Washington Township Public Schools
COURSE OF STUDY – CURRICULUM GUIDE

Course: *Principles of Engineering and Technological Design*

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Description: This course advances students' knowledge of engineering through a firm and in-depth exploration of multiple engineering fields. Some examples of past engineering projects have been bridge design, boat hull design and catapult design. Students make extensive use of 3D modeling software to generate solutions that are documented in portfolios for eventual classroom presentation.

Jack McGee: *Interim Assistant Superintendent for Curriculum & Instruction*
Gretchen Gerber: *Director of Elementary Education*
Cleve Bryan: *Interim Director of Secondary Education*

Written: August, 2015
Revised:
BOE Approval: September, 2015

DEMONSTRABLE PROFICIENCIES

COURSE TITLE: *Principles of Engineering and Technological Design (#931)*

I. CLASSWORK REQUIREMENTS

A. Students must be attentive and effectively following directions
B. Students must exhibit responsibility by bringing the necessary materials to class
C. Student resource materials should be legible, well organized, and attention to detail must be noted
D. Homework is a regular requirement
E. Short-term problem applications will be assigned when appropriate
F. A culminating long-term business simulation will be assigned during the last marking period and is a major part of the graded work for the course
G. Quizzes and tests are teacher prepared instruments and usually administered after each chapter introduction of a unit

II. ATTITUDE & BEHAVIOR

A. Behavior and class attendance must conform to Board of Education policy.
B. Students must display a readiness to work.
C. Students must actively participate in class through the maintenance of a notebook and teacher directed patterning activities of concepts.
D. Students must adhere to scheduled deadlines.
E. Students must follow oral and written directions accurately.
F. Tolerate routine work without displaying frustration.

III. COURSE OBJECTIVES/OVERVIEW

A. **COURSE CONTENT**: This course is a full year course for 10-12 grade students who wish to be exposed to engineering. The course covers the different resources of technology including materials, tools and machines, electrical engineering technologies, civil engineering technologies, mechanical engineering technologies, and applications of engineering technologies.

B. SKILLS

a. Organization and self-motivation is required for problem application work.

b. Ability to work individually or in groups to solve problems
c. Practical application of math, science, and communication skills
d. Development of documentation of the design process
e. Increased manipulative skills in the utilization of tools, machines, and equipment

C. APPRECIATION OF CONCEPTS

a. An appreciation for organization and orderliness of one's materials to enhance the expediency of performing a task.
b. An ability to analyze and reproduce select information.
c. The ability to adjust quickly to equipment, program, and procedure changes.
d. Appreciate how the initial calculation of inaccurate data affects several other areas of problem solving.

IV. ATTENDANCE

Attendance: Refer to Board of Education Policy

V. GRADING PROCEDURES

A. Assessments- 30%

B. Assignments (Classwork/projects/homework) 60%

C. Conduct (Participation/Preparation) 10%

Semester 1 Grade (S1) is calculated: (50% of Y1) MP1=20%, MP2= 20%, Mid-term(X1) exam= 10%

Semester 2 Grade (S2) is calculated: (50% of Y1) MP3= 20%, MP4= 20%, Final (X2) exam = 10%

Final Grade (Y1) is calculated: S1 + S2 = Y1

MAJOR UNITS OF STUDY

Course Title: *Principles of Engineering and Technological Design (#931)*

I. **Introduction to Engineering and Technological Design**
II. **The Resources of Technology and Safety**
III. **The Engineering Design Process**
IV. **Civil Engineering**
V. **Mechanical Engineering**
VI. **Electrical Engineering**
VII. **Applications of Engineering Systems**
VIII. **Careers in Design and Engineering Technologies**

UNIT OVERVIEW

Course Title: *Principles of Engineering and Technological Design (#931)*

Unit #: Unit 1 **Unit Title:** Introduction to Engineering and Technological Design

Unit Description and Objectives:
Students are asked "what is technological design?", and "what is engineering?" Students are introduced to the facilities, and the materials and resources that are available. Safety requirements are introduced, and course proficiency, methods of evaluation and the areas of study are reviewed. Students are also told what to do and where to go in the event of an emergency.

Essential Questions and Enduring Understandings:

Essential Questions:	**Enduring Understandings/Generalizations Students will understand that:**	**Guiding Questions**
1. What is engineering? 2. What is technological design?	1. Engineers solve problems. 2. Technological Design is the process and way that engineers solve problems and design technology.	1. What are the four branches of engineering? 2. What do engineers do? 3. How do engineers solve problems? 4. Why is technological design important to engineers?
1. What are the expectations for the Principles of Engineering and Technological Design course?	1. Students will understand the acceptable behavior for students while in the technology education laboratories. 2. The attendance policy for the high school is set out by the board of education. 3. Evaluation of the student will be based on assessments, assignments, and conduct.	1. What are the behavior expectations for this course? 2. What is the attendance policy for this building? 3. How will the instructor evaluate the student? 4. Why is safety important in the technology education class?
1. What do you do in case of an emergency?	1. There are different procedures for different emergency situations. 2. Around the room there is different equipment that can be used in case of emergency. 2. In the event of an emergency, students should following the appropriate protocol and remain calm.	1. Where do we go if there is a fire? 2. Where do we go if there is an active shooter? 3. What do we do if there are other school emergencies? 4. What should be done if an accident occurs?

CURRICULUM UNIT PLAN

Course Title/Grade: *Principles of Engineering and Technological Design (#931) 10-12*

Unit Number/Title: **Unit I- Introduction to Engineering and Technological Design**

Conceptual Lens:

Appropriate Time Allocation (# of Days)**:** 5

Primary Content Standards referenced With Cumulative Progress Indicators

8.1.12.A3,4	8.1.12.F.12	9.2.12.C.3,6	
8.1.12.D.5	9.1.12.A.3	9.3.12FN-ACT.1-4	
8.1.12.E.1	9.1.12.A.6		

Topics/Concepts (Incl. time / # days per topic)	**Critical Content (Students Will Know:)**	**Skill Objectives (Students Will Be Able To:)**	**Instructional/Learning Activities & Interdisciplinary Connections**	**Instructional Resources**	**Technology & 21st C Skills Integration (Specify)**	**NJSLS w/ CPI Reference**	**Evaluation/ Assessment:**
A. Definition of (What is technological design?) B. Definition of (What is engineering?) C. Course & Room Orientation 1. The tech lab 2. Safety letter 3. Seating chart D. Course Proficiency 1. Class requirements 2. Attitude / behavior 3. Course objectives	1. Technological design is the process and way that engineers solve problems and design technology. 2. Engineers solve problems 3. The layout of the lab 4. That the course requires good behavior, attendance, and class work.	1. Demonstrate classroom policies and procedures through their attitude and behavior 2. Explain the course proficiencies 3. Show what to do in the event of an emergency or drill 4. Recognize what safety equipment is in the classroom 5. Identify the location of safety equipment in the classroom 6. Show how to operate any safety	When asked, what is technological design? What is engineering? Students will write their individual definitions. Group discussions of various definitions while listing them on the board. A group tour of the tech. lab and computer resource room. Discussion of safety letter, students will have it signed by their parents. Fill out emergency cards. Assign seating/workstations. Group discussion of course proficiency, discipline, course content	1. Class syllabus 2. Map of the classroom 3. Emergency Procedures book 4. Student handbook	NJSLS 8.1.12.A3,4 8.1.12.D.5 8.1.12.E.1 8.1.12.F.12 9.1.12.A.3 9.1.12.A.6 9.2.12.C.3,6 9.3.12FN-ACT.1-4 CRP1-12 Technology Foundation Standards for Students (NETS) 1 (1,2,3) 2 (1,2,3,4,5) 3 (1,4) 4 (2,4) 5 (3,4) 6 (4)	NJSLS: Gr.11-12, RST 1 NJSLS: Gr.11-12, RST 3 NJSLS: Gr.11-12, RST 4 NJSLS: Gr.11-12, RST 8 NJSLS: Gr.11-12, RST 10 NJSLS: Gr.11-12, WHST 6 NJSLS: Gr.11-12, WHST 10 NJSLS N-Q.1-3 CS.5.3.12.C.1	**Formative Assessment:** 1. Class discussions **Summative Assessment** 2. Procedures Quiz 3. Classroom layout Quiz

4. Attendance / makeup 5. Grading A. Specific Areas of Study 1. The Resources of Technology 2. The Engineering Design Process 3. Civil Engineering 4. Mechanical Engineering 5. Electrical Engineering 6. Applications of Engineering Systems 7. Careers in Engineering	5. The 7 specific areas of study for the course	equipment in the event of an emergency 7. Identify the steps that should be followed in the event of an accident or medical emergency in the classroom.	attendance/makeup work and grading. Group discussion of TLA's – Technology learning activities Course outline Methods of evaluation		7 (1,2,5,6) 8 (4,5) 9 (2,5,6) 10 (3,5) 9.3.ST.1-6 9. 9.3.ST-EN.1-6 9.3.AT-SM.1-4 <u>NGSS</u> HS-ETS1-1 HS-ETS1-2 HS-ETS1-3 HS-ETS1-4 Environmental literacy Creativity and Innovation Critical Thinking and Problem Solving Communication Collaboration Productivity & Accountability Leadership & Responsibility		

Unit Modifications for Special Population Students:

Struggling Learners	Gifted and Talented Students (Challenge Activities)	English Language Learners	Learners with an IEP	Learners with a 504
• Assist students in getting organized. • Give short directions. • Use drill exercises. • Give prompt cues during student performance. • Let students with poor writing skills use a computer. • Break assignments into small segments and assign only one segment at a time. • Demonstrate skills and have students model them. • Give prompt feedback. • Use continuous assessment to mark students' daily progress. • Prepare materials at varying levels of ability.	• Provide ample opportunities for creative behavior. • Create assignments that call for original work, independent learning, critical thinking, problem solving, and experimentation. • Show appreciation for creative efforts • Respect unusual questions, ideas, and solutions. • Encourage students to test their ideas. • Provide opportunities and give credit for self-initiated learning. • Avoid overly detailed supervision and too much reliance on prescribed curricula. • Allow time for reflection. • Resist immediate and constant evaluation. • Avoid comparisons to other students.	• Use a slow, but natural rate of speech; speak clearly; use shorter sentences; repeat concepts in several ways. • When possible, use pictures, photos, and charts. • Corrections should be limited and appropriate. Do not correct grammar or usage errors in front of the class. • Give honest praise and positive feedback through your voice tones and visual articulation whenever possible. • Encourage students to use language to communicate, allowing them to use their native language to ask/answer questions when they are unable to do so in English. • Integrate students' cultural background into class discussions. • Use cooperative learning where students have opportunities to practice expressing ideas without risking language errors in front of the entire class.	Each special education student has in Individualized Educational Plan (IEP) that details the specific accommodations, modifications, services, and support needed to level the playing field. This will enable that student to access the curriculum to the greatest extent possible in the least restrictive environment. These include: • Variation of time: adapting the time allotted for learning, task completion, or testing • Variation of input: adapting the way instruction is delivered • Variation of output: adapting how a student can respond to instruction • Variation of size: adapting the number of items the student is expected to complete • Modifying the content, process or product Additional resources are outlined to facilitate appropriate behavior and increase student engagement. The most frequently used modifications and accommodations can be viewed here. Teachers are encouraged to use the Understanding by Design Learning Guidelines (UDL). These guidelines offer a set of concrete suggestions that can be applied to any discipline to ensure that all learners can access and participate in	• Refer to page four in the Parent and Educator Guide to Section 504 to assist in the development of appropriate plans.

			learning opportunities. The framework can be viewed here www.udlguidelines.cast.org	

UNIT OVERVIEW

Course Title: *Principles of Engineering and Technological Design (#931)*

Unit #: Unit 2 **Unit Title:** The Resources of Technology and Safety

Unit Description and Objectives:
This unit familiarizes the students with the necessary tools, machines and equipment for the design portion of the problem solving process used in the technology class. It promotes proper use, care and safety of all hand tools, machine tools, and equipment. The unit develops an awareness of general safety and proper procedures while in the technology lab. Students should use safe practices when using machines in the tech lab, while having an understanding of how different materials are processed using various machines.

