PUBLIC SCHOOLS OF EDISON TOWNSHIP
DIVISION OF CURRICULUM AND INSTRUCTION

INTRODUCTION TO ENGINEERING

Length of Course:	Term
Elective/Required:	Required for S&E Academy Students
School:	Edison High School
Student Eligibility:	Grade 9
Credit Value:	5 Credits
Date Approved:	September 30, 2013

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STATEMENT OF PURPOSE

The Introduction to Engineering course in the Science and Engineering Academy is designed to create a broad-based foundation for students who desire a career pathway in the field of Engineering. Core concepts and principles of Engineering Design combined with unique laboratory settings will be the key elements of this course.

Stakeholders will use engineering driven designs in conjunction with Computer aided Machining (CAM) and 3-dimensional prototyping. Additional content areas will include web-based portfolios and exposure to a paperless classroom model with an aim at improving student technological literacy. The content and methods of this course will provide a foundation for future engineering pathways and prerequisites for additional Science and Engineering Academy courses.

The Introduction to Engineering Course aligns with NJ Core Content Standards 8.1 and 8.2

Software

- Parametric Technology Corporation; PTC –CREO/ Pro-Engineer (student site license included)

Text: Engineering Design. Karsnitz, Obrien, Hutchinson, 2013.

Career Pathways

- Exposure to a multitude of current and emerging engineering fields, including but not limited to; civil, mechanical, green, nuclear, bio, electrical, computer, bio-medical and aerospace engineering.

Prototyping

- Makerbot, Replicator 2.0

The curriculum guide was created by: Kevin Kerins - Edison High School

Curriculum Scope and Sequence Chart

Curriculum Scope and Sequence		
Content Area: Science & Engineering Academy	Name of Course: Introduction to Engineering	Grade Level(s): Grade 9
General Overview and Pacing		
	Topic/Unit Name	Suggested Pacing (Days/Weeks)
Unit 1/ Chapter 1	What is Engineering	7-8 Days
Unit 2/Chapter2	What is Engineering Design	7-14 Days
Unit 3/Chapter 16	Engineering as a Profession	7-14 Days
Unit 4/Chapter 5	Engineering Communication	4-6 Days
Unit 5/Chapter 6	Engineering Modeling, Prototyping and Testing	4-10 Days
Unit 6/Chapter 7	Materials and Processing in Engineering	4-10 Days
Unit 7/Chapter 14	Engineering Production Systems	5-9 Days
Unit 8/Chapter 8	Electrical Engineering	7-10 Days
Unit 9	Green Engineering	5-7 Days
Unit 10 /Chapter 9	Civil Engineering	5-7 Days
Unit 11/Chapter 13	Aerospace Engineering	7-10 Days
Unit 12/Chapter 12	Computer Engineering	4-6 Days

Curriculum Scope and Sequence Chart (cont.)

Curriculum Scope and Sequence		
Content Area: Science & Engineering Academy	Name of Course: Introduction to Engineering	Grade Level(s): Grade 9
General Overview and Pacing		
	Topic/Unit Name	Suggested Pacing (Days/Weeks)
Unit 13/Chapter 15	Chemical Engineering	3-5 days
Unit 14 / Chapter 10	Mechanical Engineering	4-7 days
Unit 15	Engineering Graphics	12- 17 Weeks

UNIT 1: WHAT IS ENGINEERING

Month	Essential/ Supporting Questions	Content	Skills/Concepts	Assessment	Standards
MP1	What is Engineering? Is Engineering Right For me? What are the various types of engineering career fields What types of knowledge and areas of focus do Engineers Explore? What types of Technical knowledge do Engineers Explore? What are desirable Skills and Traits of Engineers? How do Engineers use CAD/CAM? What is the future of Engineering?	**Instructional Strategies:** -Paperless class format -PowerPoint -Video- -Chapter 1 of Text -Laboratory safety Laboratory learning experiences -Web Portfolio -Blog Postings -Student reflections -Class discussions	Define Engineering. Individually reflect if Engineering is Appropriate field. Identify the Scope of Engineering. Identify the various types of Engineers. Identify the scope of essential understandings required to become an engineer Identify desirable traits of Engineers Individually Provide a perspective on the future of Engineering. Describe the scope of CAD/CAM in Engineering.	**Summative Assessment:** -Web Portfolio - Unit Project- Web Portfolio -Unit Reflection via Blog **Formative Assessment:** - Lab Safety Observations -Class discussions - Web Site Discussion Boards -Instructor Question and Answer Session - Laboratory Session Participation	NJ CCS 8.1 NJ CCS 8.2 8.1.2.A.2 8.1.2.A.3 8.1.2.A.4 8.4.8.C.1 8.1.8.D.1 8.1.8.D.2 8.1.8.D.3 8.1.12.A.1 8.1.12.A.2 8.1.12.A.3 8.1.12.A.4 8.2.12.A.1 8.2.12.B.1 8.2.12.B.2 8.2.12.B.3 8.2.12.C.1 8.2.12.C.2 8.2.12.C.3 8.2.12.D.1 8.2.12.E.1 8.2.12.E.2

UNIT 2: ENGINEERING DESIGN

Month	Essential/ Supporting Questions	Content	Skills/Concepts	Assessment	Standards
MP1	What is Engineering Design? What is Investigation and Research? What role do parameters play in Design? What are Common Engineering Design Mistakes? What are the stages of the Engineering Design Loop? What is a target population? What are Ergonomics? What role Do Ergonomics play in Design?	**Instructional Strategies:** -Paperless class format -PowerPoint -Video- -Chapter 2 of Text -Laboratory safety Laboratory learning experiences -Web Portfolio -Blog Postings -Student reflections -Class discussions -Measure of Man Hand out	Describe the importance of Investigation and Research. Describe the scope of the Engineering Design Loop. Identify common pitfalls in Engineering Design. Translate the Measure of Man handout into target populations for design. Ergonomically design a mouse for an identified target population. Present rationale for design to peers. Describe role parameters play in Engineering Design.	**Summative Assessment:** -Web Portfolio - Unit Project- Ergonomic Mouse Design -Unit Reflection via Blog **Formative Assessment:** -Unit Quiz - Lab Safety Observations -Class discussions - Web Site Discussion Boards -Instructor Question and Answer Session - Laboratory Session Participation	NJ CCS 8.1 NJ CCS 8.2 8.1.2.A.2 8.1.2.A.3 8.4.8.C.1 8.1.8.D.1 8.1.8.D.2 8.1.8.D.3 8.1.12.A.1 8.1.12.A.2 8.1.12.A.3 8.1.12.A.4 8.2.12.A.1 8.2.12.B.1 8.2.12.B.2 8.2.12.B.3 8.2.12.C.1 8.2.12.C.2 8.2.12.C.3 8.2.12.D.1 8.2.12.E.1 8.2.12.F.1 8.2.12.F.2 8.2.12.F.3

