Innovative Computer Design II

9^{th} - 12^{th}

Prepared by:

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Superintendent of Schools:

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Approved by the Midland Park Board of Education on

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Revised NJSLS Date

Innovative Computer Design II

Course Description: This course introduces students to principles in STEM (Science Technology Engineering and Math) and Design. Students will learn how computer software and rapid prototyping processes, such as 3D printing, can be used to design and create products, ranging from car parts and smartphone cases to graphics, fashion accessories, and prosthetics. This is a project-based course where students will be immersed in the design process as it relates to identifying and solving real-world problems.

Course Sequence:

Unit 1: Engineering and SafetyUnit 2: DesignUnit 3: Renewable Energy and Sustainable DesignUnit 4: Design Challenge

Unit 1 - Overview

Content Area: Computer Science

Unit Title: Engineering and Safety

Grade Level: 9-12

Core Ideas: Students will be introduced to the engineering design process and the different areas of engineering. They will learn about the importance of outcomes of technological designs and the resources of technology. Students will learn how to properly and safely use technological tools and machinery (i.e. Exacto Knife, Drill Press, Sander, Laser Cutter, 3D Printer, Heat Press, Hot Glue Gun, etc.) as well as demonstrate an understanding of the OSHA Safety Regulations and proper clothing/personal protective equipment. Lastly, students will learn about different engineering designs and complete their own tasks.

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	NJSA 18A:35-4.43	Lawson, Ursula Burns, and Guion Bluford
	Holocaust Law	Explore Jewish engineers, including but not limited to Marjem Chatterton, Judith Love Cohen,
	NJSA 18A:35-28	

AAPI Law	Explore Asian-American/Pacific Islander	engineers, including but not limited to Ven te Chow,		
NJSA 18A:25-4.44	Rustum Roy, Fujio Matsuda, Thomas Lee and King-Sun Fu			
Interdisciplinary				
Math - MP1	Make sense of problems and persevere in solvi	ing them		
Math - MP5	Use appropriate tools strategically	blem by breaking it down into smaller, more manageable		
Science HS-ETS1-2	problems that can be solved through engineerin			
Science HS-ETS1-	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for			
3		eliability, and aesthetics as well as possible social, cultural, and		
History 6.1.12.SE.14.a	Explore the various ways women, racial and et disabilities have contributed to the American e	thnic minorities, the LGBTQ community, and individuals with economy, politics and society		
Companion Stand	lards			
NJSLSA.SL1	building on others' ideas and expressing their of			
NJSLSA.SL2	and orally.	n diverse media and formats, including visually, quantitatively,		
NJSLS 6.1.12.C.16.a	nations	npact of new and emerging technologies on individuals and		
NJSLSA.SL2	and orally	n diverse media and formats, including visually, quantitatively,		
Social and Emotion				
Self-Awareness	• Examining prejudices and biases			
	• Having a growth mindset			
Self-Management	 Exhibiting self-discipline and self-motivation Using planning and organizational skills 			
<u>a</u> : 1 4				
Social Awareness	 Taking others' perspectives Understanding the influences of organizations/systems on behavior 			
Relationship Skills	 Communicating effectively Practicing teamwork and collaborative pro Showing leadership in groups 	oblem-solving		
Responsible Decision-Making	 Demonstrating curiosity and open-minded Recognizing how critical thinking skills and 			
 How can we us What are the reference of the second sec	all the second s	 Unit Enduring Understandings: Understand the Engineering Design Process and apply it to projects Understand different careers in engineering Be better problem solvers when it comes to engineering Understand how to use the tools of the classroom safely and be able to demonstrate it. Create a safe working environment Understand parts of mechanical parts and how they can work together. 		
Formative Assess	Evidence of	Learning		
- Do Now	ments:			
- Do Now - Teacher obser	vations			
- I GAUNGE UDSEL	VALIOUS			

- Teacher observations

- Questioning
- Quizzes
- Practice Programs
- Entry tickets
- Exit tickets
- Online games
- Discussions
- Homework

Summative/Benchmark Assessment(s):

- Projects
- Tests
- Chapter Review / Quizzes
- Chapter Assignments
- Labs
- Final Project

Alternative Assessments:

- Portfolio
- Projects
- Online tests / assignments

Resources/Materials:	Key Vocabulary: constraint, engineering desing loop,
Paper, Rulers, Tape, Colored Markers, Wood	iterative, requirement, target population, code, ratent,
Machinery: Sander, Laser Cutter, 3D printer, Hot Glue	standard, brainstorming, computer-aided design, dynamic
Gun, Heat Press	analysis, engineering analysis, static analysis,
Design Technology: Adobe Photoshop, Adobe Illustrator, Onshape (or similar CAD program), Canva	manufacturing, model, rapid prototyping, engineering
https://www.teachengineering.org/k12engineering/designpr	drawing, machinist, goggles, safety measures, laser cutter,
OCESS	3d printer, heat press, hot glue gun, sander, lever, fulcrum,
https://sphero.com/pages/blueprint-content	effort force, resitance force, mechanical linkage, degrees of
	freedom, slider, link, node, pivot, fixed point, pantograph,
	complex machine, pulley, block and tackle, hook and
	trolley block, screw, lead screw, mechanical advantage,
	ideal mechanical advantage, actual mechanical advantage,
	gear, gear train, gear ratio, driven gear, driving gear, idler
	gear, rotational speed, torque, compound gear

	Suggested Pacing Guide					
Lesson Name/Topic	Student Learning Objective(s)	Suggested Tasks/Activities:	Day(s) to Complete			
Engineering Design Process	 Define and describe technology and its applications. Distinguish technology from science (natural world vs human- made world) Describe and understand the design process and how it can be used to solve problems 	 Review the engineering design process and discuss how it applies to solving problems. Complete a review game to check student understanding 	1-2 class periods			

Creative Engineering Design	 Identify the four outcomes of technological design: expected desired, unexpected undesired, unexpected desired, unexpected desired, unexpected desired, unexpected desired, unexpected undesired Describe the seven resources of technology: people, information, time, materials, energy, capital, tools & equipment Distinguish between needs and wants in the design process understand the processes of collaboration and communication and how they contribute to the design process. 	 Work through the steps of the Creative Engineering Design process in the context of a project Identify the need Research the problem Brainstorm possible solutions Select a promising solution using engineering analysis Create and test a prototype Improve and redesign/ manufacturer a product 	7-8 class periods
Safety	 Properly and safely use and maintain tools and machinery used in the project design Understand OSHA Safety regulations Demonstrate and understanding of clothing requirements and personal protective equipment Identify the location of items needed in case of emergency Identify the tools and where they are located in the classroom 	 Discussion on the importance of safety Demonstration of using machinery following safety rules Written test on Safety Explain orally how to use the equipment 	1 week
Simple Machines - Introduction to Engineering	 Identify and explain the function of each simple machine Build working models of each simple machine Calculate the ideal mechanical advantage (IMA) in their mechanical systems Combine multiple simple machines into a compound machine to complete a task 	 Complete the following lessons with hands-on activities Introducing the lever Introducing the common linkages Introducing the pulley Introducing the screw Introducing gears Pantograph art machines with levers and linkages Pulleys and construction cranes Mechanical advantage in a motorcycle lift Speed and Torgue with compound gears 	4 weeks

		0	Animal motion	
			profiles	
Teacher Note	s:			

Additional Resources:

	Differentiation/Modification Strategies						
Students with Disabilities	English Language Learners	Gifted and Talented Students	Students at Risk	504 Students			
 Allow errors Rephrase questions, directions, and explanations Allow extended time to answer questions and permit drawing as an explanation Accept participation on any level, even one word Consult with Case Managers and follow IEP accommodations/ modifications 	 Assign a buddy, same language or English speaking Allow errors in speaking Rephrase questions, directions, and explanations Allow extended time to answer questions Accept participation at any level, even one word 	 Provide extension activities Build on students' intrinsic motivation Consult with parents to accommodate students' interests in completing tasks at their level of engagement 	 Provide extended time to complete tasks Consult with Guidance Counselors and follow I&RS procedures/action plans Consult with other members of the 7th grade team for specific behavior interventions Provide rewards as necessary 	 Allow errors Rephrase questions, directions, and explanations Allow extended time to answer questions and permit drawing as an explanation Accept participation on any level, even one word Consult with Case Managers and follow IEP accommodations/ modifications Assign a buddy, same language or English speaking 			

Unit 2- Overview

Content Area: Computer Science

Unit Title: Design

Grade Level: 9-12

Core Ideas: Students will apply the design process to solve different design challenges while learning to design for the laser cutter, 3D printer, Cricut, and sublimation printer. Students will also focus on creating wearable technology and rapid prototyping. They will learn about criteria, constraints, ergonomics, sustainable design, and communication.

