Structures & Processes* HS-LS1-5 Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy. Energy HS-PS3-1 Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known. HS-PS3-2 Develop and use models to illustrate that	*Critical Thinking & Problem-Solving* 9.4.12. CT.1: Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1. 12acc.C1b, 2.2.12. PF.3). 9.4.12. CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1. 3E.12profCR3.a). 9.4.12. CT.3: Enlist input from a variety of stakeholders (e.g., community members, experts in the field) to design a service-learning activity that addresses a local or global issue (e.g.,

		8.2.12. NT.1: Explain how different groups can contribute to the overall design of a product. 8.2.12. NT.2: Redesign an existing product to improve form or function. *Effects of Technology on the Natural World* 8.2.12.ETW.1: Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation, and maintenance of a chosen product. 8.2.12.ETW.2: Synthesize and analyze data collected to monitor the effects of a technological product or system on the environment. 8.2.12.ETW.3: Identify a complex, global environmental or climate change issue, develop a systemic plan of investigation, and	What decisions relate to the use of energy? How do individual decisions about transportation and energy use affect society and the environment?		modify projects. The students will be able to analyze and apply scientific laws affecting vehicles. The students will be able to design and develop projects that utilize the core areas of transportation technology. The students will be able to describe how transportation plays a vital role in the operation of other technologies, such as manufacturing, construction, communication, health and safety, and agriculture. The students will be able to intermodalism is the use of		energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects). HS-PS3-3 Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy. HS-PS3-4 Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution	environmental justice). 9.4.12. CT.4: Participate in online strategy and planning sessions for course-based, school-based, or other project and determine the strategies that contribute to effective outcomes.

		propose an innovative sustainable solution.			different modes of transportation, such as highways, railways, and waterways, as part of an interconnected system that can move people and goods easily from one mode to another. The students will be able to determine transportation services and methods have led to a population that is regularly on the move. The students will be able to design intelligent and non-intelligent transportation systems that are dependent on many processes and innovative techniques.		among the components in the system (second law of thermodynamics). HS-PS3-5 Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction. Motion & Stability: Forces & Interactions HS-PS2-1 Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration. HS-PS2-3 Apply scientific and	

							engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision. HS-PS2-5 Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.	

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Unit 3 - Construction	2-4 weeks	*NJ-Career & Technical Education (CTE) Standards* 9.3.12. AC.1 Use vocabulary, symbols, and formulas common to architecture and construction. 9.3.12. AC.2 Use architecture and construction skills to create and manage a project. 9.3.12. AC.3 Comply with regulations and applicable codes to establish and manage a legal and safe workplace. 9.3.12. AC.4 Evaluate the nature and scope of the Architecture & Construction Career Cluster and the role of architecture and construction in society and the economy. 9.3.12. AC.5 Describe the roles, responsibilities, and relationships found in	How are structures designed to withstand forces exerted upon them? What is construction technology's effect on society? Identify the strengths and weaknesses of construction procedures? How do you apply construction concepts to structural engineering? What are some innovations in construction throughout history? How can engineering design and	Technology systems impact every aspect of the world in which we live. Code enforcement is essential in standardizing construction and maintaining quality results. Materials have pros and cons which should be considered when designing. Different styles of buildings and structures serve various needs based on location and purpose. Energy efficiency is the	Students will develop an understanding of and be able to select and use construction technologies. The students will be able to identify characteristics and scope of technology. The students will be able to identify the core concepts of technology. The students will be able to explain the relationships among technologies and the connections between technology and other	***Formative*** Observations Student Progress Reports Electronic portfolio of completed assignments and projects. Rubrics will be used to assess projects. Exit Tickets ***Summative*** Teacher created assessments on terminology and procedures. Engineering Notebook Quiz (es) Unit Test(s)	*Earth's Systems* HS-ESS2-3 Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection. HS-ESS2-4 Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate. HS-ESS2-5 Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. HS-ESS2-6 Develop a quantitative model to describe	*Digital Citizenship* 9.4.12.DC.1: Explain the beneficial and harmful effects that intellectual property laws can have on the creation and sharing of content (e.g., 6.1.12. CivicsPR.16. a). 9.4.12.DC.2: Compare and contrast international differences in copyright laws and ethics. 9.4.12.DC.3: Evaluate the social and economic implications of privacy in the context of safety, law, or ethics (e.g., 6.3.12. HistoryCA.1). 9.4.12.DC.4: Explain the privacy concerns related to