Essential Questions and Enduring Understandings:

Essential Questions:	**Enduring Understandings/Generalizations Students will understand that:**	**Guiding Questions**
1. Why is safety important?	1. Tools can be dangerous, and safety rules must always be followed. 2. Their knowledge of the general safety rules apply to any unit or activities in the technology lab. 3. Keeping the technology lab clean and organized can help prevent accidents. 4. Safety glasses must be worn whenever material is being processed or projects are being tested.	1. Why must safety glasses be worn? 2. What is a potential consequence of not wearing safety glasses 3. What are rules specific for each tool? 4. What are generic rules for all or most tools? 5. What is the proper way to clean-up after working? 6. What are potential consequences for not cleaning-up after working in the technology lab?
1. What can be done to decrease the chance of accidents?	1. Selecting the right tools and right machines will help decrease the chance of accidents occurring. 2. Selecting the right tools and right machines is part of the engineering design loop.	3. What are design tools? 4. What are hand tools? 5. What is the proper care and use of all tools? 6. What are different types of materials we have available? 7. How do you choose a material? 8. What properties about materials are important to know?

CURRICULUM UNIT PLAN

Course Title/Grade: *Principles of Engineering and Technological Design (#931) 10-12*

Unit Number/Title: **Unit 2-** The Resources of Technology and Safety

Conceptual Lens:

Appropriate Time Allocation (# of Days)**:** 10

Primary Content Standards referenced With Cumulative Progress Indicators

8.1.12.A3,4	8.1.12.F.12	9.2.12.C.3,6	
8.1.12.D.5	9.1.12.A.3	9.3.12FN-ACT.1-4	
8.1.12.E.1	9.1.12.A.6		

Topics/Concepts (Incl. time / # days per topic)	Critical Content (Students Will Know:)	Skill Objectives (Students Will Be Able To:)	Instructional/Learning Activities & Interdisciplinary Connections	Instructional Resources	Technology & 21st C Skills Integration (Specify)	NJSLS w/ CPI Reference	Evaluation/ Assessment:
A. General Lab Safety (2 days) 1. Safety glasses 2. Lab Procedures 3. Machine Care B. Tools for design (3 days) C. Methods of design D. Hand tools 1. Layout 2. Cutting E. Use, Care, and Safety (5 days) 1. sawing 2. drilling 3. sanding 4. jointing 5. buffing/ grinding	1. That all safety rules must be followed at all times 2. Proper care and safety for tools and machines 3. Safety classes must be worn at all times in the lab 4. All machines are to be turned off after use 5. All machines, tools, and work areas must be cleaned-up	1. Develop an awareness of general safety and proper procedures while in the technology lab. 2. Use all tools and machines with proper safety and care. 3. List 5 properties of materials that can influence the decision to use a material. 4. Comprehend the relationships that exist among the different types of machines	Discuss, define and demonstrate. 1. assign glasses, cleanup jobs, and work stations Discuss, define, and demonstrate. 1. use care safety 2. different uses on materials (wood, plastic, metal, cardboard) 3. student use 4. quiz 5. test 6. construction of mock-up 7. construction of prototype	Whiteboard Handout Displays Material Samples ● hardwoods ● softwoods ● plastics ● metals ● etc. Tools Machines Computer with internet access	NJSLS 8.1.12.A3,4 8.1.12.D.5 8.1.12.E.1 8.1.12.F.12 9.1.12.A.3 9.1.12.A.6 9.2.12.C.3,6 9.3.12FN-ACT.1-4 CRP1-12 Technology Foundation Standards for Students (NETS) 1 (1,2,3) 2 (1,2,3,4,5) 3 (1,4) 4 (2,4) 5 (3,4) 6 (4) 7 (1,2,5,6) 8 (4,5)	NJSLS: Gr.11-12, RST 1 NJSLS: Gr.11-12, RST 3 NJSLS: Gr.11-12, RST 4 NJSLS: Gr.11-12, RST 8 NJSLS: Gr.11-12, RST 10 NJSLS: Gr.11-12, WHST 6 NJSLS: Gr.11-12, WHST 10 NJSLS N-Q.1-3 CS.5.1.12.A.1-3 CS.5.1.12.C.1-3 CS.5.2.12.A.5-6	**Formative Assessment:** 1. Safety Quiz 2. Safety Test 3. Daily work/clean-up log **Summative Assessment** 4. Midterm EXAM

F. Properties of Materials (5 days) 1. Acoustical 2. Chemical 3. Electrical 4. Magnetic 5. Manufacturing 6. Mechanical 7. Thermal	and put away after use 6. How to operate different tools and machines 7. Different properties of materials				9 (2,5,6) 10 (3,5) 9.3.ST.1-6 9. 9.3.ST-EN.1-6 9.3.AT-SM.1-4 <u>NGSS</u> HS-ETS1-1 HS-ETS1-2 HS-ETS1-3 HS-ETS1-4 Environmental literacy Creativity and Innovation Critical Thinking and Problem Solving Communication Collaboration Flexibility & Adaptability Productivity & Accountability Leadership & Responsibility		

Unit Modifications for Special Population Students:

Struggling Learners	Gifted and Talented Students (Challenge Activities)	English Language Learners	Learners with an IEP	Learners with a 504
• Assist students in getting organized. • Give short directions. • Use drill exercises. • Give prompt cues during student performance. • Let students with poor writing skills use a computer. • Break assignments into small segments and assign only one segment at a time. • Demonstrate skills and have students model them. • Give prompt feedback. • Use continuous assessment to mark students' daily progress. • Prepare materials at varying levels of ability.	• Provide ample opportunities for creative behavior. • Create assignments that call for original work, independent learning, critical thinking, problem solving, and experimentation. • Show appreciation for creative efforts • Respect unusual questions, ideas, and solutions. • Encourage students to test their ideas. • Provide opportunities and give credit for self-initiated learning. • Avoid overly detailed supervision and too much reliance on prescribed curricula. • Allow time for reflection. • Resist immediate and constant evaluation. • Avoid comparisons to other students.	• Use a slow, but natural rate of speech; speak clearly; use shorter sentences; repeat concepts in several ways. • When possible, use pictures, photos, and charts. • Corrections should be limited and appropriate. Do not correct grammar or usage errors in front of the class. • Give honest praise and positive feedback through your voice tones and visual articulation whenever possible. • Encourage students to use language to communicate, allowing them to use their native language to ask/answer questions when they are unable to do so in English. • Integrate students' cultural background into class discussions. • Use cooperative learning where students have opportunities to practice expressing ideas without risking language errors in front of the entire class.	Each special education student has in Individualized Educational Plan (IEP) that details the specific accommodations, modifications, services, and support needed to level the playing field. This will enable that student to access the curriculum to the greatest extent possible in the least restrictive environment. These include: • Variation of time: adapting the time allotted for learning, task completion, or testing • Variation of input: adapting the way instruction is delivered • Variation of output: adapting how a student can respond to instruction • Variation of size: adapting the number of items the student is expected to complete • Modifying the content, process or product Additional resources are outlined to facilitate appropriate behavior and increase student engagement. The most frequently used modifications and accommodations can be viewed here. Teachers are encouraged to use the Understanding by Design Learning Guidelines (UDL). These guidelines offer a set of concrete suggestions that can be applied to any discipline to ensure that all learners can access and participate in	• Refer to page four in the Parent and Educator Guide to Section 504 to assist in the development of appropriate plans.

			learning opportunities. The framework can be viewed here www.udlguidelines.cast.org	

UNIT OVERVIEW

Course Title: *Principles of Engineering and Technological Design (#931)*

Unit #: Unit 3 **Unit Title:** The Engineering Design Process

Unit Description and Objectives:
This unit allows students to review the basics of the engineering design process. In any design there are intended and unintended, positive and negative results. The engineering design process involves testing and redesigning. During the pre-requisite course, emphasize was placed on documentation and design. For the Principles of Engineering and Technological Design course, emphasis is places on analyzing results and the testing and evaluation phase. The resources available and the processes involved may alter the design of a product. It should be noted that this unit's concepts, as well as many of the ensuing concepts, are used throughout the course while being applied to each design problem.

Essential Questions and Enduring Understandings:

Essential Questions:	**Enduring Understandings/Generalizations Students will understand that:**	**Guiding Questions**
1. What is the engineering design process/loop?	1. Problem Solving is a process that involves many steps. 2. The engineering design loop is used for any problem. 3. Following the steps to the engineering design loop will lead to more effective solutions and designs.	1. What is the difference between identifying a problem and building a solution? 2. What are the purposes of the design brief? 3. What are some examples of resources for research? 4. What is brainstorming? What does brainstorming look like? 5. What part of the design process is most important? Why? 6. Why is documentation critical?
2. What makes a bad design?	1. Many factors need to be considered before completing a problem. 2. A failure can occur due to ignorance or negligence. 3. Designs have four types of outcomes.	1. What are some examples of good and bad designs? 2. How can ignorance make a bad design? 3. How can negligence make a bad design? 4. What can be done to prevent bad designs? 5. How can you tell a design is bad? 6. Outcomes can be anticipated/unanticipated and positive or negative.
3. What should be analyzed before creating a new solution?	1. During and after testing, results should be analyzed. 2. Pin-pointing the specific area of failure can help when redesigning to make the solution stronger. 3. All aspects of the design should be analyzed whether they worked or failed.	1. What can you look for during testing? 2. What can you make note of after testing? 3. Why is it important to analyze aspects that performed well? 4. Why is it important to analyze aspects that did not perform well? 5. What can be done with analysis and evaluation?