	Unit 2 - Standards
Standards (Conter	nt and Technology):
CPI#:	Statement:
	e and Design Thinking
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 modifications to increase
	optimization based on feedback
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
9.0.10 ED 5	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.ITH.1	Analyze a product to determine the impact that economic, political, social, and/or cultural factors have had on
0.2.12.111.1	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.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
Career Readiness	, Life Literacies, and Key Skills
9.1.12.CFR.3	Research companies with corporate governance policies supporting the common good and human rights.
9.2.12.CAP.2	Develop college and career readiness skills by participating in opportunities such as structured learning
	experiences, apprenticeships, and dual enrollment programs.
9.2.12.CAP.8	Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, and drug
	tests) used by employers in various industry sectors.
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
9.4.12.CI.3	Investigate new challenges and opportunities for personal growth, advancement, and transition
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.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
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.3	Analyze the effectiveness of the process and quality of collaborative environments.
9.4.12.TL.4	Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a
J.T.12.1L.T	resolution to a real-world problem (e.g., 7.1.AL.IPERS.6).
Intercultural Stat	ements (Amistad, Holocaust, LGBT, etc)
LGBTQ and	Explore engineers in the LGBTQ community, including but not limited to Allan Hellman, Sally Ride,
Disabilities	Alan Joyce, Peter Landin, and Christopher Strachey
NJSA 18A:35-4.35	
Amistad Law	Explore African-American engineers, including but not limited to Annie Easley, Elijah McCoy, Jerry
NJSA 18A:35-4.43	Lawson, Ursula Burns, and Guion Bluford
Holocaust Law	Explore Jewish engineers, including but not limited to Marjem Chatterton, Judith Love Cohen,
NJSA 18A:35-28	Umberto Colombo, Ralph Baer, Yossi Gross, and Walter Freud

AAPI Law NJSA 18A:25-4.44		er engineers, including but not limited to Ven te Chow,		
	Rustum Roy, Fujio Matsuda, Thomas L	ee and King-Sun Fu		
Interdisciplinary Math - MP1	Make sense of problems and persevere in so	lying them		
Math - MP5	Use appropriate tools strategically			
Science		roblem by breaking it down into smaller, more manageable		
HS-ETS1-2	problems that can be solved through engineering.			
Science HS-ETS1-		l problem based on prioritized criteria and trade-offs that account		
3	for a range of constraints, including cost, sa and environmental impacts.	fety, realiablity, and aesthetics, as well as possible social, cultural,		
History		l ethnic minorities, the LGBTQ community, and individuals with		
6.1.12.SE.14.a	disabilities have contributed to the America			
Companion Stand				
NJSLSA.SL1		ange of conversations and collaborations with diverse partners,		
	building on others' ideas and expressing the			
NJSLSA.SL2	Integrate and evaluate information presented and orally.	d in diverse media and formats, including visually, quantitatively,		
Social and Emotion				
Self-Awareness	Examining prejudices and biases			
	• Having a growth mindset			
Self-Management	Exhibiting self-discipline and self-moti	vation		
	• Using planning and organizational skill	s		
Social Awareness	Taking others' perspectives			
	Understanding the influences of organizations/systems on behavior			
Relationship Skills	Communicating effectively			
	• Practicing teamwork and collaborative	problem-solving		
	• Showing leadership in groups			
Responsible	• Demonstrating curiosity and open-mine	dedness		
Decision-Making	• Recognizing how critical thinking skill	s are useful both inside & outside of school		
Unit Essential Qu	estion(s):	Unit Enduring Understandings:		
• How can we ap	oply the design process to our designs?	• Understand how the design process can be used when		
	se design software to create designs for	we are designing		
	cutting and or 3d printing?	• Be able to create designs for the laser cutter, Cricut		
	se our gained technology knowledge to	and 3d printer		
create meaning	grul design?	• Be able to use the laser cutter, Cricut and 3d printer to print our designs		
		 Start creating designs that have meaning or purpose 		
	Fyidence	of Learning		
Formative Assess				
- Do Now				
- Teacher obser	vations			
- Questioning				
- Quizzes				
- Practice Progr	ams			
- Entry tickets				
- Exit tickets				
- Online games				
 Discussions 				
- Discussions				

