**Design & Technology**
**Grade 3**
**Full Year**

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**Course Overview**

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The essential intent of the School District of the Chathams' Design & Technology program is to empower students to think critically and creatively to develop innovative solutions to problems present in our modern world. Our Design & Technology program is a nationally award winning and comprehensive program that enables our students to engage in authentic problem solving, collaboration, innovation, and critical thinking, while developing creativity and perseverance. Students gain proficiency in the application of relevant grade 3 mathematics, science, technology, and engineering concepts while engaging in the development of solutions to problems through hands-on, collaborative, project-based learning utilizing the Engineering Design and Design Thinking Processes.

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**New Jersey Student Learning Standards**
*The New Jersey Student Learning Standards (NJSLS) can be located at [www.nj.gov/education/cccs/2020/](http://www.nj.gov/education/cccs/2020/).*

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Engineering Design
8.2.5.ED.1: Explain the functions of a system and its subsystems.
8.2.5.ED.2: Collaborate with peers to collect information, brainstorm to solve a problem, and evaluate all possible solutions to provide the best results with supporting sketches or models.
8.2.5.ED.3: Follow step by step directions to assemble a product or solve a problem, using appropriate tools to accomplish the task.
8.2.5.ED.4: Explain factors that influence the development and function of products and systems (e.g., resources, criteria, desired features, constraints).
8.2.5.ED.6: Evaluate and test alternative solutions to a problem using the constraints and trade-offs identified in the design process.

Interaction of Technology & Humans
8.2.5.ITH.1: Explain how societal needs and wants influence the development and function of a product and a system.
8.2.5.ITH.2: Evaluate how well a new tool has met its intended purpose and identify any shortcomings it might have.
8.2.5.ITH.3: Analyze the effectiveness of a new product or system and identify the positive and/or negative consequences resulting from its use.

Effects of Technology on the Natural World
8.2.5.ETW.1: Describe how resources such as material, energy, information, time, tools, people, and capital are used in products or systems.

**Technology Standards**
9.4.5.TL.3: Format a document using a word processing application to enhance text, change page formatting, and include appropriate images, graphics, or symbols.
9.4.5.TL.5: Collaborate digitally to produce an artifact.

9.4.5.IML.2: Create a visual representation to organize information about a problem or issue.
9.4.5.IML.3: Represent the same data in multiple visual formats in order to tell a story about the data.

**21st Century Integration | NJSLS 9**
Creativity & Innovation
9.4.5.CI.1: Use appropriate communication technologies to collaborate with individuals with diverse perspectives about a local and/or global climate change issue and deliberate about possible solutions.
9.4.5.CI.2: Investigate a persistent local or global issue, such as climate change, and collaborate with individuals with diverse perspectives to improve upon current actions designed to address the issue.
9.4.5.CI.3: Participate in a brainstorming session with individuals with diverse perspectives to expand one's thinking about a topic of curiosity.
9.4.5.CI.4: Research the development process of a product and identify the role of failure as a part of the creative process.

Critical Thinking & Problem-Solving
9.4.5.CT.1: Identify and gather relevant data that will aid in the problem-solving process.
9.4.5.CT.2: Identify a problem and list the types of individuals and resources that can aid in solving the problem (e.g., school, community agencies, governmental, online).
9.4.5.CT.3: Describe how digital tools and technology may be used to solve problems.
9.4.5.CT.4: Apply critical thinking and problem-solving strategies to different types of problems (e.g., personal, academic, community, global).