UNIT 3: ENGINEERING AS A PROFESSION

Month	Essential/ Supporting Questions	Content	Skills/Concepts	Assessment	Standards
MP1	What are the various functions of Engineers? What is the professional Aspect of Engineering? What is the purpose of Code of Ethics? What are examples of Types of impacts in Engineering? What is the Future of Engineering? What is the Role of ABET? What economic, societal and environmental impacts of Engineering?	**Instructional Strategies:** -Paperless class format -PowerPoint -Video- -Chapter 16 of Text -Laboratory safety Laboratory learning experiences -Web Portfolio -Blog Postings -Student reflections -Class discussions	Describe the role and scope of the Accreditation Board for Engineering and Technology (ABET). Describe the role of the code of ethics in Engineering. Identify and rationalize the impacts engineering can have environmentally, socially, and economically. Explore and explain a selected negative impact of Society, Ethics and Technology. Describe the various functions performed by professional Engineers	**Summative Assessment:** -Web Portfolio - Unit Project- Presentation on a SET- Society Ethics and Technology. -Unit Reflection via Blog **Formative Assessment:** - Lab Safety Observations -Class discussions - Web Site Discussion Boards -Instructor Question and Answer Session - Laboratory Session Participation - Worksheet Completion	NJ CCS 8.1 NJ CCS 8.2 8.1.2.A.2 8.1.2.A.3 8.1.2.A.4 8.4.8.C.1 8.1.8.D.3 8.1.12.A.1 8.1.12.A.3 8.1.12.A.4 8.2.12.A.1 8.2.12.B.1 8.2.12.B.2 8.2.12.B.3 8.2.12.C.1 8.2.12.C.2 8.2.12.C.3 8.2.12.E.1 8.2.12.F.1 8.2.12.F.2 8.2.12.F.3 8.2.12.G.1

UNIT 4: ENGINGEERING COMMUNICATION

Month	Essential/ Supporting Questions	Content	Skills/Concepts	Assessment	Standards
MP1	What is the importance of Engineering Communications? What role do drawings play in Engineering Communication? What are the various types of Engineering renderings? What is the role of CAD in Engineering Communication? What is the role of CAM in Engineering Communication? How has CAM changed Communications?	**Instructional Strategies:** -Paperless class format -PowerPoint -Video- -Chapter 5 of Text -Laboratory safety Laboratory learning experiences -Web Portfolio -Blog Postings -Student reflections -Class discussions	Demonstrate the ability to provide clear directions to the reverse Engineering of the Tower of Hanoi. Demonstrate ability to communicate ideas through sketch renderings. Describe the scope and types of Engineering drawings . Describe the scope and importance of Engineering Communication Skills. Describe the role of CAD in modern day Engineering. Provide a perspective on PTC/CREO Describe the CAM has changed Engineering and Engineering Communication. Describe Makerbot CAM Systems.	**Summative Assessment:** -Web Portfolio - Unit Project- Reverse Engineer the Tower of Hanoi -Unit Reflection via Blog **Formative Assessment:** -Unit Quiz - Lab Safety Observations -Class discussions - Web Site Discussion Boards -Instructor Question and Answer Session - Laboratory Session Participation	NJ CCS 8.1 NJ CCS 8.2 8.1.2.A.2 8.1.2.A.3 8.1.2.A.4 8.1.8.D.1 8.1.8.D.2 8.1.8.D.3 8.1.12.A.1 8.1.12.A.2 8.1.12.A.3 8.2.12.A.1 8.2.12.B.1 8.2.12.B.2 8.2.12.B.3 8.2.12.C.1 8.2.12.C.2 8.2.12.C.3 8.2.12.D.1 8.2.12.F.1 8.2.12.F.2 8.2.12.F.3 8.2.12.G.1

UNIT 5: MODELING, TESTING, PROTOTYPING

Month	Essential/ Supporting Questions	Content	Skills/Concepts	Assessment	Standards
MP1	What is the role of Predictive analysis to the Engineering Design process? Describe the principles used in mathematical Modeling? What are the various types of Physical modeling? How is computer modeling used in different Engineering fields? What is the process of testing? What are the various types of final outputs? Explain Aesthetics Vs. Functionality?	**Instructional Strategies**: -Paperless class format -PowerPoint -Video- -Chapter 6 of Text -Laboratory safety Laboratory learning experiences -Web Portfolio -Blog Postings -Student reflections -Class discussions	Identify common mathematical formulas used in Engineering. Describe the various types of testing including, stress, thermal, compression, tensile, flammability and elasticity. Describe how the Makebot Replicator 2.0 produces prototypes and models. Define Aesthetics and functionality and their balance. Participate in Laboratory Tensile Strength Experiment. Produce a predictive analysis based upon Testing.	**Summative Assessment:** -Web Portfolio - Unit Project- Makerbot Replicator 2.0 Unit Project- Tensile Strength Testing -Unit Reflection via Blog **Formative Assessment:** -Unit Quiz - Lab Safety Observations -Class discussions - Web Site Discussion Boards -Instructor Question and Answer Session - Laboratory Session Participation	NJ CCS 8.1 NJ CCS 8.2 8.1.2.A.3 8.1.2.A.4 8.1.8.D.1 8.1.8.D.2 8.1.8.D.3 8.1.12.A.1 8.1.12.A.2 8.1.12.A.3 8.1.12.A.4 8.2.12.A.1 8.2.12.B.2 8.2.12.B.3 8.2.12.C.1 8.2.12.C.2 8.2.12.C.3 8.2.12.D.1 8.2.12.E.1 8.2.12.F.1 8.2.12.F.2 8.2.12.F.3 8.2.12.G.1

UNIT 6: MATERIALS AND PROCESSING IN ENGINEERING

Month	Essential/ Supporting Questions	Content	Skills/Concepts	Assessment	Standards
MP1	What is Materials Engineering? What are the various types of materials Engineers use? What are some examples of Material Tests. What is Nanotechnology? What are emerging materials in the field of engineering? What methods are appropriate for processing materials? What safety features are involved in processing Materials? Describe range of Material properties?	**Instructional Strategies:** -Paperless class format -PowerPoint -Video- Reading Ruler -Vidoe- Lab Safety -Chapter 7 of Text -Laboratory safety Laboratory learning experiences -Web Portfolio -Blog Postings -Student reflections -Class discussions	Research and investigate a selected material – present findings Identify the Variety of Materials used including polymers, composites, biomaterials, alloys and Nano particles. Participate in the processing of materials, including Pilot holes, countersinks, ripping, and vacuum forming. Identify the various ways a material can be tested. Identify new and emerging processing techniques for materials. Define Materials Engineering.	**Summative Assessment:** -Web Portfolio - Unit Project- Power point presentation of selected material. -Unit Project- Process selected Material- Design Challenge **Formative Assessment:** -Unit Quiz - Lab Safety Observations -Class discussions - Web Site Discussion Boards -Instructor Question and Answer Session - Laboratory Session Participation	NJ CCS 8.1 NJ CCS 8.2 8.1.2.A.2 8.1.2.A.3 8.1.2.A.4 8.4.8.C.1 8.1.8.D.2 8.1.8.D.3 8.1.12.A.1 8.1.12.A.2 8.1.12.A.3 8.1.12.A.4 8.2.12.A.1 8.2.12.B.1 8.2.12.B.2 8.2.12.B.3 8.2.12.C.1 8.2.12.C.2 8.2.12.C.3 8.2.12.D.1 8.2.12.E.1 8.2.12.F.2 8.2.12.F.3 8.2.12.G.1