CURRICULUM UNIT PLAN

Course Title/Grade: *Principles of Engineering and Technological Design (#931) 10-12*

Unit Number/Title: **Unit 3- The Engineering Design Process**

Conceptual Lens:

Appropriate Time Allocation (# of Days)**:** 15

Primary Content Standards referenced With Cumulative Progress Indicators

8.1.12.A3,4	8.1.12.F.12	9.2.12.C.3,6	
8.1.12.D.5	9.1.12.A.3	9.3.12FN-ACT.1-4	
8.1.12.E.1	9.1.12.A.6		

Topics/Concepts (Incl. time / # days per topic)	**Critical Content (Students Will Know:)**	**Skill Objectives (Students Will Be Able To:)**	**Instructional/Learning Activities & Interdisciplinary Connections**	**Instructional Resources**	**Technology & 21st C Skills Integration (Specify)**	**NJSLS w/ CPI Reference**	**Evaluation/ Assessment:**
The Design Process A. Design Loop 1. Identifying problems 2. Framing a design Brief 3. Investigation and Research 4. Generating Alternative Solutions 5. Choosing a solution 6. Developmental Work 7. Modeling and Prototyping 8. Testing and Evaluating a. results/impacts 1. anticipated positive	1. The difference between a problem and a solution. 2. Some methods for generating ideas. 3. How to select the best solution 4. How to transform ideas from paper to model and prototype. 5. How to evaluate designs and redesign as needed.	1. Know the steps in the design loop. 2. Understand the difference between a problem and a solution. 3. Distinguish the difference between invention and innovation. 4. Define the term ergonomics. 5. Explain what anthropometrics is. 6. Understand the importance of human	1. Students are given a design problem to solve (such as a bridge or tower). 2. Students follow the engineering design loop to create a bridge or tower to test. 3. During testing, students are able to observe and see where failure occurs. 4. Students can hypothesize what forces caused the failure, and how they could redesign their bridge or tower to improve the design. 5. Students can write a reflection about what	• Computers with internet • Measurement tools • AutoDesk Inventor Design Software • Whiteboard	NJSLS 8.1.12.A3,4 8.1.12.D.5 8.1.12.E.1 8.1.12.F.12 9.1.12.A.3 9.1.12.A.6 9.2.12.C.3,6 9.3.12FN-ACT.1-4 CRP1-12 Technology Foundation Standards for Students (NETS) 1 (1,2,3) 2 (1,2,3,4,5) 3 (1,4) 4 (2,4) 5 (3,4) 6 (4) 7 (1,2,5,6) 8 (4,5)	NJSLS: Gr.11-12, RST 1 NJSLS: Gr.11-12, RST 3 NJSLS: Gr.11-12, RST 4 NJSLS: Gr.11-12, RST 8 NJSLS: Gr.11-12, RST 10 NJSLS: Gr.11-12, WHST 6 NJSLS: Gr.11-12, WHST 10 NJSLS N-Q.1-3 NJSLS S.ID.9 CS.5.1.12.A.1-.3 CS.5.1.12.B.1-4 CS.5.1.12.C.1-3 CS.5.1.12.D.1-3	**Formative Assessment:** 1. Students answer questions when called upon during discussion of problem statements, design briefs and specification writing. 2. Student portfolio **Summative Assessment** 3. Midterm EXAM

2. anticipated negative 3. unanticipated positive 4. unanticipated negative 9. Redesigning and Improving	6. Analysis is an important step in the engineering design loop. 7. The need for standards and the role standards play in our designed world.	dimension application in the designed world. 7. State the role standards and standardized parts play in design.	could have been done to improve their design, and what went well in their design.		9 (2,5,6) 10 (3,5) 9.3.ST.1-6 9. 9.3.ST-EN.1-6 9.3.AT-SM.1-4 <u>NGSS</u> HS-ETS1-1 HS-ETS1-2 HS-ETS1-3 HS-ETS1-4 Environmental literacy Creativity and Innovation Critical Thinking and Problem Solving Communication Collaboration Flexibility & Adaptability Productivity & Accountability Leadership & Responsibility		

Unit Modifications for Special Population Students:

Struggling Learners	Gifted and Talented Students (Challenge Activities)	English Language Learners	Learners with an IEP	Learners with a 504
• Assist students in getting organized. • Give short directions. • Use drill exercises. • Give prompt cues during student performance. • Let students with poor writing skills use a computer. • Break assignments into small segments and assign only one segment at a time. • Demonstrate skills and have students model them. • Give prompt feedback. • Use continuous assessment to mark students' daily progress. • Prepare materials at varying levels of ability.	• Provide ample opportunities for creative behavior. • Create assignments that call for original work, independent learning, critical thinking, problem solving, and experimentation. • Show appreciation for creative efforts • Respect unusual questions, ideas, and solutions. • Encourage students to test their ideas. • Provide opportunities and give credit for self-initiated learning. • Avoid overly detailed supervision and too much reliance on prescribed curricula. • Allow time for reflection. • Resist immediate and constant evaluation. • Avoid comparisons to other students.	• Use a slow, but natural rate of speech; speak clearly; use shorter sentences; repeat concepts in several ways. • When possible, use pictures, photos, and charts. • Corrections should be limited and appropriate. Do not correct grammar or usage errors in front of the class. • Give honest praise and positive feedback through your voice tones and visual articulation whenever possible. • Encourage students to use language to communicate, allowing them to use their native language to ask/answer questions when they are unable to do so in English. • Integrate students' cultural background into class discussions. • Use cooperative learning where students have opportunities to practice expressing ideas without risking language errors in front of the entire class.	Each special education student has in Individualized Educational Plan (IEP) that details the specific accommodations, modifications, services, and support needed to level the playing field. This will enable that student to access the curriculum to the greatest extent possible in the least restrictive environment. These include: • Variation of time: adapting the time allotted for learning, task completion, or testing • Variation of input: adapting the way instruction is delivered • Variation of output: adapting how a student can respond to instruction • Variation of size: adapting the number of items the student is expected to complete • Modifying the content, process or product Additional resources are outlined to facilitate appropriate behavior and increase student engagement. The most frequently used modifications and accommodations can be viewed here. Teachers are encouraged to use the Understanding by Design Learning Guidelines (UDL). These guidelines offer a set of concrete suggestions that can be applied to any discipline to ensure that all learners can access and participate in	• Refer to page four in the Parent and Educator Guide to Section 504 to assist in the development of appropriate plans.

			learning opportunities. The framework can be viewed here www.udlguidelines.cast.org	

UNIT OVERVIEW

Course Title: *Principles of Engineering and Technological Design (#931)*

Unit #: Unit 4 **Unit Title:** Civil Engineering

Unit Description and Objectives:
This unit gives students an introduction to Civil Engineering. Students explore designing and building bridges, towers, and other civil engineering based projects. Civil Engineering principles and the science and mathematics applications in Civil Engineering are emphasized. Students are introduced to structural forces, loads, and components. In this unit, students are able to explore typical projects that civil engineers may work on.

Essential Questions and Enduring Understandings:

Essential Questions:	**Enduring Understandings/Generalizations Students will understand that:**	**Guiding Questions**
1. What forces are commonly considered when working on civil engineering projects?	1. Many concepts learned in physical science classes are critical in civil engineering projects. 2. Many physics concepts require the use of mathematical formulas.	1. What forces are applied to bridges? 2. What is compression? 3. What is tension? 4. What is torsion? 5. What is shear force? 6. What forces are applied to towers? 7. How can fires or other emergencies effect bridge or tower design?
2. How does the environment play a factor in civil engineering?	1. The soil can impact the footing and foundation of buildings, bridges, and towers. 2. The weather in some environments is extreme and can cause extreme forces on buildings, bridges, and towers. 3. Oftentimes, civil engineering projects can directly destroy or change the habitats of many animals.	1. What is soil? 2. What is terrain? 3. How does soil and terrain impact footing? 4. What are some examples of projects that failed because of soil or terrain issues? 5. What sort of buildings is built in areas with flood risks? 6. What sort of buildings is built in areas with high tornado risks? 7. What style buildings are built in areas with high earthquake risk? 8. How was the Millau Viaduct Bridge in France built? 9. Why was the Millau Viaduct built in such a specific way?

3. What considerations are special to large scale civil engineering projects?	1. With large scale projects, like skyscrapers and long spanning bridges, obtaining sufficient materials can be costly. 2. The availability of materials plays a factor in how to build a project.	1. How do we get materials to building sites? 2. What made skyscrapers possible in the early 20th century? 3. Why were many skyscrapers built in NY, NJ, Chicago, etc.?

