Main Criteria: Forward Education
Secondary Criteria: New Jersey Student Learning Standards
Subjects: Mathematics, Science, Technology Education
Grades: 11, 12, Key Stage 4

Forward Education

Autonomous Electric Vehicles of the Future

New Jersey Student Learning Standards
Mathematics
Grade **11** - Adopted: **2016**

CONTENT AREA / STANDARD	NJ.MP.	Mathematical Practices
STRAND	MP.1.	Make sense of problems and persevere in solving them.
STRAND	MP.2.	Reason abstractly and quantitatively.
STRAND	MP.3.	Construct viable arguments and critique the reasoning of others.
STRAND	MP.4.	Model with mathematics.
STRAND	MP.8.	Look for and express regularity in repeated reasoning.

CONTENT AREA / STANDARD	NJ.A.	Algebra
STRAND	**A-CED.**	**Creating Equations**
CONTENT STATEMENT	**A-CED.A.**	**Create equations that describe numbers or relationships**
CUMULATIVE PROGRESS INDICATOR	A-CED.A.2.	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

CONTENT AREA / STANDARD	NJ.A.	Algebra
STRAND	**A-REI.**	**Reasoning with Equations and Inequalities**
CONTENT STATEMENT	**A-REI.A.**	**Understand solving equations as a process of reasoning and explain the reasoning**
CUMULATIVE PROGRESS INDICATOR	A-REI.A.1.	Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

CONTENT AREA / STANDARD	NJ.F.	Functions
STRAND	**F-IF.**	**Interpreting Functions**
CONTENT STATEMENT	**F-IF.C.**	**Analyze functions using different representations**

CUMULATIVE PROGRESS INDICATOR	**F-IF.C.7.**	**Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.**
INDICATOR	F-IF.C.7.a.	Graph linear and quadratic functions and show intercepts, maxima, and minima.
CONTENT AREA / STANDARD	**NJ.F.**	**Functions**
STRAND	**F-LE.**	**Linear and Exponential Models**
CONTENT STATEMENT	**F-LE.A.**	**Construct and compare linear and exponential models and solve problems**
CUMULATIVE PROGRESS INDICATOR	**F-LE.A.1.**	**Distinguish between situations that can be modeled with linear functions and with exponential functions.**
INDICATOR	F-LE.A.1.a.	Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.

New Jersey Student Learning Standards

Mathematics

Grade **12** - Adopted: **2016**

CONTENT AREA / STANDARD	**NJ.MP.**	**Mathematical Practices**
STRAND	MP.1.	Make sense of problems and persevere in solving them.
STRAND	MP.2.	Reason abstractly and quantitatively.
STRAND	MP.3.	Construct viable arguments and critique the reasoning of others.
STRAND	MP.4.	Model with mathematics.
STRAND	MP.8.	Look for and express regularity in repeated reasoning.
CONTENT AREA / STANDARD	**NJ.A.**	**Algebra**
STRAND	**A-CED.**	**Creating Equations**
CONTENT STATEMENT	**A-CED.A.**	**Create equations that describe numbers or relationships**
CUMULATIVE PROGRESS INDICATOR	A-CED.A.2.	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
CONTENT AREA / STANDARD	**NJ.A.**	**Algebra**
STRAND	**A-REI.**	**Reasoning with Equations and Inequalities**
CONTENT STATEMENT	**A-REI.A.**	**Understand solving equations as a process of reasoning and explain the reasoning**

CUMULATIVE PROGRESS INDICATOR	A-REI.A.1.	Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

CONTENT AREA / STANDARD	**NJ.F.**	**Functions**
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CONTENT STATEMENT	**F-IF.C.**	**Analyze functions using different representations**
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New Jersey Student Learning Standards

Science

Grade **11** - Adopted: **2020/Effective 2021**

CONTENT AREA / STANDARD	**HS-PS.**	**Physical Science**
STRAND	**HS-PS1:**	**Matter and its Interactions**
CONTENT STATEMENT	HS-PS1-4.	Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.

CONTENT AREA / STANDARD	**HS-PS.**	**Physical Science**
STRAND	**HS-PS3:**	**Energy**
CONTENT STATEMENT	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.