UNIT 7: ENGINEERING PRODUCTION SYSTEMS

Month	Essential/ Supporting Questions	Content	Skills/Concepts	Assessment	Standards
MP2	What are characteristics of Mass Production? What are the characteristics of Lean Production? What aspects of Lean production are more efficient than Mass production? What cultural aspects influence lean and mass production strategies? How has the Japanese Lean Production Techniques influenced global production?	**Instructional Strategies:** -Paperless class format -PowerPoint -Video- -Chapter 14 of Text -Laboratory safety Laboratory learning experiences -Web Portfolio -Blog Postings -Student reflections -Class discussions	- Describe the scope of Lean production. - Describe the scope of Mass production. - - Identify common characteristics of Lean Production. - Describe common characteristics of Mass Production - - Examine and describe which production system model is more efficient. -Demonstrate through experience how jigs and fixtures play a role in production. -Describe safety protocols in production systems. - Describe Cultural influences and how they have effected global production systems	**Summative Assessment:** -Web Portfolio - Unit Project- Lean Vs. Mass Production Assembly Line -Unit Reflection via Blog - Unit Test **Formative Assessment:** -Unit Quiz - Lab Safety Observations -Class discussions - Web Site Discussion Boards -Instructor Question and Answer Session - Laboratory Session Participation - Worksheet Completion	NJ CCS 8.1 NJ CCS 8.2 8.1.2.A.2 8.1.2.A.3 8.1.2.A.4 8.4.8.C.1 8.1.8.D.1 8.1.8.D.2 8.1.12.A.1 8.1.12.A.2 8.1.12.A.3 8.1.12.A.4 8.2.12.A.1 8.2.12.B.1 8.2.12.B.2 8.2.12.B.3 8.2.12.C.2 8.2.12.D.1 8.2.12.E.1 8.2.12.F.1 8.2.12.F.2 8.2.12.G.1

UNIT 8: ELECTRICAL ENGINEERING

Month	Essential/ Supporting Questions	Content	Skills/Concepts	Assessment	Standards
MP2	What is Electrical Engineering? Explain the secondary and college level education requirements for employment in the Electrical Engineering profession? How do electrons move on an atomic level? What are the characteristics of voltage, power, current and resistance? What is Soldering? What is the role Schematics play in electrical engineering design? What is the role of IEEE? What is OHMS Law? What are series, parallel and series in parallel circuits?	**Instructional Strategies:** -Paperless class format -PowerPoint -Video- Electrical Safety -Chapter 8 of Text -Laboratory safety Laboratory learning experiences -Web Portfolio -Blog Postings -Student reflections -Class discussions	Demonstrate ability to communicate electrical circuits. Demonstrate ability to create appropriate electrical circuits Demonstrate Ability to Solder Describe the role and scope of the Institute of Electrical and electronic Engineers. Calculate Ohms Law. Identify and describe the education requirements for Electrical Engineering profession. Identify various electrical components and their use, including; resistors, LEDS, Capacitors, motors, switches, potentiometers and breadboards. Clearly identify and practice electrical safety rules	**Summative Assessment:** -Web Portfolio - Unit Project – Circuitry Design Challenge -Unit Reflection via Blog - Unit Test **Formative Assessment:** -Unit Quiz - Lab Safety Observations -Class discussions - Web Site Discussion Boards -Instructor Question and Answer Session - Laboratory Session Participation	NJ CCS 8.1 NJ CCS 8.2 8.1.2.A.2 8.1.2.A.3 8.1.2.A.4 8.4.8.C.1 8.1.8.D.1 8.1.8.D.2 8.1.8.D.3 8.1.12.A.1 8.1.12.A.2 8.1.12.A.3 8.1.12.A.4 8.2.12.A.1 8.2.12.B.1 8.2.12.B.2 8.2.12.B.3 8.2.12.C.1 8.2.12.C.2 8.2.12.C.3 8.2.12.D.1 8.2.12.E.1 8.2.12.F.1 8.2.12.F.2 8.2.12.F.3 8.2.12.G.1

UNIT 9: GREEN ENGINEERING

Month	Essential/ Supporting Questions	Content	Skills/Concepts	Assessment	Standards
MP2	What is Green Engineering? What Green Engineering careers are available? What are renewable and non-renewable resources? What are Floating cities? What are the Ethical issues of Green Engineering? Why had society become Environmentally Conscience? How? What is OPEC? What is Homasoate? What Resource and Recovery Design models	**Instructional Strategies:** -Paperless class format -PowerPoint -Laboratory safety Laboratory learning experiences -Web Portfolio -Blog Postings -Student reflections -Class discussions - Field Trips- Resource and Recovery Homasoate Plant, West Trenton, NJ	Participate in the Resource and Recovery Field Trip. Participate in the Homasoate Field Trip. Describe the growing scope of Green Engineering. Describe the role OPEC plays in the economy and Green Engineering. Provide perspective on why society has become environmentally conscious. Describe the Resource and Recover Design Model. Describe the process and scope Homasoate creation. Identify various and emerging Green Engineering Fields.	**Summative Assessment:** -Web Portfolio - Unit Project- Homasoate Design Challenge Unit Project- Resource and Recovery -Unit Reflection via Blog Field Trip Reflection **Formative Assessment:** -Unit Quiz - Lab Safety Observations -Class discussions - Web Site Discussion Boards -Instructor Question and Answer Session - Laboratory Session Participation	NJ CCS 8.1 NJ CCS 8.2 8.1.2.A.2 8.4.8.C.1 8.1.8.D.1 8.1.8.D.2 8.1.8.D.3 8.1.12.A.1 8.1.12.A.2 8.1.12.A.3 8.1.12.A.4 8.2.12.A.1 8.2.12.B.1 8.2.12.B.2 8.2.12.B.3 8.2.12.C.2 8.2.12.C.3 8.2.12.D.1 8.2.12.E.1 8.2.12.F.1 8.2.12.F.2 8.2.12.F.3 8.2.12.G.1

UNIT 10: CIVIL ENGINEERING

Month	Essential/ Supporting Questions	Content	Skills/Concepts	Assessment	Standards
MP2	What is the scope of a Civil Engineers work? What Structural Forces, loads and components are key understandings of Civil engineering? What are the various types of Bridges? What are the key understandings in the structure of a skyscraper? What is the purpose of land surveying	**Instructional Strategies:** -Paperless class format -PowerPoint -Chapter 9 of Text -Laboratory safety Laboratory learning experiences -Web Portfolio -Blog Postings -Student reflections -Class discussions	Participate in structural force Design and testing. Describe in detail the scope of Civil Engineering work. Describe the various structural loads and forces essential to Civil engineering. Describe a variety of bridge designs and structural members of bridges. Describe various safety tests performed on existing bridges. Describe the role land surveyors play in Civil Engineering. Describe and Identify the key traits and understandings of Civil Engineering Careers. Identify the 100-point scale used to test bridges.	**Summative Assessment:** -Web Portfolio - Unit Project- Structural force testing Bridge Design and Testing Project -Unit Reflection via Blog - Unit Test **Formative Assessment:** -Unit Quiz - Lab Safety Observations -Class discussions - Web Site Discussion Boards -Instructor Question and Answer Session - Laboratory Session Participation	NJ CCS 8.1 NJ CCS 8.2 8.1.2.A.2 8.1.2.A.3 8.1.2.A.4 8.4.8.C.1 8.1.8.D.2 8.1.8.D.3 8.1.12.A.1 8.1.12.A.2 8.1.12.A.3 8.1.12.A.4 8.2.12.A.1 8.2.12.B.1 8.2.12.B.3 8.2.12.C.1 8.2.12.C.2 8.2.12.C.3 8.2.12.D.1 8.2.12.E.1 8.2.12.F.1 8.2.12.F.2 8.2.12.G.1