CURRICULUM UNIT PLAN

		Primary Content Standards referenced With Cumulative Progress Indicators		
Course Title/Grade:	*Principles of Engineering and Technological Design (#931) 10-12*			
Unit Number/Title:	**Unit 4- Civil Engineering**	8.1.12.A3,4	8.1.12.F.12	9.2.12.C.3,6
Conceptual Lens:		8.1.12.D.5	9.1.12.A.3	9.3.12FN-ACT.1-4
Appropriate Time Allocation (# of Days)**:**	30	8.1.12.E.1	9.1.12.A.6	

Topics/Concepts (Incl. time / # days per topic)	**Critical Content (Students Will Know:)**	**Skill Objectives (Students Will Be Able To:)**	**Instructional/Learning Activities & Interdisciplinary Connections**	**Instructional Resources**	**Technology & 21st C Skills Integration (Specify)**	**NJSLS w/ CPI Reference**	**Evaluation/ Assessment:**
1. Forces a. Compression b. Tension c. Torsion d. Shear e. Gravity 2. Environmental Concerns a. Soil b. Terrain c. Wind d. Rain e. Floods f. Earthquakes 3. Conservation of habitats 4. Materials a. Availability b. Shipping c. Assembly 5. Projects	1. Many forces act on bridges, towers and other structures 2. Some forces reflect the material of the project, while other forces are affected by the design of the project. 3. Compression is the force felt when an object is pushed together.	1. Identify the different forces that generally affect bridges and towers. 2. Apply previously learned concepts to construct a bridge or tower. 3. Analyze points of failure. 4. Calculate the efficiency of the design based on the weight of the materials used and the weight it was able to hold without breaking. 5. Distinguish the different environmental factors and	1. Students will start by using west point bridge designing to learn the different types of bridges and how they are simulated to test under real life conditions. Once students have created a virtual skeleton plan on a bridge, students will begin designing a bridge out of balsa wood in Inventor. Using Inventor, students will be able to generate a Parts list, a blueprint on which to build. Students can then construct a bridge, and test it using a bridge tester. After testing, students	Balsawood wood glue pins poster board wax paper internet Inventor West Point Bridge designer Bridge tester Tower tester Earthquake tester x-acto knives	NJSLS 8.1.12.A3,4 8.1.12.D.5 8.1.12.E.1 8.1.12.F.12 9.1.12.A.3 9.1.12.A.6 9.2.12.C.3,6 9.3.12FN-ACT.1-4 CRP1-12 Technology Foundation Standards for Students (NETS) 1 (1,2,3) 2 (1,2,3,4,5) 3 (1,4) 4 (2,4) 5 (3,4) 6 (4) 7 (1,2,5,6) 8 (4,5) 9 (2,5,6) 10 (3,5)	NJSLS: Gr.11-12, RST 1 NJSLS: Gr.11-12, RST 3 NJSLS: Gr.11-12, RST 4 NJSLS: Gr.11-12, RST 8 NJSLS: Gr.11-12, RST 10 NJSLS: Gr.11-12, WHST 6 NJSLS: Gr.11-12, WHST 10 NJSLS N-Q.1-3 NJSLS S.SRT.6-8 NJSLS G.MG.1-3 NJSLS G.SRT.10 NJSLS G.SRT.11 NJSLS G.GMP.1 NJSLS G.GMP.13	**Formative Assessment:** 4. Safety Quiz **Summative Assessment** 5. Marking Period 1 Benchmark TEST 6. Midterm EXAM

a. Bridges b. Towers	4. Tension if the force felt when an object is pulled apart 5. Torsion is the force felt when an object is twisted 6. Shear is a force felt when an object is pushed in two different directions on different areas. 7. Gravity is a force felt by all objects on earth. 8. The building site and the environment are important to consider when thinking about designing and building structures. 9. The soil type can alter how	identify how they are related to design and construction. 6. Explain what accommodations could be made to limit the destruction of ecosystem. 7. Distinguish both the positive and negative implications of the construction of bridges, such as the Millau Viaduct 8. Analyze the impact that construction and shipping of materials can have on the environment	can analyze the point of failure, and calculate efficiency. Students can also hypothesize how to improve the design by accounting for the forces that cause the failure. 2. Students can design a tower that is tested for weight held, height, or durability during a simulated earthquake. Students can use Inventor to design a tower, and construct the tower using balsa wood and wood glue. 3. Students can research news articles about current construction projects that are being protested by environmentalist. 4. Students can research about how different construction projects locally and globally have impacted the environment. Students can present findings to the class. 5. Students can research civil engineering projects or green projects that focus on having positive impacts on the environment. Research can focus on what engineers are		9.3.ST.1-6 9. 9.3.ST-EN.1-6 9.3.AT-SM.1-4 <u>NGSS</u> HS-ETS1-1 HS-ETS1-2 HS-ETS1-3 HS-ETS1-4 HS-PS2-1 HS-PS2-2 HS-PS2-3 HS-PS2-4 HS-PS2-5 Global awareness Environmental literacy Creativity and Innovation Critical Thinking and Problem Solving Communication Collaboration Flexibility & Adaptability Productivity & Accountability Leadership & Responsibility	CS.5.1.12.A.1-3 CS.5.1.12.B.1-4 CS.5.1.12.C.1-3 CS.5.1.12.D.1-3 CS5.2.12.D.1-5 CS5.2.12.E.1-4	

	the substructure is build. 10. The weather around the world can alter the design of projects 11. A successful design in one area of the world may be less successful somewhere different. 12. When building a new structure, or remodeling an old structure, there are many conservation aspects to consider. 13. The availability of materials can alter the design of a structure.		doing to help the environment. Students can present findings to the class.				

	14. When building a tower, civil engineers have to consider wind, earthquakes, and shear forces. 15. When building a bridge, civil engineers have to considering compression, tension, and bending.						

Unit Modifications for Special Population Students:

Struggling Learners	Gifted and Talented Students (Challenge Activities)	English Language Learners	Learners with an IEP	Learners with a 504
• Assist students in getting organized. • Give short directions. • Use drill exercises. • Give prompt cues during student performance. • Let students with poor writing skills use a computer. • Break assignments into small segments and assign only one segment at a time. • Demonstrate skills and have students model them. • Give prompt feedback. • Use continuous assessment to mark students' daily progress. • Prepare materials at varying levels of ability.	• Provide ample opportunities for creative behavior. • Create assignments that call for original work, independent learning, critical thinking, problem solving, and experimentation. • Show appreciation for creative efforts • Respect unusual questions, ideas, and solutions. • Encourage students to test their ideas. • Provide opportunities and give credit for self-initiated learning. • Avoid overly detailed supervision and too much reliance on prescribed curricula. • Allow time for reflection. • Resist immediate and constant evaluation. • Avoid comparisons to other students.	• Use a slow, but natural rate of speech; speak clearly; use shorter sentences; repeat concepts in several ways. • When possible, use pictures, photos, and charts. • Corrections should be limited and appropriate. Do not correct grammar or usage errors in front of the class. • Give honest praise and positive feedback through your voice tones and visual articulation whenever possible. • Encourage students to use language to communicate, allowing them to use their native language to ask/answer questions when they are unable to do so in English. • Integrate students' cultural background into class discussions. • Use cooperative learning where students have opportunities to practice expressing ideas without risking language errors in front of the entire class.	Each special education student has in Individualized Educational Plan (IEP) that details the specific accommodations, modifications, services, and support needed to level the playing field. This will enable that student to access the curriculum to the greatest extent possible in the least restrictive environment. These include: • Variation of time: adapting the time allotted for learning, task completion, or testing • Variation of input: adapting the way instruction is delivered • Variation of output: adapting how a student can respond to instruction • Variation of size: adapting the number of items the student is expected to complete • Modifying the content, process or product Additional resources are outlined to facilitate appropriate behavior and increase student engagement. The most frequently used modifications and accommodations can be viewed here. Teachers are encouraged to use the Understanding by Design Learning Guidelines (UDL). These guidelines offer a set of concrete suggestions that can be applied to any discipline to ensure that all learners can access and participate in	• Refer to page four in the Parent and Educator Guide to Section 504 to assist in the development of appropriate plans.

			learning opportunities. The framework can be viewed here www.udlguidelines.cast.org	

UNIT OVERVIEW

Course Title: *Principles of Engineering and Technological Design (#931)*

Unit #: Unit 5 **Unit Title:** Mechanical Engineering

Unit Description and Objectives:
This unit gives students an introduction to Mechanical Engineering. Mechanical system principles and the science and mathematics applications in Mechanical Engineering are emphasized. Students are introduced to concepts of energy, motion, and simple machines. Students explore mechanical and fluid power systems. This unit gives students examples of applications in mechanical engineering. By the end of this unit, students are able to design an air engine in inventor, and then fabricate a prototype using the metals machine shop.

Essential Questions and Enduring Understandings:

Essential Questions:	**Enduring Understandings/Generalizations Students will understand that:**	**Guiding Questions**
1. What is a mechanical system?	1. A mechanical system manipulates power to accomplish a task using simple or complex machines, forces and movement. 2. A mechanical system has three parts: a power supply, mechanisms that create the movement, and a control to sense output. 3. Gears, pulleys, wheels, levers, and other simple machines are all used in mechanical systems. 4. Two examples of power systems are pneumatic and hydraulic systems. 5. Forces such as stress and torque affect mechanical systems.	1. What are simple machines? What are some examples of simple machines? 2. What are some examples of power supplies? 3. How do controls sense output of machines? 4. What are examples of controls that sense outputs of machines? 5. What is pneumatics? 6. What is hydraulics? 7. How do hydraulics to pneumatics work to power systems? 8. What are the fundamental forces? 9. What are the non-fundamental forces? 10. What is torque? 11. What is pressure and stress?
1. How have mechanical systems evolved through history?	1. The earliest mechanical systems were just a simple machine, such as a pulley, wheel and axle, or a lever.	1. What were some examples of the first mechanical systems? 2. What was the main power supply behind mechanical systems prior to the industrial revolution?

	2. Mechanical systems could be built out of wood, like a medieval trebuchet, or metals, like engines. 3. During the Industrial revolution, the creation of the steam engine revolutionized how the world operates	3. How could mechanical systems use forces such as gravity to create movement? 4. How did the industrial revolution change the availability of power? 5. What did the steam engine enable? 6. What lead to the industrial revolution? 7. How was the steam engine used? 8. What replaced the steam engine? 9. How did Ford's assembly line change mechanical systems? 10. What impact did interchangeable parts have on the popularity of mechanical systems?
1. How can energy be converted into movement?	1. There are many sources of energy. 2. Energy can be converted into movement to power machines. 3. The lower the tolerance of a drawing or machine, the higher the efficiency of converting the energy to power.	1. What can be used to power a car? 2. What are some different kinds of engines? 3. What is energy? 4. What are properties of energy? 5. What are the laws of thermodynamics? 6. How does an air engine operate? 7. How does tolerance affect efficiency?