		the architecture and construction trades and professions, including labor/management relationships. 9.3.12. AC.6 Read, interpret, and use technical drawings, documents, and specifications to plan a project. 9.3.12. AC.7 Describe career opportunities and means to achieve those opportunities in each of the Architecture & Construction Career Pathways. 9.3.12.AC-CST.1 Describe contractual relationships between all parties involved in the building process. 9.3.12.AC-CST.2 Describe the approval procedures required for successful completion of a construction project. 9.3.12.AC-CST.3 Implement testing and inspection procedures to ensure successful completion of a construction project. 9.3.12.AC-CST.4	modern materials help improve construction? What decisions relate to the use of energy efficiency? How do individual decisions about construction and energy use affect society and the environment?	goal to reduce the amount of energy required to provide products and services. Green construction practices save resources, time, and energy.	fields of study. The students will be able to identify that infrastructure is the underlying base or basic frameworks of a system. The students will be able to identify structures that are constructed using a variety of processes and procedures. The students will be able to identify structures that include prefabricated materials. The students will be able to design structures include several requirements. Structures require	Unit Project	the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.	the collection of data (e.g., cookies) and generation of data through automated processes that may not be evident to users (e.g., 8.1.12.NI.3). 9.4.12.DC.5: Debate laws and regulations that impact the development and use of software. 9.4.12.DC.6: Select information to post online that positively impacts personal image and future college and career opportunities. 9.4.12.DC.7: Evaluate the influence of digital communities on the nature, content and responsibilities of careers, and other aspects of society (e.g., 6.1.12. CivicsPD.16. a). 9.4.12.DC.8: Explain how increased network

		Apply scheduling practices to ensure the successful completion of a construction project. 9.3.12.AC-CST.5 Apply practices and procedures required to maintain jobsite safety. 9.3.12.AC-CST.6 Manage relationships with internal and external parties to successfully complete construction projects. 9.3.12.AC-CST.7 Compare and contrast the building systems and components required for a construction project. 9.3.12.AC-CST.8 Demonstrate the construction crafts required for each phase of a construction project. 9.3.12.AC-CST.9 Safely use and maintain appropriate tools, machinery, equipment, and resources to accomplish construction project goals. 9.3.12.AC-DES.1 Justify design solutions through the use of research documentation and analysis of data.			maintenance, alterations, or renovation periodically to improve them or to alter their intended use.			connectivity and computing capabilities of everyday objects allow for innovative technological approaches to climate protection.

		9.3.12.AC-DES.2 Use effective communication skills and strategies (listening, speaking, reading, writing and graphic communications) to work with clients and colleagues. 9.3.12.AC-DES.3 Describe the requirements of the integral systems that impact the design of buildings. 9.3.12.AC-DES.4 Apply building codes, laws, and rules in the project design. 9.3.12.AC-DES.5 Identify the diversity of needs, values, and social patterns in project design, including accessibility standards. 9.3.12.AC-DES.6 Apply the techniques and skills of modern drafting, design, engineering, and construction to projects. 9.3.12.AC-DES.7 Employ appropriate representational media to communicate concepts and project design. 9.3.12.AC-DES.8						

		Apply standards, applications and restrictions pertaining to the selection and use of construction materials, components, and assemblies in the project design. *Computer Science & Design Thinking Ethics & Culture* 8.2.12. EC.1: Analyze controversial technological issues and determine the degree to which individuals, businesses, and governments have an ethical role in decisions that are made. 8.2.12. EC.2: Assess the positive and negative impacts of emerging technologies on developing countries and evaluate how individuals, non-profit organizations, and governments have responded. 8.2.12. EC.3: Synthesize data, analyze trends, and draw conclusions regarding the effect of a technology on the individual, culture,						

		society, and environment and share this information with the appropriate audience. 8.2.12.ETW.4: Research historical tensions between environmental and economic considerations as driven by human needs and wants in the development of a technological product and present the competing viewpoints.						