UNIT 11: AEROSPACE ENGINEERING

Month	Essential/ Supporting Questions	Content	Skills/Concepts	Assessment	Standards
MP2	What is Aerospace Engineering? What are Newton's laws of Motion? What is the role of fluid mechanics and aerodynamics in Aerospace Engineering? What are the forces acting on an airplane in flight? What are Aerospace Engineering Examples?	**Instructional Strategies:** -Paperless class format -PowerPoint -Video- Apollo 13 -Chapter 13 of Text -Laboratory safety Laboratory learning experiences -Web Portfolio -Blog Postings -Student reflections -Class discussions	Identify the role and scope of American Institute of Aeronautics and Astronautics. (AIAA) Newtown's three laws of motion and their impact on aerospace engineering. Fluid mechanics divided into roles- fluid dynamics and fluid statistics. Four forces acting on fixed wing aircraft; lift, thrust, drag, gravity. Divisions of Aircraft Design; aerodynamics, propulsion, stability and control and materials and structures. Demonstrate ability to design aircraft for maximum flight distance or height.	**Summative Assessment:** -Web Portfolio - Unit Project- Aviation Design Challenge Rocketry -Unit Reflection via Blog **Formative Assessment:** -Unit Quiz - Lab Safety Observations -Class discussions - Web Site Discussion Boards -Instructor Question and Answer Session - Laboratory Session Participation - Worksheet Completion	NJ CCS 8.1 NJ CCS 8.2 8.1.2.A.2 8.1.2.A.3 8.1.2.A.4 8.1.8.D.1 8.1.8.D.2 8.1.8.D.3 8.1.12.A.2 8.1.12.A.3 8.1.12.A.4 8.2.12.A.1 8.2.12.B.1 8.2.12.B.2 8.2.12.B.3 8.2.12.C.1 8.2.12.C.2 8.2.12.C.3 8.2.12.D.1 8.2.12.E.1 8.2.12.F.1 8.2.12.F.2 8.2.12.F.3 8.2.12.G.1

UNIT 12: COMPUTER ENGINEERING

Month	Essential/ Supporting Questions	Content	Skills/Concepts	Assessment	Standards
MP2	What is Computer Engineering? What is the operation of Logic Gates? What is the purpose of Databases? How are Algorithms used? What are the Basic parts of computer? What is Binary Code? What are examples of Computer Engineering Applications?	**Instructional Strategies:** -Paperless class format -PowerPoint -Chapter 12 of Text -Laboratory safety Laboratory learning experiences -Web Portfolio -Blog Postings -Student reflections -Class discussions	Identify the courses that are required to achieve degree in Computer Engineering. Describe the process of binary code in digital and electronic devices. Describe how algorithms are used to design computer programs in addition to completing other tasks. Effectively communicate information using binary code. Demonstrate knowledge digital electronic decision making via logic gates. Demonstrate computer architecture focusing on physical and software design with cost parameters.	**Summative Assessment:** -Web Portfolio - Unit Project- Test on Binary code and Algorithms Design Personal computer with Cost Parameters -Unit Reflection via Blog **Formative Assessment:** - Lab Safety Observations -Class discussions - Web Site Discussion Boards -Instructor Question and Answer Session - Laboratory Session Participation	NJ CCS 8.1 NJ CCS 8.2 8.1.2.A.2 8.1.2.A.3 8.1.2.A.4 8.4.8.C.1 8.1.8.D.2 8.1.8.D.3 8.1.12.A.1 8.1.12.A.2 8.1.12.A.3 8.1.12.A.4 8.2.12.A.1 8.2.12.B.1 8.2.12.B.2 8.2.12.B.3 8.2.12.C.1 8.2.12.C.2 8.2.12.C.3 8.2.12.D.1 8.2.12.E.1 8.2.12.F.1 8.2.12.F.2 8.2.12.G.1

UNIT 13: CHEMICAL ENGINEERING

Month	Essential/ Supporting Questions	Content	Skills/Concepts	Assessment	Standards
MP2	What is Chemical Engineering? What is difference between chemical engineering and chemistry? What are the Laws of thermodynamics and how are they used in chemical engineering ? What are the various types of measurements used in Chemical Engineering? What is OSHA? What is OSHA role? How is Mass balance used to analyze chemical processes?	**Instructional Strategies:** -Paperless class format -PowerPoint -Guest Speaker -Chapter 15 of Text -Laboratory safety Laboratory learning experiences -Web Portfolio -Blog Postings -Student reflections -Class discussions	Identify and explain the role of the Occupational Safety and Health Administration. (OSHA) Explain how thermodynamics explore the change of energy into work and heat. Describe how mass balance is used to ensure the same amount of materials in equal the same of amount of materials out. Identify and describe the measurements in chemical engineering. Identify and explain the role of American Institute of Chemical Engineers. (AIChE) Explain the understanding of gas and liquid motion, knows as fluid dynamics.	**Assessment:** -Web Portfolio -Unit Reflection via Blog - Unit Test **Formative Assessment:** -Unit Quiz - Lab Safety Observations -Class discussions - Web Site Discussion Boards -Instructor Question and Answer Session - Laboratory Session Participation	NJ CCS 8.1 NJ CCS 8.2 8.1.2.A.2 8.1.2.A.4 8.4.8.C.1 8.1.8.D.1 8.1.8.D.2 8.1.8.D.3 8.1.12.A.1 8.1.12.A.2 8.1.12.A.3 8.1.12.A.4 8.2.12.B.1 8.2.12.B.2 8.2.12.B.3 8.2.12.C.1 8.2.12.C.2 8.2.12.C.3 8.2.12.D.1 8.2.12.E.1 8.2.12.F.1 8.2.12.F.3 8.2.12.G.1

UNIT 14: MECHANICAL ENGINEERING

Month	Essential/ Supporting Questions	Content	Skills/Concepts	Assessment	Standards
MP3	What is Mechanical Engineering? What is the concept of energy, motion and simple machines? What are the components of Mechanical and Fluid power systems? What are Mechanical power and mechanical advantage? What are examples of Mechanical Engineering applications? What are classes of Levers? What are Mechanical Engineering Careers?	**Instructional Strategies:** -Paperless class format -PowerPoint -Video-Simple Machines -Guest Speaker -Chapter 10 of Text -Laboratory safety -Laboratory learning experience -Web Portfolio -Blog Postings -Student reflections -Class discussions	Describe the scope of fluid mechanics and mechanical advantage. Identify classes of levers and their common uses. Identify common and Emerging Mechanical engineering fields. Describe the application of fluid mechanics including hydraulics and pneumatics. Describe the application of Pascal's law applies to Mechanical Engineering. Explore gear and pulley reduction and advantages. Describe and define torque, hydraulic systems, rotary motion, actuators and energy.	**Summative Assessment:** -Web Portfolio -Unit Reflection via Blog -Unit Test **Formative Assessment:** -Lab Safety Observations -Class discussions -Web Site -Discussion Boards -Instructor Question and Answer Session -Laboratory Session Participation -Worksheet Completion	NJ CCS 8.1 NJ CCS 8.2 8.1.2.A.2 8.1.2.A.3 8.1.2.A.4 8.4.8.C.1 8.1.8.D.3 8.1.12.A.1 8.1.12.A.2 8.1.12.A.3 8.1.12.A.4 8.2.12.A.1 8.2.12.B.1 8.2.12.B.3 8.2.12.C.1 8.2.12.C.2 8.2.12.C.3 8.2.12.D.1 8.2.12.E.1 8.2.12.F.1 8.2.12.F.2 8.2.12.F.3 8.2.12.G.1