**Career Ready Practices**
CRP2. Apply appropriate academic and technical skills
CRP4. Communicate clearly and effectively and with reason
CRP5. Consider the environmental, social and economic impacts of decisions
CRP6. Demonstrate creativity and innovation.
CRP7. Employ valid and reliable research strategies
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them
CRP11. Use technology to enhance productivity
CRP12. Work productively in teams while using cultural global competence

**Interdisciplinary Connections**
Comprehensive Health & Physical Education
- 2.1.5.EH.1: Discuss the impact of one's feelings and thoughts that lead to healthy and unhealthy behaviors.
- 2.1.5.EH.2: Explain how to cope with difficult learning situations.
- 2.1.5.EH.3: Identify different feelings and emotions that people may experience and how they might express these emotions (e.g., anger, fear, happiness, sadness, hopelessness, anxiety).
- 2.1.5.EH.4: Identify behaviors that help to deal with difficult situations that can occur in school, and where to go for assistance.
- 2.1.5.SSH.3: Demonstrate ways to promote dignity and respect for all people.
- 2.1.5.CHSS.3: Describe strategies that are useful for individuals who are feeling sadness, anger, anxiety, or stress.
- 2.2.5.MSC.1: Demonstrate body management skills and control when moving in relation to others, objects, and boundaries in personal and general space.
- 2.2.5.MSC.6: Execute appropriate behaviors and etiquette while participating and viewing as an observer.
- 2.2.5.PF.2: Accept and respect others of all skill levels and abilities during participation.
- 2.3.5.PS.4: Develop strategies to safely communicate through digital media with respect.

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- 2.3.5.PS.5: Communicate personal boundaries and demonstrate ways to respect other people's personal boundaries.

Science
- 3-5-ETS1-1 - Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- 3-5-ETS1-2 - Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- 3-5-ETS1-3 - Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
- 2-PS1-2. - Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.
- 3-PS2-1 - Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.
- 3-PS2-2 - Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.
- 3-LS4-3 - Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.
- 3-LS4-4 - Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.
- 3-ESS3-1 - Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.

Social Studies
- 6.1.5.CivicsPI.1: Describe ways in which people benefit from and are challenged by working together.
- 6.1.5.CivicsPD.3: Explain how and why it is important that people from diverse cultures collaborate to find solutions to community, state, national, and global challenges.
- 6.1.5.CivicsPR.1: Compare procedures for making decisions in a classroom.
- 6.1.5.CivicsPR.3: Evaluate school and community rules, laws and/or policies and determine if they meet their intended purpose.
- 6.1.5.CivicsCM.3: Identify the types of behaviors that promote collaboration and problem solving with others who have different perspectives.
- 6.3.5.CivicsPD.3: Propose a solution to a local issue after considering evidence and the perspectives of different groups, including community members and local officials.

Visual and Performing Arts
- 2.2.5.CR2b: Models ideas, plans in an effective direction.
- 2.5.5.CR3b: Demonstrate craftsmanship through the safe and respectful use of materials, tools and equipment.

English Language Arts
- NJSLSA.R7. Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.
- NJSLSA.R8. Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence
- RI.3.4. Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 3 topic or subject area.
- RI.3.5. Use text features and search tools (e.g., key words, sidebars, hyperlinks) to locate information relevant to a given topic efficiently.

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- NJSLSA.W7. Conduct short as well as more sustained research projects, utilizing an inquiry-based research process, based on focused questions, demonstrating understanding of the subject under investigation.
- NJSLSA.W8. Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.
- NJSLSA.W9. Draw evidence from literary or informational texts to support analysis, reflection, and research.
- W.3.4. With guidance and support from adults, produce writing in which the development and organization are appropriate to task and purpose.
- W.3.6. With guidance and support from adults, use technology to produce and publish writing as well as to interact and collaborate with others
- NJSLSA.SL1. Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
- NJSLSA.SL2. Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.
- NJSLSA.SL5. Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations.

Mathematics
- 3.MD A. Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects.
- 3.MD B. Represent and interpret data.
- 3.G A. Reason with shapes and their attributes.

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**Units of Study**

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Unit 1: Parachute Design & Peer Feedback *(~10 days)*
- How does application of the engineering design process help me to develop the best solution to a given problem?
- How can I learn from receiving and providing effective feedback to and from peers?
- How can I create a parachute that maximizes air resistance?
- How can I safely and effectively communicate with peers through an online chat?