- Homework

Summative/Benchmark Assessment(s):

- Projects
- Tests
- Chapter Review / Quizzes
- Chapter Assignments
- Labs
- Final Project

Alternative Assessments:

- Portfolio
- Projects
- Online tests / assignments

Resources/Materials:	Key Vocabulary: Vector drawings, Gemoetric shapes,
Resources/Materials: Paper, Rulers, Tape, Colored Markers, Wood Machinery: Sander, Laser Cutter, 3D printer, Hot Glue Gun, Heat Press Design Technology: Adobe Photoshop, Adobe Illustrator,	Outlines, SVG file type, Document, View Cube, Zoom, Pan, Rotate, Assembly, Mate, Plane, View Cube, Add, Extrude, Feature, Loft, Remove, Revolve, Revolve Mate,
Onshape (or similar CAD program), Canva https://tryengineering.org/teachers/lesson-plans/ https://www.onshape.com/en/	Sweep, Interference, Dimension, Sketch, Constrained, Diameter, Radius, Origin, Midpoint, Mirror, Offset, Construction. Metric units, Bearing, Design Intent

		Suggested	Pacing Guid	e	
Lesson Name/Topic	Student Learning Object	ctive(s)	Suggested 7	Tasks/Activities:	Day(s) to Complete
SVG Files	 using Adobe Illu Be able to use the SVG files Be able to use the with SVG files 	Be able to use the Cricut machine with SVG files Create designs from given		ate a logo that can be d for both machines. ate a "shipping" box that be cut on the laser cutter ate a custom shirt/and or on the Cricut	2 weeks
3D Printing	 Learn about the Genvironment that Be able to create printed Create rapid-prot given specification 	will be used designs to be 3d otypes from	 Welcome to Cad - Learning the environment Design your first 3d print Learn More Tools in Cad Design more complex 3d printable items 		3 weeks
Teacher Note	s: The 3d Printing curricul	um will depend on	what CAD er	vironment is being used.	
Additional Re		Differentiation/N	Iodification St	rategies	
Students v Disabilit	vith English Lang	uage Gifted a	ifted and Talented Students at Risk Students		504 Students
Allow errors	• Assign a budd same language o English speakin	or activities	• Provide extended time to complete tasks		• Allow errors

Rephrase questions,	• Allow errors in	• Build on students'	Consult with	Rephrase questions,
directions, and	speaking	intrinsic motivation	Guidance Counselors	directions, and
explanations	 Rephrase questions, 	• Consult with parents	and follow I&RS	explanations
 Allow extended 	directions, and	to accommodate	procedures/action	• Allow extended time
time to answer	explanations	students' interests in	plans	to answer questions
questions and permit	 Allow extended 	completing tasks at	 Consult with other 	and permit drawing as
drawing as an	time to answer	their level of	members of the 7th	an explanation
explanation	questions	engagement	grade team for	 Accept participation
 Accept participation 	 Accept participation 		specific behavior	on any level, even one
on any level, even one	at any level, even one		interventions	word
word	word		 Provide rewards as 	• Consult with Case
Consult with Case			necessary	Managers and follow
Managers and follow				IEP accommodations/
IEP accommodations/				modifications
modifications				• Assign a buddy,
				same language or
				English speaking

Unit 3 - Overview

Content Area: Computer Science

Unit Title: Renable Energy and Sustainable Design

Grade Level: 9-12

Core Ideas: Students will learn about renable energy and sustainable design. Inventions made from this unit are representations of energy collected from renewable resources through simulated reproduction while consuming responsibly. Throughout this unit students will learn about sustainable design and how technology can help the environment