UNIT 15: ENGINEERING GRAPHICS – PTC/CREO

Month	Essential/ Supporting Questions	Content	Skills/Concepts	Assessment	Standards
MP 3-4	What is CAD? What is CAM? What is PTC? What is PTC/CREO? How are geometric features and models edited and created? What is the function of each PTC/CREO tool? What is the PTC/CREO Basic modeling Process? What are the PTC/CREO parametric concepts? How is PTC/Creo Parametric Interfaced? How is Sketcher Geometry created? How are Datum Features Created? How are Extrudes Created?	**Instructional Strategies:** -Paperless class format -PowerPoint -Laboratory safety Laboratory learning experiences -Web Portfolio -Blog Postings -Student reflections -Class discussions	**PTC/CREO Basic parametric Process:** Understanding solid modeling concepts Understanding Feature-based Concepts Understanding parametric Concepts. Understanding Associative Concepts Understanding Model – Centric –Concepts. Identifying appropriate file extensions **Using Creo Parametric interface** Understanding Main interface with folder browser. Understanding Ribbon Interface with customization. Understanding Datum Display options. Understanding 3-D orientations.	**Assessment:** -Web Portfolio - Unit Projects- • Air Circulator • Piston Assembly Components -Unit Reflection via Blog Unit tests **Formative Assessment:** -Projects: • Crankshaft. • Engine block • Soccer stadium • Impeller • Impeller housing • Chess Piece • Tower of Hanoi Modeling	NJ CCS 8.1 NJ CCS 8.2 8.1.2.A.2 8.1.2.A.3 8.1.2.A.4 8.4.8.C.1 8.1.8.D.1 8.1.8.D.2 8.1.8.D.3 8.1.12.A.1 8.1.12.A.2 8.1.12.A.3 8.1.12.A.4 8.2.12.A.1 8.2.12.B.1 8.2.12.B.2 8.2.12.B.3 8.2.12.C.1 8.2.12.C.2 8.2.12.C.3 8.2.12.D.1 8.2.12.E.1 8.2.12.F.1 8.2.12.F.2 8.2.12.F.3 8.2.12.G.1

UNIT 15: ENGINEERING GRAPHICS – PTC/CREO (CONT.)

Month	Essential/ Supporting Questions	Content	Skills/Concepts	Assessment	Standards
	What is the Process to create Revolves? How are internal sketches and embedded Datums used? What is process for creating sweeps and blends? How are holes, shells and drafts created? What are rounds and chamfers and how are they created? How are mirror and group copy tools utilized? How are measuring and Inspecting Models used? What is the process of creating patterns? How is assembly with constraints accomplished?		Creating styles, states using view manager. Managing and editing Appearances. Setting up new Part Models. **Selecting Geometry, Features and Models.** Understanding Creo Parametric Controls. Using Drag handles and dimension draggers. Using Shortcuts on keyboard. Using Model tree and Model Tree Filters. Understanding Model Tree Columns Using Search Filter and renaming objects.	• Mouse Modeling • Chemical Engineering pipeline • Cell phone Design • Toothbrush Design - Lab Safety Observations -Class discussions - Web Site Discussion Boards -Instructor Question and Answer Session - Laboratory Session Participation - Worksheet Completion	

UNIT 15: ENGINEERING GRAPHICS – PTC/CREO (CONT.)

Month	Essential/ Supporting Questions	Content	Skills/Concepts	Assessment	Standards
	What is the process of assembling with connections? How are exploding assemblies created? How are drawing layouts and views with annotations utilized? How is managing design intent utilized? What outputs are possible via Creo? What is Makerbot? What is Replicator 2.0. What is prototyping? How is Prototyping utilized in Engineering Design?		**Editing Geometry, Features and Models** Understanding Regeneration vs. Auto Generation Understanding Feature and Component Visibility. **Creating Sketcher Geometry.** Understanding Sketcher Theory. Understanding Design Intent. Utilization of constraints. Understanding Sketcher on-the-fly constraints. Understanding sketcher; lines, centerlines, rectangles, parallelograms, circles, arcs, circular fillets, chamfers. **Using sketcher Tools.** Understanding Constructive Geometry Theory. Manipulating sketches and		

UNIT 15: ENGINEERING GRAPHICS – PTC/CREO (CONT.)

Month	Essential/ Supporting Questions	Content	Skills/Concepts	Assessment	Standards
			dimensioning entities. Sketcher conflicts with sketcher sectioning. **<u>Creating Sketches for Features.</u>** Understanding and manipulating Sketch makeup/setup. Utilizing sketch references. Using Entity from edges within sketcher. Understanding thinking edges **<u>Creating Extrudes, Revolves and Ribs.</u>** Creating Solid Extrude Features. Adding Taper to Extrudes. Understanding Dashboard options; extrude depth, feature direction, thicken sketch. Understanding rib features. Understanding revolve and		

UNIT 15: ENGINEERING GRAPHICS – PTC/CREO (CONT.)

Month	Essential/ Supporting Questions	Content	Skills/Concepts	Assessment	Standards
			revolve angles. **<u>Utilizing internal Sketches and Embedded Datums.</u>** Creating internal Sketches Creating Embedded Datum Sketches. **<u>Creating Sweeps and blends.</u>** Creating sweeps with open and closed trajectories. Analyzing sweep feature attributes. Creating blends by selecting sketches or parallel sections. Analyzing Blend Options. **<u>Creating Holes, Shells and Drafts.</u>** Common Dashboard options; hole depth, coaxial holes, linear holes, radial and diameter holes. Exploring hole profile options.		

UNIT 15: ENGINEERING GRAPHICS – PTC/CREO (CONT.)

Month	Essential/ Supporting Questions	Content	Skills/Concepts	Assessment	Standards
			Creating Shell features. Creating draft split and hinge features. **Creating Rounds and Chamfers.** Theory of Rounds. Creating Rounds, surface, surface and edge, full rounds, sets. Creating Chamfers, by selecting edges. Chamfer dimensioning schemes. **Group Copy and Mirror Tools.** Creating local groups. Rotating copied features/ Moving rotated copied features. Mirroring selected features and parts.		

UNIT 15: ENGINEERING GRAPHICS – PTC/CREO (CONT.)

Month	Essential/ Supporting Questions	Content	Skills/Concepts	Assessment	Standards
			Creating Patterns. Understanding Directional Patterning. Understanding Axis Patterning. Creating reference patterns and components. **Measurement and Inspection Tools.** Understanding and investigating; model properties, mass properties, measure tools, model units and planar part cross sections. Measuring global interface. **Assembling with Constraints and Connections.** Understanding Assembly and connection theory. Understanding Creating, assembly models, components using slider connection, pin connection, datum features, angle constraints. Analyzing collision direction settings.		

UNIT 15: ENGINEERING GRAPHICS – PTC/CREO (CONT.)

Month	Essential/ Supporting Questions	Content	Skills/Concepts	Assessment	Standards
			Exploding Assemblies. Creating and managing explode states Creating explode lines Animating explode states. **Drawing layout and views.** Analyzing drawing concepts and theory. Applying formats Understanding creating; orientation views, general views, projection views, cross section views, detailed views, auxiliary views, assembly and exploded views. Utilization of drawing tree and templates. **Creating Drawing annotations**. Creating and inserting; notes, dimensions, cleanups, publishing. **Using Layers.** Understanding layer theory. Creating and managing layers. Utilization of layering assembly models.		