Unit of Study	Pacing	NJ Student Learning Standards	Essential Questions	Enduring Understandings	Learning Targets	Assessment: Formative & Summative	Interdisciplinary Connections	Career Readiness, Life Literacies, & Key Skills Standards
Unit 4- Manufacturing	2-4 weeks	*NJ-Career & Technical Education (CTE) Standards* 9.3.MN.1 Evaluate the nature and scope of the Manufacturing Career Cluster and the role of manufacturing in society and in the economy. 9.3.MN.2 Analyze and summarize how manufacturing businesses improve performance. 9.3.MN.3 Comply with federal, state, and local regulations to ensure worker safety and health and environmental work practices.	What are current types of manufacturing processes used to create goods? What are the strengths and weaknesses of different manufacturing processes? How do you apply manufacturing concepts to product design and engineering? What are some innovations in manufacturing throughout history? How can engineering design and modern materials help improve manufacturing?	Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources such as: -Casting. -Imaging and coating. - Molding. - Forming. - Machining. - Joining. - Additive manufacturing. Every manufacturing process has different costs, quality, strengths, and weaknesses. Efficiency can be increased by reducing energy usage and recycling byproducts.	Students will develop an understanding of and be able to select and use manufacturing technologies. The students will be able to identify how servicing keeps products in good operating condition. The students will be able to explain how materials have different qualities and may be classified as natural, synthetic, or mixed. The students will be able to explain how durable goods are designed to operate for a long period of	***Formative*** Observations Student Progress Reports Electronic portfolio of completed assignments and projects. Rubrics will be used to assess projects. Exit Tickets ***Summative*** Teacher created assessments on terminology and procedures. Engineering Notebook	*Ecosystems: Interactions, Energy, and Dynamics* HS-LS2-1 Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. HS-LS2-1 Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.	*Technology Literacy* 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.). 9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data. 9.4.12.TL.3: Analyze the effectiveness of the process and quality of collaborative environments.

		9.3.MN.4 Describe career opportunities and means to achieve those opportunities in each of the Manufacturing Career Pathways. 9.3.MN.5 Describe government policies and industry standards that apply to manufacturing. 9.3.MN.6 Demonstrate workplace knowledge and skills common to manufacturing. *Computer Science & Design Thinking Computing Systems* 8.1.12.CS.1: Describe ways in which integrated systems hide underlying implementation details to simplify user experiences.	What decisions relate to the use of energy? How do individual decisions about manufacturing and energy use affect society and the environment?		time, while non-durable goods are designed to operate for a short period of time. The students will be able to explain how manufacturing systems may be classified into types, such as customized production, batch production, and continuous production. The students will be able to describe how marketing involves establishing a product's identity, conducting research on its potential, advertising it, distributing it, and selling it.	(addition: must "advertise their design/ market it" Quiz (es) Unit Test(s) Unit Project	HS-LS2-1 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity. *Mater & Its Interactions* MS-PS1-6 Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.	9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL. IPERS.6). *Economic & Government Influences* 9.1.12.EG.6: Analyze the rights and responsibilities of buyers and sellers under consumer protection laws.

		8.1.12.CS.2: Model interactions between application software, system software, and hardware. 8.1.12.CS.3: Compare the functions of application software, system software, and hardware. 8.1.12.CS.4: Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors. Networking & the Internet 8.1.12.NI.1: Evaluate the scalability and reliability of networks, by describing the relationship between routers, switches, servers,						

		topology, and addressing. 8.1.12.NI.2: Evaluate security measures to address various common security threats. 8.1.12.NI.3: Explain how the needs of users and the sensitivity of data determine the level of security implemented. 8.1.12.NI.4: Explain how decisions on methods to protect data are influenced by whether the data is at rest, in transit, or in use.						