CURRICULUM UNIT PLAN

Course Title/Grade: *Principles of Engineering and Technological Design (#931) 10-12*

Unit Number/Title: **Unit 5- Mechanical Engineering**

Conceptual Lens:

Appropriate Time Allocation (# of Days)**:** 30

Primary Content Standards referenced With Cumulative Progress Indicators

8.1.12.A3,4	8.1.12.F.12	9.2.12.C.3,6	
8.1.12.D.5	9.1.12.A.3	9.3.12FN-ACT.1-4	
8.1.12.E.1	9.1.12.A.6		

Topics/Concepts (Incl. time / # days per topic)	Critical Content (Students Will Know:)	Skill Objectives (Students Will Be Able To:)	Instructional/Learning Activities & Interdisciplinary Connections	Instructional Resources	Technology & 21st C Skills Integration (Specify)	NJSLS w/ CPI Reference	Evaluation/ Assessment:
1. Simple machines 1. Definition 2. Gears 3. Pulleys 4. Levers 5. Wheel/Axle 6. inclined plane 7. Screw 2. Pneumatic and hydraulic systems 1. Pneumatics 2. Hydraulics 3. Applications 3. Forces 1. Fundamental 1. Gravitational 2. Electromagnetic 3. Nuclear 2. Non-fundamental 1. Friction 2. Normal 3. tension 4. Elastic 5. Continuum	1. A simple machine can change the direction or magnitude of a force 2. Simple machines are combined to form complex or compound machines 3. A force is anything that can change the motion of an object. 4. There are two main branches of forces, fundamental, and non-fundamental forces.	1. Distinguish the types of simple machines, and identify how they change the magnitude of a force. 2. Break down compound machines into the simple machines they are made up as. 3. Combine simple machines to create a compound machine, such as a Rune	1. Students will research different simple and compound machines, and explain how each aspect is able to change the magnitude of a force, and what the force is. 2. The teacher assigns a task, and students are responsible for designing and building a Rune Goldberg device that uses at least one of each of the types of simple machines. Students may only use gravitational	Aluminum Metals lathe Metals milling machine Miscellaneous machinist tools, Machine shop Air compressor card stock springs gears pulleys Internet Scales, sensors, and machines to test for different forces	NJSLS 8.1.12.A3,4 8.1.12.D.5 8.1.12.E.1 8.1.12.F.12 9.1.12.A.3 9.1.12.A.6 9.2.12.C.3,6 9.3.12FN-ACT.1-4 CRP1-12 Technology Foundation Standards for Students (NETS) 1 (1,2,3) 2 (1,2,3,4,5) 3 (1,4) 4 (2,4) 5 (3,4) 6 (4) 7 (1,2,5,6) 8 (4,5) 9 (2,5,6)	NJSLS: Gr.11-12, RST 1 NJSLS: Gr.11-12, RST 3 NJSLS: Gr.11-12, RST 4 NJSLS: Gr.11-12, RST 8 NJSLS: Gr.11-12, RST 10 NJSLS: Gr.11-12, WHST 6 NJSLS: Gr.11-12, WHST 10 NJSLS N-Q.1-3 NJSLS S.SRT.6-8 NJSLS G.MG.1-3 NJSLS G.SRT.10 NJSLS G.SRT.11 NJSLS G.GMP.1	**Formative Assessment:** 5. Safety Quiz **Summative Assessment** 7. Marking Period 1 Benchmark TEST 8. Midterm EXAM

6. Fictitious forces 4. Stress 1. deformation of solid materials 2. flow in fluids 3. Pressure 5. Torque 6. Energy 1. Converting energy 7. Early mechanical systems 1. Materials 2. Forces 3. Improvements 8. Industrial Revolution 1. Steam engine 2. Effects on society 9. Efficiency 1. Tolerances 2. Laws of Thermodynamics	5. Pressure is a type of stress 6. Torque is the tendency of a force to rotate an object around an axis. 7. Pneumatic systems work using pressurized air, while hydraulic systems use pressurized water. 8. Early mechanical systems were more likely to rely on gravity as a power supply, such as in a trebuchet. 9. The Industrial Revolution had a major impact on mechanical systems. 10. The steam engine changed how people traveled, and lead to internal and external combustion engines. 11. The lower the tolerance of a design, the	Goldberg device. 4. Discuss the types of fundamental and non-fundamental forces. 5. Identify applications of forces such as pressure and torque in real life applications. 6. Analyze how early mechanical systems worked. 7. Design an air engine with tolerances +-.003” 8. Machine an aluminum air engine with low tolerances that operates when attached to the air compressor.	and non-fundamental type forces to power the machine. The teacher may assign the same materials for all students, or allow students to use other materials from home. 3. Students machine an air engine from aluminum using a student created design from Inventor. Students can calculate the tolerance, and estimate the efficiency prior to testing, and then calculate how much energy was lost based on the power of the air compressor, and the speed of the engine. Students should analyze the need for accuracy and precision to have the piston move smoothly.		10 (3,5) 9.3.ST.1-6 9. 9.3.ST-EN.1-6 9.3.AT-SM.1-4 <u>NGSS</u> HS-ETS1-1 HS-ETS1-2 HS-ETS1-3 HS-ETS1-4 HS-PS2-1 HS-PS2-2 HS-PS2-3 HS-PS2-4 HS-PS2-5 Global awareness Environmental literacy Creativity and Innovation Critical Thinking and Problem Solving Communication Collaboration Flexibility & Adaptability Productivity & Accountability Leadership & Responsibility	NJSLS G.GMP.13 CS.5.1.12.A.1-.3 CS.5.1.12.B.1-4 CS.5.1.12.C.1-3 CS.5.1.12.D.1-3 CS.5.2.12.C1-2 CS5.2.12.D.1-5 CS5.2.12.E.1-4	

	higher the efficiency.						

Unit Modifications for Special Population Students:

Struggling Learners	Gifted and Talented Students (Challenge Activities)	English Language Learners	Learners with an IEP	Learners with a 504
• Assist students in getting organized. • Give short directions. • Use drill exercises. • Give prompt cues during student performance. • Let students with poor writing skills use a computer. • Break assignments into small segments and assign only one segment at a time. • Demonstrate skills and have students model them. • Give prompt feedback. • Use continuous assessment to mark students' daily progress. • Prepare materials at varying levels of ability.	• Provide ample opportunities for creative behavior. • Create assignments that call for original work, independent learning, critical thinking, problem solving, and experimentation. • Show appreciation for creative efforts • Respect unusual questions, ideas, and solutions. • Encourage students to test their ideas. • Provide opportunities and give credit for self-initiated learning. • Avoid overly detailed supervision and too much reliance on prescribed curricula. • Allow time for reflection. • Resist immediate and constant evaluation. • Avoid comparisons to other students.	• Use a slow, but natural rate of speech; speak clearly; use shorter sentences; repeat concepts in several ways. • When possible, use pictures, photos, and charts. • Corrections should be limited and appropriate. Do not correct grammar or usage errors in front of the class. • Give honest praise and positive feedback through your voice tones and visual articulation whenever possible. • Encourage students to use language to communicate, allowing them to use their native language to ask/answer questions when they are unable to do so in English. • Integrate students' cultural background into class discussions. • Use cooperative learning where students have opportunities to practice expressing ideas without risking language errors in front of the entire class.	• Use concrete examples to introduce concepts. • Make learning activities consistent. • Use repetition and drills spread over time. • Provide work folders for daily assignments. • Use behavior management techniques, such as behavior modification, in the area of adaptive behavior. • Break assignments into small segments and assign only one segment at a time. • Demonstrate skills and have students model them. • Encourage students to function independently. • Give students extra time to both ask and answer questions while giving hints to answers. • Give simple directions and read them over with students. • Shorten the number of items on exercises, tests, and quizzes.	• Refer to page four in the Parent and Educator Guide to Section 504 to assist in the development of appropriate plans.

UNIT OVERVIEW

Course Title: *Principles of Engineering and Technological Design (#931)*

Unit #: Unit 6 **Unit Title:** Electrical Engineering

Unit Description and Objectives:
This unit gives students an introduction to Computer and Electrical Engineering. Students explore designing and building circuits, the use of algorithms and computer engineering projects. Basic electrical principles and the science and mathematics applications in Electrical Engineering are emphasized. Students are introduced to the function of basic parts of a personal computer, voltage, current, resistance and power. Operations and application of common electronic components such as resistors, switches, capacitors, diodes, and transistors are discussed. Students are given the opportunity to learn to solder, and work with arduinos. Students can apply what was learned in previous units on forces and mechanics to design and fabricate robotic parts and also have the opportunity to compete in the TSA Vex robotics competition.

Essential Questions and Enduring Understandings:

Essential Questions:	**Enduring Understandings/Generalizations** **Students will understand that:**	**Guiding Questions**
1. What is electricity?	1. Atoms are made of protons, neutrons, and electrons. 2. Electricity is the flow of electrons from positive to negative. 3. Electricity can be manipulated to send electronic pulses, and used as a form of communication.	1. What is an electron? 2. How does an electron flow? 3. How can electricity be used as a method of communication? 4. What is electricity used for?
2. What are the parts of a circuit?	1. Circuit boards are made up of smaller components that manipulate how electricity flows. 2. Most circuit boards are made of silicon because of its conductive materials.	3. What components make up a circuit board? 4. What is a conductor? 5. What us an insulator? 6. What are the jobs of specific components?
3. Why do electrical systems generally require programing?	1. There are many different programming languages. 2. Programs are what allow electrical systems to perform basic and complex functions without a direct influence. 3. The most popular number systems are binary and hexadecimal. 4. Robotic systems require programs to be written to allow the robot to function autonomously or with a controller.	1. What are examples of programming language? 2. What is binary? 3. How do programs work? 4. How do programs allow systems to function autonomously? 5. What is Boolean algebra? 6. What is an “if/then” statement?

CURRICULUM UNIT PLAN

Course Title/Grade: *Principles of Engineering and Technological Design (#931) 10-12*

Unit Number/Title: **Unit 6- Electrical Engineering**

Conceptual Lens:

Appropriate Time Allocation (# of Days)**:** 30

Primary Content Standards referenced With Cumulative Progress Indicators

8.1.12.A3,4	8.1.12.F.12	9.2.12.C.3,6	
8.1.12.D.5	9.1.12.A.3	9.3.12FN-ACT.1-4	
8.1.12.E.1	9.1.12.A.6		

Topics/Concepts (Incl. time / # days per topic)	**Critical Content (Students Will Know:)**	**Skill Objectives (Students Will Be Able To:)**	**Instructional/Learning Activities & Interdisciplinary Connections**	**Instructional Resources**	**Technology & 21st C Skills Integration (Specify)**	**NJSLS w/ CPI Reference**	**Evaluation/ Assessment:**
1. Basic Electronics a. Parts of an atom b. Flow of electricity c. Uses of electricity d. Properties of electricity 2. Circuits a. circuit components b. conductors c. insulators d. resistors e. power supplies f. diodes g. transistors h. capacitors i. sensors/detectors j. switches k. wires 3. Basic programing applications	1. An atom is made up of protons, neutrons, and electrons 2. Electricity is the flow of electrons 3. Materials that generally “give” electrons are known as conductors 4. Materials that do not give up electrons are known as insulators	1. Identify the parts of an atom 2. Discuss the properties and uses of electricity 3. Construct simple circuits using a breadboard and different components. 4. Construct a circuit board with components, solder and a soldering iron. 5. Use LogixPro to program a garage door. 6. Read schematic diagrams	1. Students will participate in a teacher led discussion about the parts of an atom and basic electricity. By the end of the discussion, students should be able to draw an atom, and identify the three main parts of an atom. Students will look at the periodic table of elements, and identify materials that are conductors or insulators, and why they would conduct electricity. Students will draw connections to chemistry concepts. 2. Schematic diagrams will be introduced with	Whiteboard Schematic diagrams Breadboards Wire Miscellaneous electrical components such as diodes, transistors, resistors, LED lights, switches, etc. Soldering kits Solder Soldering iron Soldering boards Computers LogixPro Vex Robotic kits Machining lab arduinos	NJSLS 8.1.12.A3,4 8.1.12.D.5 8.1.12.E.1 8.1.12.F.12 9.1.12.A.3 9.1.12.A.6 9.2.12.C.3,6 9.3.12FN-ACT.1-4 CRP1-12 Technology Foundation Standards for Students (NETS) 1 (1,2,3) 2 (1,2,3,4,5) 3 (1,4) 4 (2,4) 5 (3,4) 6 (4) 7 (1,2,5,6) 8 (4,5) 9 (2,5,6)	NJSLS: Gr.11-12, RST 1 NJSLS: Gr.11-12, RST 3 NJSLS: Gr.11-12, RST 4 NJSLS: Gr.11-12, RST 8 NJSLS: Gr.11-12, RST 10 NJSLS: Gr.11-12, WHST 6 NJSLS: Gr.11-12, WHST 10 NJSLS N-Q.1-3 NJSLS FBF.1 CS.5.1.12.A.1-3 CS.5.1.12.B.1-4 CS.5.1.12.C.1-3 CS.5.1.12.D.1-3 CS.5.2.12.C1-2 CS5.2.12.D.1-5 CS5.2.12.E.1-4	**Formative Assessment:** 6. Safety Quiz 7. Diagram of an atom 8. Notebooks 9. circuits 10. Logix Pro program **Summative Assessment** 9. Arduino or Vex Robotics 10. Final Exam/Practical

a. Languages b. Number systems i. Binary ii. Hexadecimal c. Digital Logic i. If/Then statements ii. Boolean algebra d. Analog systems e. Robotics 4. VEX Robotics 5. Arduinos	5. Electricity can generate heat or light 6. Circuits are made up of many components that are able to harness the power of electricity 7. Electrical pulses are used to communicate in the simplest form 8. There are two main numbering systems called binary or hexadecimal. 9. Programs can be written to allow electrical systems to respond to electrical pulses. 10. Logic is a critical aspect of	7. Construct a circuit from a corresponding schematic diagram 8. Convert from traditional English to binary 9. Convert from binary to traditional English 10. Write an "if/then" statement.	students, and students will be able to build corresponding circuits using both a non-solder bread board, and a soldering kit. Students will be able to identify different components in the circuits, and what each component contributes to the overall circuit. 3. Students will use the LogixPro software to write programs that allow a specific outcome. Students will start by programming a garage door to open and shut. Students will have to think about sensors, and how the garage door should operate. 4. Students also will work on programming a traffic light in LogixPro. The traffic light should accommodate two way traffic, and also a crosswalk in all directions. 5. Students will have the opportunity to work with Vex Robotics parts, or Arduinos to create		10 (3,5) 9.3.ST.1-6 9. 9.3.ST-EN.1-6 9.3.AT-SM.1-4 <u>NGSS</u> HS-ETS1-1 HS-ETS1-2 HS-ETS1-3 HS-ETS1-4 Creativity and Innovation Critical Thinking and Problem Solving Communication Collaboration Flexibility & Adaptability Productivity & Accountability Leadership & Responsibility		

	programming any language.		electrical systems and robotics.				

Unit Modifications for Special Population Students:

Struggling Learners	Gifted and Talented Students (Challenge Activities)	English Language Learners	Learners with an IEP	Learners with a 504
• Assist students in getting organized. • Give short directions. • Use drill exercises. • Give prompt cues during student performance. • Let students with poor writing skills use a computer. • Break assignments into small segments and assign only one segment at a time. • Demonstrate skills and have students model them. • Give prompt feedback. • Use continuous assessment to mark students' daily progress. • Prepare materials at varying levels of ability.	• Provide ample opportunities for creative behavior. • Create assignments that call for original work, independent learning, critical thinking, problem solving, and experimentation. • Show appreciation for creative efforts • Respect unusual questions, ideas, and solutions. • Encourage students to test their ideas. • Provide opportunities and give credit for self-initiated learning. • Avoid overly detailed supervision and too much reliance on prescribed curricula. • Allow time for reflection. • Resist immediate and constant evaluation. • Avoid comparisons to other students.	• Use a slow, but natural rate of speech; speak clearly; use shorter sentences; repeat concepts in several ways. • When possible, use pictures, photos, and charts. • Corrections should be limited and appropriate. Do not correct grammar or usage errors in front of the class. • Give honest praise and positive feedback through your voice tones and visual articulation whenever possible. • Encourage students to use language to communicate, allowing them to use their native language to ask/answer questions when they are unable to do so in English. • Integrate students' cultural background into class discussions. • Use cooperative learning where students have opportunities to practice expressing ideas without risking language errors in front of the entire class.	Each special education student has in Individualized Educational Plan (IEP) that details the specific accommodations, modifications, services, and support needed to level the playing field. This will enable that student to access the curriculum to the greatest extent possible in the least restrictive environment. These include: • Variation of time: adapting the time allotted for learning, task completion, or testing • Variation of input: adapting the way instruction is delivered • Variation of output: adapting how a student can respond to instruction • Variation of size: adapting the number of items the student is expected to complete • Modifying the content, process or product Additional resources are outlined to facilitate appropriate behavior and increase student engagement. The most frequently used modifications and accommodations can be viewed here. Teachers are encouraged to use the Understanding by Design Learning Guidelines (UDL). These guidelines offer a set of concrete suggestions that can be applied to any discipline to ensure that all learners can access and participate in	• Refer to page four in the Parent and Educator Guide to Section 504 to assist in the development of appropriate plans.

			learning opportunities. The framework can be viewed here www.udlguidelines.cast.org	

UNIT OVERVIEW

Course Title: *Principles of Engineering and Technological Design (#931)*

Unit #: Unit 7 **Unit Title:** Applications of Engineering Systems

Unit Description and Objectives:
This unit gives students a chance to apply what was learned in other units to solve real world problems. Students have the opportunity to work on projects that require an interdisciplinary approach and background. In this unit, students will be able to identify individual projects, or work as a group to solve a class assigned problem. Past projects have included designing a custom Map for a History class, a model of the Ben Franklin Bridge, and a Police body camera case for a local company. This unit will require students to apply all previous units.

Essential Questions and Enduring Understandings:

Essential Questions:	**Enduring Understandings/Generalizations Students will understand that:**	**Guiding Questions**
1. What is the desired result?	1. Most engineering projects require an interdisciplinary approach. 2. The engineering design loop should be followed, starting with identifying the problem. 3. Different projects may have different degrees of legality or safety concerns 4. The client should always be consulted prior to finalizing a design. 5. Having a diversified team can help come up with more creative and effective solutions.	1. What is the problem? 2. Who is the solution being designed for? Is it for a specific person or client? Is it for public use? 3. What safety aspects need to be considered? 4. What legal aspects need to be considered? 5. What does the client want? 6. Is there anything the client does not want? 7. Who are the team members? 8. What can each person bring to the team? 9. Should any team members have specific roles, or not have certain responsibilities?
2. How do we achieve the desired result?	1. When creating the design, it is important to consider construction, materials, and forces. 2. Specialists are sometimes consulted when the desired result is outside someone's specialty.	1. How do the materials affect the design? 2. How might the construction affect the design? 3. What other knowledge may be needed for an efficient design? 4. Where can we gather more information on the design, materials, or construction process?

CURRICULUM UNIT PLAN

Course Title/Grade: *Principles of Engineering and Technological Design (#931) 10-12*

Unit Number/Title: **Unit 7- Applications of Engineering Systems**

Conceptual Lens:

Appropriate Time Allocation (# of Days)**:** 30

Primary Content Standards referenced With Cumulative Progress Indicators

8.1.12.A3,4	8.1.12.F.12	9.2.12.C.3,6	
8.1.12.D.5	9.1.12.A.3	9.3.12FN-ACT.1-4	
8.1.12.E.1	9.1.12.A.6		

Topics/Concepts (Incl. time / # days per topic)	**Critical Content (Students Will Know:)**	**Skill Objectives (Students Will Be Able To:)**	**Instructional/Learning Activities & Interdisciplinary Connections**	**Instructional Resources**	**Technology & 21st C Skills Integration (Specify)**	**NJSLS w/ CPI Reference**	**Evaluation/ Assessment:**
1. Define the desired result a. Who is the client? b. What is the client's desire? c. When does the project need to be finished by? d. Where is the project supposed to be? e. Why is there a problem? 2. How do we create a solution?	1. The client is the first consideration to be made when trying to create a solution. 2. Sometimes the municipality may have rules and regulations regarding how the project needs to be carried about. 3. Deadline can alter solutions.	1. Identify the client and the problem 2. Compile a list of questions or information that students will need before creating a solution 3. Research any regulations or other background information. 4. Brainstorm possible solutions that accounts for rules,	1. Students will have the opportunity to create an independent or group project. In the past, students have worked with teachers in other disciplines to create projects. Students can identify their own need, or students can identify a client's need. Examples have been a large map for the history department, podiums for teachers, or projects for clubs and activities. 2. Students could also work on projects that have been	1. AutoDesk Inventor Software 2. Whiteboard 3. Internet 4. Computers 5. Miscellaneous design tools 6. Hand tools, power tools, machines for construction 7. Paper for sketches 8. Wood, plastics, metal materials 9. 3D printer for prototyping	NJSLS 8.1.12.A3,4 8.1.12.D.5 8.1.12.E.1 8.1.12.F.12 9.1.12.A.3 9.1.12.A.6 9.2.12.C.3,6 9.3.12FN-ACT.1-4 CRP1-12 Technology Foundation Standards for Students (NETS) 1 (1,2,3) 2 (1,2,3,4,5) 3 (1,4) 4 (2,4) 5 (3,4) 6 (4) 7 (1,2,5,6) 8 (4,5) 9 (2,5,6)	NJSLS: Gr.11-12, RST 1 NJSLS: Gr.11-12, RST 3 NJSLS: Gr.11-12, RST 4 NJSLS: Gr.11-12, RST 8 NJSLS: Gr.11-12, RST 10 NJSLS: Gr.11-12, WHST 6 NJSLS: Gr.11-12, WHST 10 NJSLS N-Q.1-3 NJSLS S.SRT.6-8 NJSLS A.REI.3 NJSLS F.LE.1 NJSLS S.ID.2 CS.5.1.12.A.1-3 CS.5.1.12.B.1-4 CS.5.1.12.C.1-3 CS.5.1.12.D.1-3 CS5.2.12.E.1-4	**Formative Assessment:** 11. Safety Quiz **Summative Assessment** 11. Marking Period 1 Benchmark TEST 12. Midterm EXAM