UNIT 15: ENGINEERING GRAPHICS – MAKERBOT REPLICATOR 2.0 – PROTOTYPING WITH PTC/CREO

Month	Essential/ Supporting Questions	Content	Skills/Concepts	Assessment	Standards
MP 3-4	What is CAM? What is Makerbot Replicator 2.0? How do Engineers Utilize 3D prototyping? What is an STL file? What is milling? What Is Micron Layer Resolution? What is filament? What are the professional engineering benefits of 3D modeling and prototyping? How will PTC/CREO configure with Makerbot?	**Instructional Strategies:** -Paperless class format -PowerPoint -Video-Safety -Chapter 14 of Text -Laboratory safety Laboratory learning experiences -Web Portfolio -Blog Postings -Student reflections -Class discussions	Define Prototyping. Define and demonstrate ability to safely setup and utilize Makerbot 2.0. Define STL files. Describe and observe milling and rasterizing. Describe the scope of 3D prototyping in the field of Engineering. Define filament and how utilized in Makerbot prototyping. Describe the scope of configuring Makerbot with PTC/Creo. Demonstrable ability to produce unique design and 3Dimenstional Prototype	**Summative Assessment:** -Web Portfolio -Unit Project-Design Challenges -Unit Reflection via Blog -Unit test **Formative Assessment:** -Unit Quiz -Lab Safety Observations -Class discussions -Web Site Discussion Boards -Instructor Question and Answer Session -Laboratory Session Participation	NJ CCS 8.1 NJ CCS 8.2 8.1.2.A.2 8.1.2.A.3 8.1.2.A.4 8.4.8.C.1 8.1.8.D.3 8.1.12.A.1 8.1.12.A.2 8.1.12.A.3 8.1.12.A.4 8.2.12.A.1 8.2.12.B.1 8.2.12.B.3 8.2.12.C.1 8.2.12.C.2 8.2.12.C.3 8.2.12.D.1 8.2.12.E.1 8.2.12.F.1 8.2.12.F.2 8.2.12.F.3 8.2.12.G.1

2009 New Jersey Core Curriculum Content Standards - Technology

Content Area	**Technology**		
Standard	**8.1 Educational Technology:** All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaboratively and to create and communicate knowledge.		
Strand	**A. Technology Operations and Concepts**		
By the end of grade	**Content Statement**	**CPI#**	**Cumulative Progress Indicator (CPI)**
P	The use of technology and digital tools requires knowledge and appropriate use of operations and related applications.	8.1.P.A.1	Use the mouse to negotiate a simple menu on the screen (e.g., to print a picture).
		8.1.P.A.2	Use electronic devices (e.g., computer) to type name and to create stories with pictures and letters/words.
		8.1.P.A.3	Identify the "power keys" (e.g., ENTER, spacebar) on a keyboard.
		8.1.P.A.4	Recognize that the number keys are in a row on the top of the keyboard.
		8.1.P.A.5	Use basic technology terms in conversations (e.g., digital camera, battery, screen, computer, Internet, mouse, keyboards, and printer).
		8.1.P.A.6	Turn smart toys on and off.
2	The use of technology and digital tools requires knowledge and appropriate use of operations and related applications.	8.1.2.A.1	Identify the basic features of a computer and explain how to use them effectively.
		8.1.2.A.2	Use technology terms in daily practice.
		8.1.2.A.3	Discuss the common uses of computer applications and hardware and identify their advantages and

			disadvantages.
		8.1.2.A.4	Create a document with text using a word processing program.
		8.1.2.A.5	Demonstrate the ability to navigate in virtual environments that are developmentally appropriate.
4	The use of technology and digital tools requires knowledge and appropriate use of operations and related applications.	8.1.4.A.1	Demonstrate effective input of text and data using an input device.
		8.1.4.A.2	Create a document with text formatting and graphics using a word processing program.
		8.1.4.A.3	Create and present a multimedia presentation that includes graphics.
		8.1.4.A.4	Create a simple spreadsheet, enter data, and interpret the information.
		8.1.4.A.5	Determine the benefits of a wide range of digital tools by using them to solve problems.
8	The use of technology and digital tools requires knowledge and appropriate use of operations and related applications.	8.1.8.A.1	Create professional documents (e.g., newsletter, personalized learning plan, business letter or flyer) using advanced features of a word processing program.
		8.1.8.A.2	Plan and create a simple database, define fields, input data, and produce a report using sort and query.
		8.1.8.A.3	Create a multimedia presentation including sound and images.
		8.1.8.A.4	Generate a spreadsheet to calculate, graph, and present information.
		8.1.8.A.5	Select and use appropriate tools and digital resources to accomplish a variety of tasks and to

			solve problems.
12	The use of technology and digital tools requires knowledge and appropriate use of operations and related applications.	8.1.12.A.1	Construct a spreadsheet, enter data, and use mathematical or logical functions to manipulate data, generate charts and graphs, and interpret the results.
		8.1.12.A.2	Produce and edit a multi-page document for a commercial or professional audience using desktop publishing and/or graphics software.
		8.1.12.A.3	Participate in online courses, learning communities, social networks, or virtual worlds and recognize them as resources for lifelong learning.
		8.1.12.A.4	Create a personalized digital portfolio that contains a résumé, exemplary projects, and activities, which together reflect personal and academic interests, achievements, and career aspirations.

Content Area	**Technology**		
Standard	**8.1 Educational Technology:** All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaboratively and to create and communicate knowledge.		
Strand	**B. Creativity and Innovation**		
By the end of grade	**Content Statement**	**CPI#**	**Cumulative Progress Indicator (CPI)**
P	The use of digital tools and media-rich resources enhances creativity and the construction of knowledge.	8.1.P.B.1	Use a digital camera to take a picture.
2	The use of digital tools and	8.1.2.B.1	Illustrate and communicate original ideas and

	media-rich resources enhances creativity and the construction of knowledge.		stories using digital tools and media-rich resources.
4	The use of digital tools and media-rich resources enhances creativity and the construction of knowledge.	8.1.4.B.1	Produce a media-rich digital story about a significant local event or issue based on first-person interviews.
8	The use of digital tools and media-rich resources enhances creativity and the construction of knowledge.	8.1.8.B.1	Synthesize and publish information about a local or global issue or event on a collaborative, web-based service (also known as a shared hosted service).
12	The use of digital tools and media-rich resources enhances creativity and the construction of knowledge.	8.1.12.B.1	Design and pilot a digital learning game to demonstrate knowledge and skills related to one or more content areas or a real world situation.

Content Area	**Technology**		
Standard	**8.1 Educational Technology:** All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaboratively and to create and communicate knowledge.		
Strand	**C. Communication and Collaboration**		
By the end of grade	**Content Statement**	**CPI#**	**Cumulative Progress Indicator (CPI)**
P	Digital tools and environments support the learning process and foster collaboration in solving local or global issues and	8.1.P.C.1	Operate frequently used, high-quality, interactive games or activities in either screen or toy-based formats.
		8.1.P.C.2	Access materials on a disk, cassette tape, or DVD. Insert a disk, cassette tape, CD-Rom, DVD, or

	problems.		other storage device and press "play" and "stop."
2	Digital tools and environments support the learning process and foster collaboration in solving local or global issues and problems.	8.1.2.C.1	Engage in a variety of developmentally appropriate learning activities with students in other classes, schools, or countries using electronic tools.
4	Digital tools and environments support the learning process and foster collaboration in solving local or global issues and problems.	8.1.4.C.1	Engage in online discussions with learners in the United States or from other countries to understand their perspectives on a global problem or issue.
8	Digital tools and environments support the learning process and foster collaboration in solving local or global issues and problems.	8.1.8.C.1	Participate in an online learning community with learners from other countries to understand their perspectives on a global problem or issue, and propose possible solutions.
12	Digital tools and environments support the learning process and foster collaboration in solving local or global issues and problems.	8.1.12.C.1	Develop an innovative solution to a complex, local or global problem or issue in collaboration with peers and experts, and present ideas for feedback in an online community.