Unit 3 - Standards Statement: Computer Science and Design Thinking 8.1.12.AP.6 Create artifacts by using procedures within a program, combinations of data a interrelated problems. 8.1.12.AP.9 Collaboratively document and present design decisions in the development of 8.2.12.ED.1 Use research to design and create a product or system and make modification on feedback Design a product system that addresses a global problem and document decis constraints, trade-offs, and aesthetic and ethical considerations and share this audience. 8.2.12.ETW.1 Evaluate ethical considerations regarding the sustainability of environmental design, creation, and maintenance of chosen product. 8.2.12.ETW.3 Identify a complex, global environmental or climate change issue, develop a propose an innovative sustainable solution. Carcer Readiness, Life Literacices, and Key Skills 9.12.CCAP.2 Develop college and career readiness skills by participating in opportunities a cxperiences, apprenticeships, and dual enrollment programs. 9.2.12.CAP.8 Determine job entrance criteria (e.g., education credentials, math/writing/reatesti, sued by employers in various industry sectors. 9.4.12.CL3 Identify career pathways that highlight personal talents, skills, and abilities (J.4.12.CCL) 9.4.12.CL4 Identify reare pathways that highlight personal talents, skills, and abilities (J.4.12.CL3)	
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9.4.12.IML.5Evaluate, synthesize, and apply information on climate change from various9.4.12.TL.1Assess digital tools based on features such as accessibility options, capacities specified task (e.g., W.11-12.6.).9.4.12.TL.3Analyze the effectiveness of the process and quality of collaborative environm 9.4.12.TL.49.4.12.TL.4Collaborate in online learning communities or social networks or virtual work resolution to a real-world problem (e.g., 7.1.AL.IPERS.6).Intercultural Statements (Amistad, Holocaust, LGBT, etc)LGBTQ and Disabilities NJSA 18A:35-4.35Explore engineers in the LGBTQ community, including but not limited Alan Joyce, Peter Landin, and Christopher StracheyNJSA 18A:35-4.43Explore African-American engineers, including but not limited to Ann Lawson, Ursula Burns, and Guion BlufordHolocaust Law NJSA 18A:35-28Explore Jewish engineers, including but not limited to Marjem Chatted Umberto Colombo, Ralph Baer, Yossi Gross, and Walter FreudNJSA 18A:25-4.44Rustum Roy, Fujio Matsuda, Thomas Lee and King-Sun Fu	
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AAPI LawExplore Asian-American/Pacific Islander engineers, including but notNJSA 18A:25-4.44Rustum Roy, Fujio Matsuda, Thomas Lee and King-Sun Fu	hatterton, Judith Love Cohen,
	it not limited to Ven te Chow,
Math - MP1 Make sense of problems and persevere in solving them	

Math - MP5	Use appropriate tools strategically				
Science	Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with				
HS-ETS1-4	numerous criteria and constraints on interactions within and between systems relevant to the problem.				
History	Explore the various ways women, racial and ethnic minorities, the LGBTQ community, and individuals with				
6.1.12.SE.14.a	disabilities have contributed to the American economy, politics and society				
Companion Stand NJSLSA.SL1					
NJSLSA.SLI	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.				
Social and Emotion					
Self-Awareness	• Examining prejudices and biases				
	Having a growth mindset				
Self-Management	Exhibiting self-discipline and self-motivation				
Sen-Management	 Using planning and organizational skills 				
	• Using plaining and organizational skins				
Social Awareness	Taking others' perspectives				
	Understanding the influences of organizations/systems on behavior				
Relationship Skills	Communicating effectively				
	Practicing teamwork and collaborative problem-solving				
	Showing leadership in groups				
Responsible	Demonstrating curiosity and open-mindedness				
Decision-Making	 Demonstrating currosity and open-initidedness Recognizing how critical thinking skills are useful both inside & outside of school 				
U					
• Why is sustain	 How technology can help with climate change? How technology can help with climate change Why sustainablity is important to the design process? ful problems need to be and can be solved 				
	Evidence of Learning				
Formative Assess	ments:				
- Do Now					
- Teacher obser	vations				
- Questioning					
- Quizzes					
- Practice Progr	rams				
- Entry tickets					
- Exit tickets					
- Online games					
- Discussions					
- Homework					
Summative/Renel	nmark Assessment(s):				
	11111 X 1 355-55111-111(5).				
- Protects					
- Projects - Tests					
 Projects Tests Chapter Revie 	ww / Ouizzes				

- Chapter Assignments
- Labs
- Final Project

Alternative Assessments:

- Portfolio
- Projects
- Online tests / assignments

Resources/Materials:	Key Vocabulary:
• Paper, Rulers, Tape, Colored Markers, Wood,	Sustainable design, Hydroelectricty Energy,
Strawbees, Microbits	Hydroelectricity, Kinetic Energy, Potential Energy,
• Machinery: Sander, Laser Cutter, 3D printer, Hot Glue	Renewable Energy, Reservoir, Persevere, Iteration, Crop
Gun, Heat Press Design Technology: Adobe Photoshop, Adobe	Rotation, Irrigation, Decompose, Spillway, Turbine,
Illustrator, Onshape (or similar CAD program), Canva	Laborious, Intake, Precipitation, Submerged, Indigenous
 https://tryengineering.org/teachers/lesson-plans/ 	Wind Engergy,, Air Masses, Beautiful Wind Scale, Gale,
• <u>https://www.onshape.com/en/</u>	Trade Winds, Westerlies, Latitude, Non-Renewable,
	Vertical, Horizontal, Solar Power, Solar Energy,
	Photovoltaic Effect, Solar Array, Nuclear Fusion,
	Photosphere, Photosynthesis, Fossil Fuels, Habitable,
	Passive, Concentrate

	Suggested Pacing Guide						
Lesson Name/Topic	Suggested Student Learning Objective(s)	Suggested Tasks/Activities:	Day(s) to Complete				
Renewable Energy - Hydroelectricy	 Explain the importance of inventions and inventing in human society. Explore old mechanical inventions using water power as a source of renewable energy for laborious tasks. Evaluate the advantages and disadvantages of hydroelectric power. Experiment with friction to create a spinning machine to move a structure to simulate a grindstone for grain. Invent a design to address the Sustainable Development Goals. 	 Create and research Hydropower Inventions Reflect upon your inventions using the engineering design process How does this help with sustainable design 	2 days				
Renewable Energy - Wind Energy	 Recognize that fossil fuels are derived from the earth and that their use affects the environment. Make an argument for wind energy as a sustainable alternative to fossil fuels. Explain the process of energy transfer from the wind to another object through the use 	 Create and research Wind Power Inventions Reflect upon your inventions using the engineering design process How does this help with sustainable design 	2 days				

 turbines. Articulate ways that p have utilized wind end throughout history. Compare and contrast wind zones on earth. Describe how wind end helps to address climatic change. Create wind turbine p that harness wind end Evaluate future uses a applications of wind end Differentiate between 	beople ergy t various nergy ate prototypes ergy. and energy.		
 Understand that light energy from place to p Investigate solar energy possible solution for f dependence. Explore the transform energy from one form another. Recognize that energi fuels come from natur sources and these affe environment. Compare types of energibility 	place. gy as a fossil fuel nation of n to ies and ral ect our brgy e how newable	ower Inventions eflect upon your inventions sing the engineering design rocess ow does this help with	2 days
			504 Stard and a
Learners	Students	Students at Kisk	504 Students
 Assign a buddy, same language or English speaking Allow errors in speaking Rephrase questions, directions, and explanations Allow extended 	 Provide extension activities Build on students' intrinsic motivation Consult with parents to accommodate students' interests in completing tasks at their level of 	Provide extended time to complete tasks Consult with Guidance Counselors and follow I&RS procedures/action plans Consult with other members of the 7th	 Allow errors Rephrase questions, directions, and explanations Allow extended time to answer questions and permit drawing as an explanation Accept participation
	 turbines. Articulate ways that p have utilized wind entitive wind entitive wind zones on earth. Describe how wind entitive helps to address climation change. Create wind turbine p that harness wind ene Evaluate future uses a applications of wind entities between in wind energy. Understand that light energy from place to p Investigate solar energipossible solution for f dependence. Explore the transform energy from one form another. Recognize that energifuels come from nature sources and these afferentiates and some are limited. Differentiates and some are limited. Assign a buddy, same language or English speaking Allow errors in speaking Rephrase questions, directions, and explanations 	 Articulate ways that people have utilized wind energy throughout history. Compare and contrast various wind zones on earth. Describe how wind energy helps to address climate change. Create wind turbine prototypes that harness wind energy. Evaluate future uses and applications of wind energy. Evaluate future uses and applications of wind energy. Differentiate between careers in wind energy. Understand that light transfers energy from place to place. Investigate solar energy as a possible solution for fossil fuel dependence. Explore the transformation of energy from one form to another. Recognize that energies and fuels come from natural sources and these affect our environment. Compare types of energy solutions and describe how some energies are renewable and some are limited. Differentiation/Modification Gifted and Talented Students' Allow errors in speaking Allow errors in explanations 	turbines. Articulate ways that people have utilized wind energy throughout history. Compare and contrast various wind zones on earth. Describe how wind energy helps to address climate change. Create wind turbine prototypes that harness wind energy. Evaluate future uses and applications of wind energy. Differentiate between careers in wind energy. Differentiate between careers in wind energy. Understand that light transfers energy from place to place. Power Inventions Investigate solar energy as a possible solution for fossil fuel dependence. Reflect upon your inventions Explore the transformation of energy from one form to another. Recognize that energies and fuels come from natural sources and these affect our environment. Compare types of energy solutions and describe how some energies are renewable and some are limited. Gifted and Talented Students Students at Risk • Assign a buddy, same language or English peaking • Provide extension activities • Provide extended time to complete tasks • Allow errors in speaking • Provide extended time to complete tasks • Consult with parents to accommodate students' interests in completing tasks at • Consult with other