a. What do we know about the problem? b. What do we need to know about the problem? c. How can we find out answers to any questions we may have? d. What will need to be considered requiring construction and materials? e. What will be considered successful?	Some deadlines are more important than others 4. Defining the problem can eliminate some possible solutions. 5. A list of questions should be created about the project. 6. Research should be completed before too much time has been invested in any one solution. 7. Working as a team helps come up with more ideas, and better solutions.	construction regulations, materials, construction, and any forces that may affect the outcome. 5. Consult with experts 6. Apply concepts learned regarding forces, mechanical systems, and electrical components 7. Create possible solutions. 8. Decide on one solution and construct a solution. 9. Test a solution and evaluate results	identified as a community need. Examples are redesigning the library layout, working with outside companies to design a body camera case, or exploring drones and designing quadcopters.		10 (3,5) 9.3.ST.1-6 9. 9.3.ST-EN.1-6 9.3.AT-SM.1-4 <u>NGSS</u> HS-ETS1-1 HS-ETS1-2 HS-ETS1-3 HS-ETS1-4 Global awareness Environmental literacy Creativity and Innovation Critical Thinking and Problem Solving Communication Collaboration Flexibility & Adaptability Productivity & Accountability Leadership & Responsibility	CS.5.3.12.C.2 CS.6.1.12.D.12.C-E CS.6.1.12.A.16.A-C CS.6.1.12.B.16.A CS.6.1.12.C.16.A-C CS.6.1.12.D.16.A-C CS.6.2.12.A.6.A-D	

Unit Modifications for Special Population Students:

Struggling Learners	Gifted and Talented Students (Challenge Activities)	English Language Learners	Learners with an IEP	Learners with a 504
• Assist students in getting organized. • Give short directions. • Use drill exercises. • Give prompt cues during student performance. • Let students with poor writing skills use a computer. • Break assignments into small segments and assign only one segment at a time. • Demonstrate skills and have students model them. • Give prompt feedback. • Use continuous assessment to mark students' daily progress. • Prepare materials at varying levels of ability.	• Provide ample opportunities for creative behavior. • Create assignments that call for original work, independent learning, critical thinking, problem solving, and experimentation. • Show appreciation for creative efforts • Respect unusual questions, ideas, and solutions. • Encourage students to test their ideas. • Provide opportunities and give credit for self-initiated learning. • Avoid overly detailed supervision and too much reliance on prescribed curricula. • Allow time for reflection. • Resist immediate and constant evaluation. • Avoid comparisons to other students.	• Use a slow, but natural rate of speech; speak clearly; use shorter sentences; repeat concepts in several ways. • When possible, use pictures, photos, and charts. • Corrections should be limited and appropriate. Do not correct grammar or usage errors in front of the class. • Give honest praise and positive feedback through your voice tones and visual articulation whenever possible. • Encourage students to use language to communicate, allowing them to use their native language to ask/answer questions when they are unable to do so in English. • Integrate students' cultural background into class discussions. • Use cooperative learning where students have opportunities to practice expressing ideas without risking language errors in front of the entire class.	Each special education student has in Individualized Educational Plan (IEP) that details the specific accommodations, modifications, services, and support needed to level the playing field. This will enable that student to access the curriculum to the greatest extent possible in the least restrictive environment. These include: • Variation of time: adapting the time allotted for learning, task completion, or testing • Variation of input: adapting the way instruction is delivered • Variation of output: adapting how a student can respond to instruction • Variation of size: adapting the number of items the student is expected to complete • Modifying the content, process or product Additional resources are outlined to facilitate appropriate behavior and increase student engagement. The most frequently used modifications and accommodations can be viewed here. Teachers are encouraged to use the Understanding by Design Learning Guidelines (UDL). These guidelines offer a set of concrete suggestions that can be	• Refer to page four in the Parent and Educator Guide to Section 504 to assist in the development of appropriate plans.

			applied to any discipline to ensure that all learners can access and participate in learning opportunities. The framework can be viewed here www.udlguidelines.cast.org	

UNIT OVERVIEW

Course Title: *Principles of Engineering and Technological Design (#931)*

Unit #: Unit 8 **Unit Title:** Careers in Engineering

Unit Description and Objectives:
This unit has students explore some of the career paths associated with the field of engineering and technological design. Areas such as civil engineering, mechanical engineering, electrical engineering, design, and engineering technologies are highlighted. Emphasis is placed on educational requirements, salaries and working conditions as well as future job demand. Correlation between business, industry and the economy are also discussed. Different specializations in engineering are introduced, such as aerospace engineering, biomedical engineering, etc.

Essential Questions and Enduring Understandings:

Essential Questions:	**Enduring Understandings/Generalizations Students will understand that:**	**Guiding Questions**
1. What opportunities are available in the field of engineering and design?	1. There are many occupational pathways associated with the area of design. 2. They can access employment information at the government's Occupational Outlook Hand out website. 3. Engineering is a broad field that includes numerous sub sets.	1. What are the four types of engineers? 2. What specializations are possible in engineering? 3. What is the job outlook for different branches of engineering? 4. What does a landscape architect do? 5. What does an architect do? 6. What is the median income for different branches of engineering? 7. What companies do you see as being successful in 10 years? Why?
1. What requirements are standard for individuals wishing to pursue a career in engineering and design?	1. Many times education is an important facet of the design career pathways 2. Some schools cost significantly more than others. 3. For most design occupations, learning is a lifelong endeavor	4. What are the educational requirements of engineering? 5. What are the educational requirements of an architect? 6. What programs are available for engineering? 7. How does the cost of a public school compare with the cost of a private school? 8. Are there any 2 year programs in engineering?

CURRICULUM UNIT PLAN

Course Title/Grade: *Principles of Engineering and Technological Design (#931) 10-12*

Unit Number/Title: **Unit 8- Careers in Engineering**

Conceptual Lens:

Appropriate Time Allocation (# of Days)**:** 30

Primary Content Standards referenced With Cumulative Progress Indicators

8.1.12.A3,4	8.1.12.F.12	9.2.12.C.3,6	
8.1.12.D.5	9.1.12.A.3	9.3.12FN-ACT.1-4	
8.1.12.E.1	9.1.12.A.6		

Topics/Concepts (Incl. time / # days per topic)	**Critical Content (Students Will Know:)**	**Skill Objectives (Students Will Be Able To:)**	**Instructional/Learning Activities & Interdisciplinary Connections**	**Instructional Resources**	**Technology & 21st C Skills Integration (Specify)**	**NJSLS w/ CPI Reference**	**Evaluation/ Assessment:**
I. Career Paths in the Field of Design 1. Engineering a. Chemical b. Civil c. Structural d. Computer e. Environmental 2. Industrial designer 3. Specialized engineering pathways A. Educational requirements 1. four year degree 2. two year degree 3. technical school 4. apprenticeship 5. post graduate degree B. Earnings potential C. Degree cost D. Job Outlook	1. The relationship between education and earnings potential. 2. Engineering is a broad field encompassing many specialty areas. 3. The difference between median, starting and top incomes. 4. The job outlook for at least three design related occupations	1. List three design careers. 2. Recall the job outlook for at least three design related occupations over the next ten years. 3. Distinguish between median, starting and top incomes. 4. Understand the relationship between the design field and many businesses and industries. 5. Follow their stock market investments.	1. Students will find job listings and the requirements for different jobs. 2. Students research how much income is required for independent living. 3. Students use classroom computers and an internet connection to access the federal government's Occupational Outlook Handbook. 4. Students go online to access stock quotes for selected design related industries and invest $10.000 in two different companies. 5. Adults currently employed in the field	Computers Internet Occupational Outlook Handout Excel TSA competitive events	NJSLS 8.1.12.A3,4 8.1.12.D.5 8.1.12.E.1 8.1.12.F.12 9.1.12.A.3 9.1.12.A.6 9.2.12.C.3,6 9.3.12FN-ACT.1-4 CRP1-12 Technology Foundation Standards for Students (NETS) 1 (1,2,3) 2 (1,2,3,4,5) 3 (1,4) 4 (2,4) 5 (3,4) 6 (4) 7 (1,2,5,6) 8 (4,5) 9 (2,5,6)	NJSLS: Gr.11-12, RST 1 NJSLS: Gr.11-12, RST 3 NJSLS: Gr.11-12, RST 4 NJSLS: Gr.11-12, RST 8 NJSLS: Gr.11-12, RST 10 NJSLS: Gr.11-12, WHST 6 NJSLS: Gr.11-12, WHST 10 NJSLS N-Q.1-3 CS.5.1.12.B.1-4 CS.5.1.12.C.1-3 CS.5.3.12.C.2 CS.6.1.12.D	**Formative Assessment:** 1. Stock Portfolio **Summative Assessment** 1. Career Presentation

E. Business and Industry connection	over the next ten years. 5. The relationship between the design field and many businesses and industries. 6. Basic stock market investment techniques.		of engineering give presentations about their careers, challenges, and what they do. 6. Students complete research as aligned in the TSA Career Comparison competition.		10 (3,5) 9.3.ST.1-6 9. 9.3.ST-EN.1-6 9.3.AT-SM.1-4 9.2.12.C.1, 9.2.12.C.2, 9.2.12.C.3, 9.2.12.C.4, 9.2.12.C.5, 9.2.12.C.6, 9.2.12.C.7, 9.2.12.C.8, 9.2.12.C.9 NGSS HS-ETS1-1 HS-ETS1-2 HS-ETS1-3 HS-ETS1-4 Global awareness Environmental literacy Creativity and Innovation Critical Thinking and Problem Solving Communication Collaboration Flexibility & Adaptability		

					Productivity & Accountability Leadership & Responsibility		

Unit Modifications for Special Population Students:

Struggling Learners	Gifted and Talented Students (Challenge Activities)	English Language Learners	Learners with an IEP	Learners with a 504
• Assist students in getting organized. • Give short directions. • Use drill exercises. • Give prompt cues during student performance. • Let students with poor writing skills use a computer. • Break assignments into small segments and assign only one segment at a time. • Demonstrate skills and have students model them. • Give prompt feedback. • Use continuous assessment to mark students' daily progress. • Prepare materials at varying levels of ability.	• Provide ample opportunities for creative behavior. • Create assignments that call for original work, independent learning, critical thinking, problem solving, and experimentation. • Show appreciation for creative efforts • Respect unusual questions, ideas, and solutions. • Encourage students to test their ideas. • Provide opportunities and give credit for self-initiated learning. • Avoid overly detailed supervision and too much reliance on prescribed curricula. • Allow time for reflection. • Resist immediate and constant evaluation. • Avoid comparisons to other students.	• Use a slow, but natural rate of speech; speak clearly; use shorter sentences; repeat concepts in several ways. • When possible, use pictures, photos, and charts. • Corrections should be limited and appropriate. Do not correct grammar or usage errors in front of the class. • Give honest praise and positive feedback through your voice tones and visual articulation whenever possible. • Encourage students to use language to communicate, allowing them to use their native language to ask/answer questions when they are unable to do so in English. • Integrate students' cultural background into class discussions. • Use cooperative learning where students have opportunities to practice expressing ideas without risking language errors in front of the entire class.	Each special education student has in Individualized Educational Plan (IEP) that details the specific accommodations, modifications, services, and support needed to level the playing field. This will enable that student to access the curriculum to the greatest extent possible in the least restrictive environment. These include: • Variation of time: adapting the time allotted for learning, task completion, or testing • Variation of input: adapting the way instruction is delivered • Variation of output: adapting how a student can respond to instruction • Variation of size: adapting the number of items the student is expected to complete • Modifying the content, process or product Additional resources are outlined to facilitate appropriate behavior and increase student engagement. The most frequently used modifications and accommodations can be viewed here. Teachers are encouraged to use the Understanding by Design Learning Guidelines (UDL). These guidelines offer a	• Refer to page four in the Parent and Educator Guide to Section 504 to assist in the development of appropriate plans.

			set of concrete suggestions that can be applied to any discipline to ensure that all learners can access and participate in learning opportunities. The framework can be viewed here www.udlguidelines.cast.org	

CROSS-CONTENT STANDARDS ANALYSIS

Course Title: *Principles of Engineering and Technological Design (#931)* **Grade:** 10-12

Unit Title:	Visual and Performing Arts	Comp. Health & Physical Ed.	English Language Arts	Mathematics	Science	Social Studies	World Languages	Technology	21st Century Life & Careers
Introduction to Engineering			NJSLS: Gr.11-12, RST 1 NJSLS: Gr.11-12, RST 3 NJSLS: Gr.11-12, RST 4 NJSLS: Gr.11-12, RST 8 NJSLS: Gr.11-12, RST 10 NJSLS: Gr.11-12, WHST 6 NJSLS: Gr.11-12, WHST 10	NJSLS N-Q.1-3	CS.5.3.12.C.1 NGSS HS-ETS1-1 HS-ETS1-2 HS-ETS1-3 HS-ETS1-4				
The Resources of Technology and Safety			NJSLS: Gr.11-12, RST 1 NJSLS: Gr.11-12, RST 3 NJSLS: Gr.11-12, RST 4 NJSLS: Gr.11-12, RST 8 NJSLS: Gr.11-12, RST 10 NJSLS: Gr.11-12, WHST 6 NJSLS: Gr.11-12, WHST 10	NJSLS N-Q.1-3	CS.5.1.12.A.1-3 CS.5.1.12.C.1-3 CS.5.2.12.A.5-6 NGSS HS-ETS1-1 HS-ETS1-2 HS-ETS1-3 HS-ETS1-4			9.3.ST.1-6 9. 9.3.ST-EN.1-6 9.3.AT-SM.1-4	
The Engineering Design Process	CS1.1.12.D.1		NJSLS: Gr.11-12, RST 1 NJSLS: Gr.11-12, RST 3 NJSLS: Gr.11-12, RST 4 NJSLS: Gr.11-12, RST 8 NJSLS: Gr.11-12, RST 10 NJSLS: Gr.11-12, WHST 6 NJSLS: Gr.11-12, WHST 10	NJSLS N-Q.1-3 NJSLS S.ID.9	CS.5.1.12.A.1-.3 CS.5.1.12.B.1-4 CS.5.1.12.C.1-3 CS.5.1.12.D.1-3 NGSS HS-ETS1-1			9.3.ST.1-6 9. 9.3.ST-EN.1-6 9.3.AT-SM.1-4	

					HS-ETS1-2 HS-ETS1-3 HS-ETS1-4				
Civil Engineering			NJSLS: Gr.11-12, RST 1 NJSLS: Gr.11-12, RST 3 NJSLS: Gr.11-12, RST 4 NJSLS: Gr.11-12, RST 8 NJSLS: Gr.11-12, RST 10 NJSLS: Gr.11-12, WHST 1.a NJSLS: Gr.11-12, WHST 1.c NJSLS: Gr.11-12, WHST 6 NJSLS: Gr.11-12, WHST 10	NJSLS N-Q.1-3 NJSLS S.SRT.6-8 NJSLS G.MG.1-3 NJSLS G.SRT.10 NJSLS G.SRT.11 NJSLS G.GMP.1 NJSLS G.GMP.13	CS.5.1.12.A.1-3 CS.5.1.12.B.1-4 CS.5.1.12.C.1-3 CS.5.1.12.D.1-3 CS5.2.12.D.1-5 CS5.2.12.E.1-4 <u>NGSS</u> HS-ETS1-1 HS-ETS1-2 HS-ETS1-3 HS-ETS1-4 HS-PS2-1 HS-PS2-2 HS-PS2-3 HS-PS2-4 HS-PS2-5			9.3.ST.1-6 9. 9.3.ST-EN.1-6 9.3.AT-SM.1-4 9.3.ST.1-6 9. 9.3.ST-EN.1-6 9.3.AT-SM.1-4	
Mechanical Engineering			NJSLS: Gr.11-12, RST 1 NJSLS: Gr.11-12, RST 3 NJSLS: Gr.11-12, RST 4 NJSLS: Gr.11-12, RST 8 NJSLS: Gr.11-12, RST 10 NJSLS: Gr.11-12, WHST 6 NJSLS: Gr.11-12, WHST 10	NJSLS N-Q.1-3 NJSLS S.SRT.6-8 NJSLS G.MG.1-3 NJSLS G.SRT.10 NJSLS G.SRT.11 NJSLS G.GMP.1 NJSLS G.GMP.13	CS.5.1.12.A.1-.3 CS.5.1.12.B.1-4 CS.5.1.12.C.1-3 CS.5.1.12.D.1-3 CS.5.2.12.C1-2 CS5.2.12.D.1-5 CS5.2.12.E.1-4 <u>NGSS</u> HS-ETS1-1 HS-ETS1-2 HS-ETS1-3 HS-ETS1-4 HS-PS2-1 HS-PS2-2 HS-PS2-3 HS-PS2-4 HS-PS2-5			9.3.ST.1-6 9. 9.3.ST-EN.1-6 9.3.AT-SM.1-4	

Electrical Engineering			NJSLS: Gr.11-12, RST 1 NJSLS: Gr.11-12, RST 3 NJSLS: Gr.11-12, RST 4 NJSLS: Gr.11-12, RST 8 NJSLS: Gr.11-12, RST 10 NJSLS: Gr.11-12, WHST 1.a NJSLS: Gr.11-12, WHST 1.c NJSLS: Gr.11-12, WHST 6 NJSLS: Gr.11-12, WHST 10	NJSLS N-Q.1-3 NJSLS FBF.1	CS.5.1.12.A.1-3 CS.5.1.12.B.1-4 CS.5.1.12.C.1-3 CS.5.1.12.D.1-3 CS.5.2.12.C1-2 CS5.2.12.D.1-5 CS5.2.12.E.1-4 <u>NGSS</u> HS-ETS1-1 HS-ETS1-2 HS-ETS1-3 HS-ETS1-4			9.3.ST.1-6 9. 9.3.ST-EN.1-6 9.3.AT-SM.1-4	
Applications in Engineering Technologies	CS1.1.12.D.1		NJSLS: Gr.11-12, RST 1 NJSLS: Gr.11-12, RST 3 NJSLS: Gr.11-12, RST 4 NJSLS: Gr.11-12, RST 8 NJSLS: Gr.11-12, RST 10 NJSLS: Gr.11-12, WHST 6 NJSLS: Gr.11-12, WHST 10	NJSLS N-Q.1-3 NJSLS S.SRT.6-8 NJSLS A.REI.3 NJSLS F.LE.1 NJSLS S.ID.2	CS.5.1.12.A.1-3 CS.5.1.12.B.1-4 CS.5.1.12.C.1-3 CS.5.1.12.D.1-3 CS5.2.12.E.1-4 CS.5.3.12.C.2 <u>NGSS</u> HS-ETS1-1 HS-ETS1-2 HS-ETS1-3 HS-ETS1-4	CS.6.1.12.D.12.C-E CS.6.1.12.A.16.A-C CS.6.1.12.B.16.A CS.6.1.12.C.16.A-C CS.6.1.12.D.16.A-C CS.6.2.12.A.6.A-D		9.3.ST.1-6 9. 9.3.ST-EN.1-6 9.3.AT-SM.1-4	
Careers in Engineering			NJSLS: Gr.11-12, RST 1 NJSLS: Gr.11-12, RST 3 NJSLS: Gr.11-12, RST 4 NJSLS: Gr.11-12, RST 8 NJSLS: Gr.11-12, RST 10 NJSLS: Gr.11-12, WHST 6 NJSLS: Gr.11-12, WHST 10	NJSLS N-Q.1-3	CS.5.1.12.B.1-4 CS.5.1.12.C.1-3 CS.5.3.12.C.2 <u>NGSS</u> HS-ETS1-1 HS-ETS1-2 HS-ETS1-3 HS-ETS1-4	CS.6.1.12.D		9.3.ST.1-6 9. 9.3.ST-EN.1-6 9.3.AT-SM.1-4	9.2.12.C.1, 9.2.12.C.2, 9.2.12.C.3, 9.2.12.C.4, 9.2.12.C.5, 9.2.12.C.6, 9.2.12.C.7, 9.2.12.C.8, 9.2.12.C.9

***All content areas may not be applicable in a particular course.**

Washington Township Public Schools
Department of Student Personnel Services

CURRICULUM MODIFICATION

The regular curriculum is modified for Special Education students enrolled in both self-contained and resource center classes.

Each special education student has in Individualized Educational Plan (IEP) that details the specific accommodations, modifications, services, and support needed to level the playing field. This will enable that student to access the curriculum to the greatest extent possible in the least restrictive environment. These include:

- Variation of time: adapting the time allotted for learning, task completion, or testing
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- Variation of output: adapting how a student can respond to instruction
- Variation of size: adapting the number of items the student is expected to complete
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Additional resources are outlined to facilitate appropriate behavior and increase student engagement. The most frequently used modifications and accommodations can be viewed here.

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