Content Area	**Technology**
Standard	**8.1 Educational Technology:** All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and

	collaboratively and to create and communicate knowledge.		
Strand	**D. Digital Citizenship**		
By the end of grade	**Content Statement**	**CPI#**	**Cumulative Progress Indicator (CPI)**
2	Technological advancements create societal concerns regarding the practice of safe, legal, and ethical behaviors.	8.1.2.D.1	Model legal and ethical behaviors when using both print and non-print information by citing resources.
4	Technological advancements create societal concerns regarding the practice of safe, legal, and ethical behaviors.	8.1.4.D.1	Explain the need for each individual, as a member of the global community, to practice cyber safety, cyber security, and cyber ethics when using existing and emerging technologies.
		8.1.4.D.2	Analyze the need for and use of copyrights.
		8.1.4.D.3	Explain the purpose of an acceptable use policy and the consequences of inappropriate use of technology.
8	Technological advancements create societal concerns regarding the practice of safe, legal, and ethical behaviors.	8.1.8.D.1	Model appropriate online behaviors related to cyber safety, cyber bullying, cyber security, and cyber ethics.
		8.1.8.D.2	Summarize the application of fair use and Creative Commons guidelines.
		8.1.8.D.3	Demonstrate how information on a controversial issue may be biased.
12	Technological advancements create societal concerns regarding the practice of safe, legal, and ethical behaviors.	8.1.12.D.1	Evaluate policies on unauthorized electronic access (e.g., hacking) and disclosure and on dissemination of personal information.
		8.1.12.D.2	Demonstrate appropriate use of copyrights as well as fair use and Creative Commons guidelines.

		8.1.12.D.3	Compare and contrast international government policies on filters for censorship.
		8.1.12.D.4	Explain the impact of cyber crimes on society.

Content Area	**Technology**		
Standard	**8.1 Educational Technology:** All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaboratively and to create and communicate knowledge.		
Strand	**E. Research and Information Literacy**		
By the end of grade	**Content Statement**	**CPI#**	**Cumulative Progress Indicator (CPI)**
P	Effective use of digital tools assists in gathering and managing information.	8.1.P.E.1	Use the Internet to explore and investigate questions with a teacher's support.
2	Effective use of digital tools assists in gathering and managing information.	8.1.2.E.1	Use digital tools and online resources to explore a problem or issue affecting children, and discuss possible solutions.
4	Effective use of digital tools assists in gathering and managing information.	8.1.4.E.1	Investigate a problem or issue found in the United States and/or another country from multiple perspectives, evaluate findings, and present possible solutions, using digital tools and online resources for all steps.
		8.1.4.E.2	Evaluate the accuracy of, relevance to, and appropriateness of using print and non-print electronic information sources to complete a variety of tasks.
8	Effective use of digital tools assists in gathering and	8.1.8.E.1	Gather and analyze findings using data collection technology to produce a possible solution for a

	managing information.		content-related or real-world problem.
12	Effective use of digital tools assists in gathering and managing information.	8.1.12.E.1	Develop a systematic plan of investigation with peers and experts from other countries to produce an innovative solution to a state, national, or worldwide problem or issue.
		8.1.12.E.2	Predict the impact on society of unethical use of digital tools, based on research and working with peers and experts in the field.

Content Area	**Technology**		
Standard	**8.1 Educational Technology:** All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaboratively and to create and communicate knowledge.		
Strand	**F. Critical Thinking, Problem Solving, and Decision-Making**		
By the end of grade	**Content Statement**	**CPI#**	**Cumulative Progress Indicator (CPI)**
P	Information accessed through the use of digital tools assists in generating solutions and making decisions.	8.1.P.F.1	Navigate the basic functions of a browser, including how to open or close windows and use the "back" key.
2	Information accessed through the use of digital tools assists in generating solutions and making decisions.	8.1.2.F.1	Use mapping tools to plan and choose alternate routes to and from various locations.
4	Information accessed through the use of digital tools assists in generating solutions and making decisions.	8.1.4.F.1	Select and apply digital tools to collect, organize, and analyze data that support a scientific finding.

8	Information accessed through the use of digital tools assists in generating solutions and making decisions.	8.1.8.F.1	Use an electronic authoring tool in collaboration with learners from other countries to evaluate and summarize the perspectives of other cultures about a current event or contemporary figure.
12	Information accessed through the use of digital tools assists in generating solutions and making decisions.	8.1.12.F.1	Select and use specialized databases for advanced research to solve real-world problems.
		8.1.12.F.2	Analyze the capabilities and limitations of current and emerging technology resources and assess their potential to address educational, career, personal, and social needs.

Content Area	**Technology**		
Standard	**8.2 Technology Education, Engineering, and Design:** All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world, as they relate to the individual, global society, and the environment.		
Strand	**A. Nature of Technology: Creativity and Innovation**		
By the end of grade	**Content Statement**	**CPI#**	**Cumulative Progress Indicator (CPI)**
2	Technology products and systems impact every aspect of the world in which we live.	8.2.2.A.1	Describe how technology products, systems, and resources are useful at school, home, and work.
4	Technology products and systems impact every aspect of the world in which we live.	8.2.4.A.1	Investigate factors that influence the development and function of technology products and systems.
		8.2.4.A.2	Using a digital format, compare and contrast how a technology product has changed over time due to economic, political, and/or cultural influences.
8	Technology products and	8.2.8.A.1	Explain the impact of globalization on the

	systems impact every aspect of the world in which we live.		development of a technological system over time.
12	Technology products and systems impact every aspect of the world in which we live.	8.2.12.A.1	Design and create a technology product or system that improves the quality of life and identify trade-offs, risks, and benefits.

Content Area	**Technology**		
Standard	**8.2 Technology Education, Engineering, and Design:** All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world, as they relate to the individual, global society, and the environment.		
Strand	**B. Design: Critical Thinking, Problem Solving, and Decision-Making**		
By the end of grade	**Content Statement**	**CPI#**	**Cumulative Progress Indicator (CPI)**
2	The design process is a systematic approach to solving problems.	8.2.2.B.1	Brainstorm and devise a plan to repair a broken toy or tool using the design process.
		8.2.2.B.2	Investigate the influence of a specific technology on the individual, family, community, and environment.
4	The design process is a systematic approach to solving problems.	8.2.4.B.1	Develop a product using an online simulation that explores the design process.
		8.2.4.B.2	Design an alternative use for an existing product.
		8.2.4.B.3	Explain the positive and negative effect of products and systems on humans, other species, and the environment.
		8.2.4.B.4	Compare and contrast how technology transfer happens within a technology, among technologies,

			and among other fields of study.
8	The design process is a systematic approach to solving problems.	8.2.8.B.1	Design and create a product that addresses a real-world problem using the design process and working with specific criteria and constraints.
		8.2.8.B.2	Identify the design constraints and trade-offs involved in designing a prototype (e.g., how the prototype might fail and how it might be improved) by completing a design problem and reporting results in a multimedia presentation.
		8.2.8.B.3	Solve a science-based design challenge and build a prototype using science and math principles throughout the design process.
12	The design process is a systematic approach to solving problems.	8.2.12.B.1	Design and create a product that maximizes conservation and sustainability of a scarce resource, using the design process and entrepreneurial skills throughout the design process.
		8.2.12.B.2	Design and create a prototype for solving a global problem, documenting how the proposed design features affect the feasibility of the prototype through the use of engineering, drawing, and other technical methods of illustration.
		8.2.12.B.3	Analyze the full costs, benefits, trade-offs, and risks related to the use of technologies in a potential career path.