CONTENT AREA / STANDARD	**HS-PS.**	**Physical Science**
STRAND	**HS-PS4:**	**Waves and Their Applications in Technologies for Information Transfer**

CONTENT STATEMENT	HS-PS4-2.	Evaluate questions about the advantages of using a digital transmission and storage of information.
CONTENT AREA / STANDARD	**HS-LS.**	**Life Science**
STRAND	**HS-LS2:**	**Ecosystems: Interactions, Energy, and Dynamics**
CONTENT STATEMENT	HS-LS2-7.	Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
CONTENT AREA / STANDARD	**HS-ESS.**	**Earth and Space Science**
STRAND	**HS-ESS2:**	**Earth's Systems**
CONTENT STATEMENT	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.
CONTENT AREA / STANDARD	**HS-ESS.**	**Earth and Space Science**
STRAND	**HS-ESS3:**	**Earth and Human Activity**
CONTENT STATEMENT	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.
CONTENT STATEMENT	HS-ESS3-2.	Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
CONTENT STATEMENT	HS-ESS3-3.	Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.
CONTENT STATEMENT	HS-ESS3-4.	Evaluate or refine a technological solution that reduces impacts of human activities on climate change and other natural systems.
CONTENT STATEMENT	HS-ESS3-6.	Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity (i.e., climate change).
CONTENT AREA / STANDARD	**HS-ETS.**	**Engineering, Technology and Applications of Science**
STRAND	**HS-ETS1:**	**Engineering Design**
CONTENT STATEMENT	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.
CONTENT STATEMENT	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.

CONTENT STATEMENT	HS-ETS1-3.	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

New Jersey Student Learning Standards

Science

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New Jersey Student Learning Standards

Technology Education

Grade **11** - Adopted: **2020**

CONTENT AREA / STANDARD		**Computer Science and Design Thinking Practices**
STRAND		**1 Fostering an Inclusive Computing and Design Culture**
CONTENT STATEMENT		**Building an inclusive and diverse computing culture requires strategies for incorporating perspectives from people of different genders, ethnicities, and abilities. Incorporating these perspectives involves understanding the personal, ethical, social, economic, and cultural contexts in which people operate. Considering the needs of diverse users during the design process is essential to producing inclusive computational products. When engaging in this practice, students:**
CUMULATIVE PROGRESS INDICATOR		Employ self- and peer-advocacy to address bias in interactions, product design, and development methods.
CONTENT AREA / STANDARD		**Computer Science and Design Thinking Practices**
STRAND		**3 Recognizing and Defining Computational Problems**

CONTENT STATEMENT		**The ability to recognize appropriate and worthwhile opportunities to apply computation is a skill that develops over time and is central to computing. Solving a problem with a computational approach requires defining the problem, breaking it down into parts, and evaluating each part to determine whether a computational solution is appropriate. When engaging in this practice, students:**
CUMULATIVE PROGRESS INDICATOR		Decompose complex real-world problems into manageable sub-problems that could integrate existing solutions or procedures.
CUMULATIVE PROGRESS INDICATOR		Evaluate whether it is appropriate and feasible to solve a problem computationally.
CONTENT AREA / STANDARD		**Computer Science and Design Thinking Practices**
STRAND		**4 Developing and Using Abstractions**
CONTENT STATEMENT		**Abstractions are formed by identifying patterns and extracting common features from specific examples in order to create generalizations. Using generalized solutions and parts of solutions designed for broad reuse simplifies the development process by managing complexity. When engaging in this practice, students:**
CUMULATIVE PROGRESS INDICATOR		Evaluate existing technological functionalities and incorporate them into new designs.
CUMULATIVE PROGRESS INDICATOR		Create modules and develop points of interaction that can apply to multiple situations and reduce complexity.
CONTENT AREA / STANDARD		**Computer Science and Design Thinking Practices**
STRAND		**5 Creating Computational Artifacts**
CONTENT STATEMENT		**The process of developing computational artifacts embraces both creative expression and the exploration of ideas to create prototypes and solve computational problems. Students create artifacts that are personally relevant or beneficial to their community and beyond. Computational artifacts can be created by combining and modifying existing artifacts or by developing new artifacts. Examples of computational artifacts include programs, simulations, visualizations, digital animations, robotic systems, and apps. When engaging in this practice, students:**
CUMULATIVE PROGRESS INDICATOR		Plan the development of a computational artifact using an iterative process that includes reflection on and modification of the plan, taking into account key features, time and resource constraints, and user expectations.
CUMULATIVE PROGRESS INDICATOR		Create a computational artifact for practical intent, personal expression, or to address a societal issue.
CONTENT AREA / STANDARD		**Computer Science and Design Thinking Practices**
STRAND		**6 Testing and Refining Computational Artifacts**
CONTENT STATEMENT		**Testing and refinement is the deliberate and iterative process of improving a computational artifact. This process includes debugging (identifying and fixing errors) and comparing actual outcomes to intended outcomes. Students also respond to the changing needs and expectations of end users and improve the performance, reliability, usability, and accessibility of artifacts. When engaging in this practice, students:**