word

• Consult with Case

Managers and follow

interventions

Consult with Case	 Accept participation 	 Provide rewards as 	IEP accommodations/
Managers and follow	at any level, even one	necessary	modifications
IEP accommodations/	word		 Assign a buddy,
modifications			same language or
			English speaking

Unit 4 - Overview **Content Area:** Computer Science Unit Title: Design Challenge Grade Level: 9-12 **Core Ideas:** Students will solve a meaningful problem by using the design process to meet the needs of a particular population/consumer. They will create prototypes and models to effectively communicate design ideas. Unit 4 - Standards **Standards** (Content and Technology): CPI#: **Statement: Computer Science and Design Thinking** 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 modifications to increase optimization based on feedback Design a product or system that addresses a global problem and document decisions made based on 8.2.12.ED.4 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.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. Redesign an existing product to improve form or function 8.2.12.NT.2 8.2.12.EC.3 Synthesize data, analyze trends and draw conclusions regarding the effect of technology on the individual, culture, society, and environment and share this information with the appropriate audience. **Career Readiness, Life Literacies, and Key Skills** 9.1.12.CFR.3 Research companies with corporate governance policies supporting the common good and human rights. 9.2.12.CAP.2 Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs. 9.2.12.CAP.8 Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, and drug tests) used by employers in various industry sectors. 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 Investigate new challeneges and opportunities for personal growth, advancement, and transition 9.4.12.CI.3 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.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) Assess and critique the appropriateness and impace of existing data visualizations for an intended audience 9.4.12.IML.4 9.4.12.IML.5 Evaluate, synthesize, and apply information on climate change from various sources appropriately 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.). Analyze the effectiveness of the process and quality of collaborative environments. 9.4.12.TL.3 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). Intercultural Statements (Amistad, Holocaust, LGBT, etc...) LGBTO and Explore engineers in the LGBTO community, including but not limited to Allan Hellman, Sally Disabilities Ride, Alan Joyce, Peter Landin, and Christopher Strachey NJSA 18A:35-4.35 Amistad Law Explore African-American engineers, including but not limited to Annie Easley, Elijah McCoy, NJSA 18A:35-4.43 Jerry Lawson, Ursula Burns, and Guion Bluford Holocaust Law Explore Jewish engineers, including but not limited to Marjem Chatterton, Judith Love Cohen, NJSA 18A:35-28 Umberto Colombo, Ralph Baer, Yossi Gross, and Walter Freud