Content Area	**Technology**
Standard	**8.2 Technology Education, Engineering, and Design:** All students will develop an understanding of the nature and impact of technology, engineering, technological design,

	and the designed world, as they relate to the individual, global society, and the environment.		
Strand	**C. Technological Citizenship, Ethics, and Society**		
By the end of grade	**Content Statement**	**CPI#**	**Cumulative Progress Indicator (CPI)**
2	Knowledge and understanding of human, cultural, and societal values are fundamental when designing technology systems and products in the global society.	8.2.2.C.1	Demonstrate how reusing a product affects the local and global environment.
4	Knowledge and understanding of human, cultural, and societal values are fundamental when designing technology systems and products in the global society.	8.2.4.C.1	Explain the impact of disposing of materials in a responsible way.
		8.2.4.C.2	Explain the purpose of trademarks and the impact of trademark infringement on businesses.
		8.2.4.C.3	Examine ethical considerations in the development and production of a product from its inception through production, marketing, use, maintenance, and eventual disposal by consumers.
8	Knowledge and understanding of human, cultural, and societal values are fundamental when designing technology systems and products in the global society.	8.2.8.C.1	Explain the need for patents and the process of registering one.
		8.2.8.C.2	Compare and contrast current and past incidences of ethical and unethical use of labor in the United States or another country and present results in a media-rich presentation.
12	Knowledge and understanding of human, cultural, and societal values are fundamental when designing	8.2.12.C.1	Analyze the ethical impact of a product, system, or environment, worldwide, and report findings in a web-based publication that elicits further comment and analysis.

	technology systems and products in the global society.	8.2.12.C.2	Evaluate ethical considerations regarding the sustainability of resources that are used for the design, creation, and maintenance of a chosen product.
		8.2.12.C.3	Evaluate the positive and negative impacts in a design by providing a digital overview of a chosen product and suggest potential modifications to address the negative impacts.

Content Area	**Technology**		
Standard	**8.2 Technology Education, Engineering, and Design:** All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world, as they relate to the individual, global society, and the environment.		
Strand	**D. Research and Information Fluency**		
By the end of grade	**Content Statement**	**CPI#**	**Cumulative Progress Indicator (CPI)**
2	Information-literacy skills, research, data analysis, and prediction provide the basis for the effective design of technology systems.	8.2.2.D.1	Collect and post the results of a digital classroom survey about a problem or issue and use data to suggest solutions.
4	Information-literacy skills, research, data analysis, and prediction provide the basis for the effective design of technology systems.	8.2.4.D.1	Analyze responses collected from owners/users of a particular product and suggest modifications in the design of the product based on their responses.
8	Information-literacy skills,	8.2.8.D.1	Evaluate the role of ethics and bias on trend

	research, data analysis, and prediction provide the basis for the effective design of technology systems.		analysis and prediction in the development of a product that impacts communities in the United States and/or other countries.
12	Information-literacy skills, research, data analysis, and prediction provide the basis for the effective design of technology systems.	8.2.12.D.1	Reverse-engineer a product to assist in designing a more eco-friendly version, using an analysis of trends and data about renewable and sustainable materials to guide your work.

Content Area	**Technology**		
Standard	**8.2 Technology Education, Engineering, and Design:** All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world, as they relate to the individual, global society, and the environment.		
Strand	**E. Communication and Collaboration**		
By the end of grade	**Content Statement**	**CPI#**	**Cumulative Progress Indicator (CPI)**
2	Digital tools facilitate local and global communication and collaboration in designing products and systems.	8.2.2.E.1	Communicate with students in the United States or other countries using digital tools to gather information about a specific topic and share results.
4	Digital tools facilitate local and global communication and collaboration in designing products and systems.	8.2.4.E.1	Work in collaboration with peers to produce and publish a report that explains how technology is or was successfully or unsuccessfully used to address a local or global problem.
8	Digital tools facilitate local and global communication	8.2.8.E.1	Work in collaboration with peers and experts in the field to develop a product using the design process,

	and collaboration in designing products and systems.		data analysis, and trends, and maintain a digital log with annotated sketches to record the development cycle.
12	Digital tools facilitate local and global communication and collaboration in designing products and systems.	8.2.12.E.1	Use the design process to devise a technological product or system that addresses a global issue, and provide documentation through drawings, data, and materials, taking the relevant cultural perspectives into account throughout the design and development process.

Content Area	**Technology**		
Standard	**8.2 Technology Education, Engineering, and Design:** All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world, as they relate to the individual, global society, and the environment.		
Strand	**F. Resources for a Technological World**		
By the end of grade	**Content Statement**	**CPI#**	**Cumulative Progress Indicator (CPI)**
2	Technological products and systems are created through the application and appropriate use of technological resources.	8.2.2.F.1	Identify the resources needed to create technological products and systems.
4	Technological products and systems are created through the application and appropriate use of technological resources.	8.2.4.F.1	Describe how resources are used in a technological product or system.
		8.2.4.F.2	Explain how resources are processed in order to produce technological products and systems.

8	Technological products and systems are created through the application and appropriate use of technological resources.	8.2.8.F.1	Explain the impact of resource selection and processing in the development of a common technological product or system.
		8.2.8.F.2	Explain how the resources and processes used in the production of a current technological product can be modified to have a more positive impact on the environment (e.g., by using recycled metals, alternate energy sources) and the economy.
12	Technological products and systems are created through the application and appropriate use of technological resources.	8.2.12.F.1	Determine and use the appropriate application of resources in the design, development, and creation of a technological product or system.
		8.2.12.F.2	Explain how material science impacts the quality of products.
		8.2.12.F.3	Select and utilize resources that have been modified by digital tools (e.g., CNC equipment, CAD software) in the creation of a technological product or system.

Content Area	**Technology**		
Standard	**8.2 Technology Education, Engineering, and Design:** All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world, as they relate to the individual, global society, and the environment.		
Strand	**G. The Designed World**		
By the end of grade	**Content Statement**	**CPI#**	**Cumulative Progress Indicator (CPI)**
2	The designed world is the product of a design process	8.2.2.G.1	Describe how the parts of a common toy or tool interact and work as part of a system.

	that provides the means to convert resources into products and systems.	8.2.2.G.2	Explain the importance of safety in the use and selection of appropriate tools and resources for a specific purpose.
4	The designed world is the product of a design process that provides the means to convert resources into products and systems.	8.2.4.G.1	Examine a malfunctioning tool and use a step-by-step process to troubleshoot and present options to repair the product.
		8.2.4.G.2	Explain the functions of a system and subsystems.
		8.2.4.G.3	Evaluate the function, value, and aesthetics of a technological product, system, or environment from the perspective of the user and the producer.
8	The designed world is the product of a design process that provides the means to convert resources into products and systems.	8.2.8.G.1	Explain why human-designed systems, products, and environments need to be constantly monitored, maintained, and improved.
		8.2.8.G.2	Explain the interdependence of a subsystem that operates as part of a system.
12	The designed world is the product of a design process that provides the means to convert resources into products and systems.	8.2.12.G.1	Analyze the interactions among various technologies and collaborate to create a product or system demonstrating their interactivity.