Unit 2: Safety Helmet Design *(~15 days)*
- How does application of the engineering design process help me to develop the best solution to a given problem?
- What is a concussion and why is it important for me to have knowledge on them and how to prevent them?
- How can I create a helmet that protects the brain from a concussion when playing a given sport?
- How can I learn from receiving and providing effective feedback to and from peers?
- How can I safely and effectively communicate with peers through an online chat?

Unit 3: Human Impact on the Environment *(~15 days)*
- What are the impacts that human actions have on the environment and what steps can I take to make a difference?
- How are plastic pollution, deforestation, and climate change related and why is it important to be knowledgeable in these topics?
- How can I use a variety of online resources to obtain information that fits into specific categories?

- How can I effectively and productively collaborate with peers while working simultaneously on a project?
- How can I create and format a Google document to best present information on a given topic?

| Learning Objectives/Discipline Standards of Practice |
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Learning Objectives:
- Students will be able to name and apply the steps of the engineering design process to solve a problem.
- Students will meet the given expectations at each step of the Engineering Design Process.
- Students will provide effective peer feedback during the "Imagine" step in order to help peers better meet the given specifications.
- Students will work collaboratively with a group to solve the problem.
- Students will build parachutes using the Engineering Design Process.
- Students will decide what materials could be used to successfully design a parachute.
- Students will reflect on the success of personal and peer parachutes and demonstrate this understanding through having an online chat using Padlet.
- Students will design and build helmets for a given sport using the Engineering Design Process.
- Students will conduct research on concussions in order to build a foundation of knowledge that will be used to guide decisions throughout the design challenge.
- Students will decide what materials could be used to successfully design a helmet.
- Students will interview classmates who play the sport that they will be designing a helmet for through an online chat using Padlet in order to better design a helmet for the "client."
- Students will be able to conduct research using online resources to find information that fits under a given category.
- Students will be able to use information learned from researching to create a project of choice.
- Students will be able to utilize a type of Google document (Google Docs, Google Slides, Google Drawings) to present learned information.
- Students will be able to type learned information.
- Students will be able to format text.
- Students will be able to insert pictures.
- Students will be able to insert animations and transitions, if applicable.

Discipline Standards of Practice:
- Computing Systems
  - People interact with a wide variety of computing devices that collect, store, analyze, and act upon information in ways that can affect human capabilities both positively and negatively. The physical components (hardware) and instructions (software) that make up a computing system communicate and process information in digital form.
- Networks and the Internet
  - Computing devices typically do not operate in isolation. Networks connect computing devices to share information and resources and are an increasingly integral part of computing. Networks and communication systems provide greater connectivity in the computing world.
- Impacts of Computing
  - Computing affects many aspects of the world in both positive and negative ways at local, national, and global levels. Individuals and communities influence computing through their behaviors and cultural and social interactions, and, in turn, computing influences new cultural practices.