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Unit 5- Medical Technologies/ Agriculture / Biotechnology	2-4 weeks	*NJ-Career & Technical Education (CTE) Standards* 9.3.12.AG.1 Analyze how issues, trends, technologies and public policies impact systems in the Agriculture, Food & Natural Resources Career Cluster. 9.3.12.AG.2 Evaluate the nature and scope of the Agriculture, Food & Natural Resources Career Cluster and the role of agriculture, food, and natural resources (AFNR) in society and the economy. 9.3.12.AG.3 Examine and summarize the importance of health, safety, and environmental management systems in AFNR businesses. 9.3.12.AG.4 Demonstrate stewardship of natural resources in AFNR activities.	What are current agricultural and biotechnology that are evident in current society? Identify the strengths and weaknesses of agricultural and biotechnology systems? How do you apply agricultural and biotechnology concepts to food production and medical applications? What are some innovations in agricultural and biotechnology throughout history? How can engineering design and	Knowledge and understanding of human, cultural and societal values are fundamental when designing technological systems and products in the global society. Large scale farming is one of the most used farming techniques. Advances in growing human replaceable parts for the human body and cybernetic are advancing. Understand the difference between agricultural infrastructure and biotech infrastructure and their	Students will develop an understanding of and be able to select and use agriculture and related biotechnologies. The students will be able to explain cultural, social, economic, and political effects of technology. The students will be able to explain the effects of technology on the environment. The students will be able to explain the role of society in the development and use of technology.	***Formative*** Observations Student Progress Reports Electronic portfolio of completed assignments and projects. Rubrics will be used to assess projects. Exit Tickets ***Summative*** Teacher created assessments on terminology and procedures. Engineering Notebook Quiz (es) Unit Test(s)	*Earth & Human Activity* HS-ESS3-1 Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and climate change have influenced human activity. HS-ESS3-2 Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios. HS-ESS3-3 Create a computational simulation to illustrate the	*Global & Cultural Awareness* 9.4.12.GCA.1: Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political. economic, cultural) may work better than others (e.g., SL.11-12.1., HS-ETS1-1, HS-ETS1-2, HS-ETS1-4, 6.3.12. GeoGI.1, 7.1.IH. IPERS.6, 7.1.IL. IPERS.7, 8.2.12.ETW.3).

		9.3.12.AG.5 Describe career opportunities and means to achieve those opportunities in each of the Agriculture, Food & Natural Resources Career Pathways. 9.3.12.AG.6 Analyze the interaction among AFNR systems in the production, processing and management of food, fiber and fuel and the sustainable use of natural resources. 9.3. HL-BRD.1 Summarize the goals of biotechnology research and development within legal and ethical protocols. 9.3. HL-BRD.2 Apply the fundamentals of biochemistry, cell biology, genetics, mathematical concepts, microbiology, molecular biology, organic chemistry, and statistics to conduct effective biotechnology research and development of products. 9.3. HL-BRD.3	modern materials help improve agricultural and biotechnology? What decisions relate to the use of energy? How do individual decisions about transportation and energy use affect society and the environment?	impacts on the environment.	The students will be able to describe the influence of technology on history. The students will be able to explain that agriculture includes a combination of businesses that use a wide array of products and systems to produce, process, and distribute food, fiber, fuel, chemicals, and other useful products. The students will be able to explain that biotechnology has applications in such areas as agriculture, pharmaceuticals, food and beverages, medicine, energy, the environment, and genetic engineering.	Unit Project	relationships among management of natural resources, the sustainability of human populations, and biodiversity. HS-ESS3-4 Evaluate or refine a technological solution that reduces impacts of human activities on climate change and other natural systems. HS-ESS3-5 Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems. HS-ESS3-6 Use a computational representation to illustrate the relationships	