AAPI Law	Explore Asian-American/Pacific Islan	der engineers, including but not limited to Ven te Chow,		
NJSA 18A:25-4.44	Rustum Roy, Fujio Matsuda, Thomas Lee and King-Sun Fu			
Interdisciplinary Co				
Math - MP1	Make sense of problems and persevere in solving them			
Math - MP5	Use appropriate tools strategically			
Science		mpact of proposed solutions to a complex real-world problem with		
HS-ETS1-4		actions within and between systems relevant to the problem.		
History 6.1.12.SE.14.a	Explore the various ways women, racial and disabilities have contributed to the Americ	nd ethnic minorities, the LGBTQ community, and individuals with		
Companion Standar		can economy, pointes and society		
NJSLSA.SL1		range of conversations and collaborations with diverse partners,		
	building on others' ideas and expressing th			
NJSLSA.SL2	Integrate and evaluate information present	ted in diverse media and formats, including visually,		
	quantitatively, and orally.			
Social and Emotiona				
Self-Awareness	• Examining prejudices and biases			
	• Having a growth mindset			
Salf Managamant	• Exhibiting solf disainling and solf ma	stituction		
Self-Management	 Exhibiting self-discipline and self-mo Using planning and organizational ski 			
	• Using planning and organizational ski	IIIS		
Social Awareness	Taking others' perspectives			
	 Understanding the influences of organizations/systems on behavior 			
Relationship Skills	Communicating effectively			
	Practicing teamwork and collaborative	e problem-solving		
	• Showing leadership in groups			
D 11 D 11				
Responsible Decision-	• Demonstrating curiosity and open-min			
Making	• Recognizing how critical thinking ski	ills are useful both inside & outside of school		
Unit Essential Quest	jon(s):	Unit Enduring Understandings:		
-	e a meaningful problem by using the	 Use the design process in creating a prototype that 		
	meet the needs of the	meets the needs of a meaningful problem.		
population/consu		nicets the needs of a mouningful problem.		
	hinking and how does it incorporate			
e				
empathy into the				
	adaptive and assistive technologies			
currently exist, an	d what improvements are being made?			
	Evidence of	fLearning		
Formative Assessme	nts:			
- Do Now				
	ions			
- Teacher observat				
Teacher observatQuestioning				
- Questioning	S			
 Questioning Quizzes	S			
QuestioningQuizzesPractice Program	S			
 Questioning Quizzes Practice Program Entry tickets Exit tickets 	IS			
 Questioning Quizzes Practice Program Entry tickets Exit tickets Online games 	IS			
 Questioning Quizzes Practice Program Entry tickets Exit tickets Online games Discussions 	IS			
 Questioning Quizzes Practice Program Entry tickets Exit tickets Online games 	IS			

 Projects Tests Chapter R Chapter A Labs Final Proj Alternative As Portfolio Projects Online tes 	eview / (ssignmen ect ssessmen ts / assig	nts .ts:				
 Strawbees, Machinery Gun, Heat Design Tea Illustrator, 	ers, Tape Microbi : Sander, Press chnology Onshape ngineerir	Laser Cutter, 3D printer Adobe Photoshop, Ado (or similar CAD program <u>ag.org/teachers/lesson-pla</u> <u>be.com/en/</u>	, Hot Glue be m), Canva ans/	Engineerin	e design, Prototype, Rapio g Design process	l prototype,
T	Gt 1			Pacing Guide		
Lesson Name/Topic	Studen	t Learning Objective(s)		Suggested '	Fasks/Activities:	Day(s) to Complete
Design Project Teacher Notes	 Project Integrate and apply knowledge of the design process to solve a problem Utilize rapid prototyping devices to support learning Create a design prototype or model Effectively and persuasively communicate design ideas 		 Research a population and design a device/game/puzzle that would benefit them (i.e. create an assistive techology for Parkinson's patiends; puzzle for preschool students, a device to help with climate change etc) Create a dynamic prototype of the device/game/puzzle using the design process Create a graphic and oral presentation of the design 			
Additional Re		options should be avalla		CIIIS		
	• 41			odification St		
Students v Disabiliti		English Language Learners		d Talented dents	Students at Risk	504 Students
 Allow errors Rephrase que directions, and explanations Allow extend time to answer 	 Allow errors Rephrase questions, directions, and explanations Allow extended time to answer questions and permit Allow errors in speaking Allow errors in speaking Consult w to accomm students' in stud		extension students' notivation with parents nodate	 Provide extended time to complete tasks Consult with Guidance Counselors and follow I&RS procedures/action plans 	 Allow errors Rephrase questions, directions, and explanations Allow extended time to answer questions and permit drawing as an explanation 	

drawing as an	Allow extended	their level of	• Consult with other	 Accept participation
explanation	time to answer	engagement	members of the 7th	on any level, even one
 Accept participation 	questions		grade team for	word
on any level, even one	 Accept participation 		specific behavior	 Consult with Case
word	at any level, even one		interventions	Managers and follow
Consult with Case	word		 Provide rewards as 	IEP accommodations/
Managers and follow			necessary	modifications
IEP accommodations/				 Assign a buddy,
modifications				same language or
				English speaking