CUMULATIVE PROGRESS INDICATOR		Systematically test computational artifacts by considering all scenarios and using test cases.

CONTENT AREA / STANDARD	**8.1.**	**Computer Science and Design Thinking – Computer Science**
STRAND		**Impacts of Computing**
CONTENT STATEMENT		**The design and use of computing technologies and artifacts can positively or negatively affect equitable access to information and opportunities.**
CUMULATIVE PROGRESS INDICATOR	8.1.12.IC.2:	Test and refine computational artifacts to reduce bias and equity deficits.

CONTENT AREA / STANDARD	**8.1.**	**Computer Science and Design Thinking – Computer Science**
STRAND		**Algorithms & Programming**
CONTENT STATEMENT		**Individuals evaluate and select algorithms based on performance, reusability, and ease of implementation.**
CUMULATIVE PROGRESS INDICATOR	8.1.12.AP.1:	Design algorithms to solve computational problems using a combination of original and existing algorithms.

CONTENT AREA / STANDARD	**8.1.**	**Computer Science and Design Thinking – Computer Science**
STRAND		**Algorithms & Programming**
CONTENT STATEMENT		**Complex programs are developed, tested, and analyzed by teams drawing on the members' diverse strengths using a variety of resources, libraries, and tools.**
CUMULATIVE PROGRESS INDICATOR	8.1.12.AP.9:	Collaboratively document and present design decisions in the development of complex programs.

CONTENT AREA / STANDARD	**8.2.**	**Computer Science and Design Thinking – Design Thinking**
STRAND		**Engineering Design**
CONTENT STATEMENT		**Engineering design is a complex process in which creativity, content knowledge, research, and analysis are used to address local and global problems. Decisions on trade-offs involve systematic comparisons of all costs and benefits, and final steps that may involve redesigning for optimization.**
CUMULATIVE PROGRESS INDICATOR	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.
CUMULATIVE PROGRESS INDICATOR	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.

CONTENT AREA / STANDARD	**8.2.**	**Computer Science and Design Thinking – Design Thinking**
STRAND		**Engineering Design**
CONTENT STATEMENT		**Engineering design evaluation, a process for determining how well a solution meets requirements, involves systematic comparisons between requirements, specifications, and constraints.**
CUMULATIVE PROGRESS INDICATOR	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).
CUMULATIVE PROGRESS INDICATOR	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).

CONTENT AREA / STANDARD	**8.2.**	**Computer Science and Design Thinking – Design Thinking**
STRAND		**Interaction of Technology and Humans**
CONTENT STATEMENT		**Decisions to develop new technology are driven by societal and cultural opinions and demands that differ from culture to culture.**
CUMULATIVE PROGRESS INDICATOR	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.

New Jersey Student Learning Standards

Technology Education

Grade **12** - Adopted: **2020**

CONTENT AREA / STANDARD		**Computer Science and Design Thinking Practices**
STRAND		**1 Fostering an Inclusive Computing and Design Culture**
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CUMULATIVE PROGRESS INDICATOR	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.
CUMULATIVE PROGRESS INDICATOR	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.
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