- Data & Analysis
  - Computing systems exist to process data. The amount of digital data generated in the world is rapidly expanding, so the need to process data effectively is increasingly important. Data is collected and stored so that it can be analyzed to better understand the world and make more accurate predictions.
- Algorithms & Programming
  - An algorithm is a sequence of steps designed to accomplish a specific task. Algorithms are translated into programs, or code, to provide instructions for computing devices. Algorithms and programming control all computing systems, empowering people to communicate with the world in new ways and solve compelling problems.
- Engineering Design
  - People design for enjoyment and to solve problems, extend human capabilities, satisfy needs and wants, and improve the human condition. Engineering Design, a systematic approach to creating solutions to technological problems and finding ways to meet people's needs and desires, allows for the effective and efficient development of products and systems.
- Interaction of Technology and Humans
  - Societies influence technological development. Societies are characterized by common elements such as shared values, differentiated roles, and cultural norms, as well as by entities such as community institutions, organizations, and businesses. Interaction of Technology and Humans concerns the ways society drives the improvement and creation of new technologies, and how technologies both serve and change society.
- Nature of Technology
  - Human population, patterns and movement focus on the size, composition, distribution, and movement of human populations and how they are fundamental and active features on Earth's surface. This includes understanding that the expansion and redistribution of the human population affects patterns of settlement, environmental changes, and resource use. Patterns and movements of population also relate to physical phenomena including climate variability, landforms, and locations of various natural hazards and their effects on population size, composition, and distribution.
- Effects of Technology on the Natural World
  - Many of engineering and technology's impacts on society and the environment are widely regarded as desirable. However, other impacts are regarded as less desirable. Effects of Technology on the Natural World concerns the positive and negative ways that technologies affect the natural world.
- Ethics & Culture
  - Ethics and Culture concerns the profound effects that technologies have on people, how those effects can widen or narrow disparities, and the responsibility that people have for the societal consequences of their technological decisions.

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**Instructional Resources and Materials**
*Whole class resources have been identified with an asterisk.*

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**Resources**
- ITEEA's Engineering byDesign™ Program
- Engineering is Elementary (Museum of Science, Boston)
- Google Apps for Littles by Christine Pinto & Alice Keeler
- Headphones *
- STEM folders and notebooks *

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- Lesson Resources: *
  - Forces on a Falling Object (video)
  - "Ask" Worksheet
  - Safety Helmet Design Challenge Slideshow
  - Concussion Research Paper (video)
  - Model heads shaped as jumbo pasta shells (using air-dry clay)
  - Human Impact Images
  - Human Impact Graphic Organizer
  - Research Tips
  - Human Impact Research Website
  - Human Impact Project Templates
    - Brochure
    - Fiction Children's Book
    - Nonfiction Children's Book
    - Song
    - Poster
    - Slideshow
  - Human Impact Project Checklists

**Materials**
- Building/Modeling Materials: *
  - Cardboard
  - String
  - Masking Tape
  - Construction Paper
  - Plastic Bag
  - Cups
  - Aluminum Foil
  - Coffee Filters
  - Index Cards
  - Cotton Balls
  - Bubble Wrap
  - Pipe Cleaners
  - Popsicle Sticks
  - Rubber Bands
  - Paper Clips
  - Brass Fasteners
  - Plastic Spoons
  - Plastic Straws
  - Jumbo pasta shells
  - Potato-mix

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**Assessment Strategies**

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*Assessment is designed to measure a student's mastery of a course standard and learning objective. Assessment can be used for both instructional purposes (formative assessment) and for evaluative purposes (summative assessment).*

The following is a general list of the many forms assessment may take in learning.
- Projects
- Unit Assessments

Course Specific Assessments Include:
- Formative:
    - o Peer Feedback: TAG (Tell, Ask, Give) Sticky Notes
    - o Peer Feedback Form
    - o Self-Reflection: 2 Stars & 1 Wish
    - o Design Challenge Self-Assessment
    - o Critique Guide
    - o Reflective Exit Tickets/Slips
    - o EDP Self-Guided Checklists

- Summative Assessment:
    - o Gummy Bear Parachute Challenge: Students create a parachute that will keep the Gummy Bears safe when they land on the ground. Students test their design by dropping their design off the top of the school's play structure. If the Gummy Bears stay in the design and land "on their feet", then it is a successful model. Students will have an opportunity to go back and improve their design based on observations from the initial test.
    - o Safety Helmet Design Challenge: Students create a helmet that will protect a head from injury and damage. They test their design by putting a water balloon under their helmet and dropping 2 books on top of it. If the balloon is unbroken, then they have created a successful model. Students will have an opportunity to go back and improve their design based on observations from the initial test.
    - o Human Impacts Design Challenge: Students are challenged to develop a model for educating the Chatham community about human impacts on the environment. They present their findings to other classes in the school.