		Demonstrate basic knowledge of recombinant DNA, genetic engineering, bioprocessing, monoclonal antibody production, nanotechnology, bioinformatics, genomics, proteomics, and transcriptomics to conduct biotechnology research and development. 9.3. HL-BRD.4 Demonstrate the principles of solution preparation, sterile techniques, contamination control, and measurement and calibration of instruments used in biotechnology research. 9.3. HL-BRD.5 Determine processes for product design and production and how that work contributes to an understanding of the biotechnology product development process. 9.3. HL-BRD.6 Summarize and explain the larger ethical, moral, and legal issues related to biotechnology research, product development and use in society.			The students will be able to explain that conservation is the process of controlling soil erosion, reducing sediment in waterways, conserving water, and improving water quality. The students will be able to explain that engineering design and management of agricultural systems require knowledge of artificial ecosystems and the effects of technological development on flora and fauna. The students will be able to plan strategies to guide inquiry. Locate, organize, analyze, evaluate,		among Earth systems and how those relationships are being modified due to human activity (i.e., climate change). Hereditary: Inheritance and Variation of Traits HS-LS3-1 Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring. HS-LS3-1 Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication,	

		Computer Science & Design Thinking *Impacts of Computing* 8.1.12.IC.1: Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices. 8.1.12.IC.2: Test and refine computational artifacts to reduce bias and equity deficits. 8.1.12.IC.3: Predict the potential impacts and implications of emerging technologies on larger social, economic, and political structures, using evidence from credible sources. Data & Analysis 8.1.12. DA.1: Create interactive data visualizations using software tools to help others better understand real world phenomena, including climate change. 8.1.12. DA.2: Describe the trade-offs in how and where data is organized and stored. 8.1.12. DA.3: Translate between decimal numbers and binary numbers.			synthesize, and ethically use information from a variety of sources and media. Evaluate and select information sources and digital tools based on the appropriateness for specific tasks. Process data and report results.		and/or (3) mutations caused by environmental factors. HS-LS3-1 Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.	

		8.1.12. DA.4: Explain the relationship between binary numbers and the storage and use of data in a computing device. 8.1.12. DA.5: Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena. 8.1.12. DA.6: Create and refine computational models to better represent the relationships among different elements of data collected from a phenomenon or process.						

Unit of Study	Pacing	NJ Student Learning Standards	Essential Questions	Enduring Understandings	Learning Targets	Assessment: Formative & Summative	Interdisciplinary Connections	Career Readiness, Life Literacies, & Key Skills Standards
Unit 6- Computational Thinking	1 Week	*NJ-Career & Technical Education (CTE) Standards* 9.3. IT.4 Demonstrate positive cyber citizenry by applying industry accepted ethical practices and behaviors. 9.3. IT.12 Demonstrate knowledge of the hardware components associated with information systems. 9.3.IT-SUP.3 Apply appropriate troubleshooting techniques in resolving computer hardware, software, and configuration problems. *Computer Science & Design Thinking Algorithms & Programming*	What is computational thinking? What is computer programming? How can engineers use computational thinking and computer programming to enhance their designs and prototypes?	Computational thinking builds and enhances problem solving, allowing students to move beyond using knowledge to creating knowledge. The designed world is the product of a design process that provides the means to convert resources into products and systems.	The students will be able to understand the relationship between internal and external computer components (software/hard ware). The students will be able to use a programming language to solve problems or accomplish a task. The students will be able to use appropriate computer science terms in conversation. The students will be able to apply the design process. The students will be able to use and	***Formative*** Observations Student Progress Reports Electronic portfolio of completed assignments and projects. Rubrics will be used to assess projects. Exit Tickets ***Summative*** Teacher created assessments on terminology and procedures. Engineering Notebook Quiz (es) Unit Test(s) Unit Project	Waves & Their Applications in Technologies for Information Transfer HS-PS4-1 Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media. HS-PS4-2 Evaluate questions about the advantages of using a digital transmission and storage of information. HS-PS4-3 Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can	*Financial Institutions* 9.1.12.FI.1: Identify ways to protect yourself from identify theft *Information & Media Literacy* 9.4.12.IML.1: Compare search browsers and recognize features that allow for filtering of information. 9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources (e.g., NJSLSA.W8, Social Studies Practice: Gathering and Evaluating Sources.

		8.1.12. AP.1: Design algorithms to solve computational problems using a combination of original and existing algorithms. 8.1.12. AP.2: Create generalized computational solutions using collections instead of repeatedly using simple variables. 8.1.12. AP.3: Select and combine control structures for a specific application based upon performance and readability, and identify trade-offs to justify the choice. 8.1.12. AP.4: Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue. 8.1.12. AP.5: Decompose problems into smaller components			maintain technological products and systems. The students will be able to assess the impact of products and systems.		be described either by a wave model or a particle model, and that for some situations one model is more useful than the other. HS-PS4-4 Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter. HS-PS4-5 Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.	9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12. DA.5, 7.1.IH. IPRET.8) 9.4.12.IML.4: Assess and critique the appropriateness and impact of existing data visualizations for an intended audience (e.g., S-ID.B.6b, HS-LS2-4). 9.4.12.IML.5: Evaluate, synthesize, and apply information on climate change from various sources appropriately (e.g., 2.1.12.CHSS.6, S.IC.B.4, S.IC.B.6, 8.1.12.DA.1, 6.1.12.GeoHE.14.a 7.1.AL.PRSNT.2). 9.4.12.IML.6: Use various types of media to produce and store

		through systematic analysis, using constructs such as procedures, modules, and/or objects. 8.1.12. AP.6: Create artifacts by using procedures within a program, combinations of data and procedures, or independent but interrelated programs. 8.1.12. AP.7: Collaboratively design and develop programs and artifacts for broad audiences by incorporating feedback from users. 8.1.12. AP.8: Evaluate and refine computational artifacts to make them more usable and accessible. 8.1.12. AP.9: Collaboratively document and present design decisions in the development of complex programs.						information on climate change for different purposes and audiences with sensitivity to cultural, gender, and age diversity (e.g., NJSLSA.SL5). 9.4.12.IML.7: Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change (e.g., NJSLSA.W1, 7.1.AL. PRSNT.4). 9.4.12.IML.8: Evaluate media sources for point of view, bias, and motivations (e.g., NJSLSA.R6, 7.1.AL. IPRET.6). 9.4.12.IML.9: Analyze the decisions creators make to reveal explicit and implicit messages within information and media (e.g., 1.5. 12acc.C2a, 7.1.IL. IPRET.4).

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NGSS Lead States. "Next Generation Science Standards: For States, By States." The National Academies Press, 9 April 2013, https://www.nextgenscience.org/

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WEBLIOGRAPHY

None.

ASSOCIATED JOBS LIST BY UNIT

Unit 1 – Engineering Design Process	All Engineers & Technologists
Unit 2 – Transportation	Transportation Engineer, Drivers, Distribution Manager, Automotive Service Technician/Mechanic, Cargo & Freight Agent, Material Moving Machine Operator
Unit 3 - Construction	Construction Engineer, Construction Superintendent, Project Engineer, Construction Estimator, Construction Inspector, Journeyman Electrician, Plumber, Pipefitter, Carpenter, Equipment Operator, Construction Laborer
Unit 4-Manufacturing	Manufacturing Engineer, Maintenance Engineer, Mechanic, Plant Operator, Shop Forman, Factory Worker, Woodworker, Stationary Engineer, Welder, Plumber, Mold Maker
Unit 5- Medical Technologies/ Agriculture / Biotechnology	Doctor, Scientist, Biotechnologist, Medical Laboratory, Laboratory Technician, Research Specialist, Lab Manager, Emergency Medical Team, Dental Hygienist, Physical Therapist, Home Health Aide, Diagnostic Medical Sonographer, Medical Assistant, Medical Records Technician, Veterinary Technologist, Data Entry Specialist, Senior Research Scientist, Biofuel Technician, Cell Culture Technician, Chemistry Quality Control Technician, Clinical Research Associate, Compliance Specialist, Environmental Health & Safety Technician, Food Sample Inspector, Genomics Technician, Molecular Biology Technician, Microbiology Quality Control Technician, Water Quality Technician
Unit 6- Computational Thinking	Computer Scientist, Robotics Engineer, Network Manager, Information Systems Engineer, Computer Technician, White Hat Hacker, Military Drone Technician