



## **Transportation Technology III - Intermediate Auto Maintenance and Servicing**

**Course Information**

<b>Grade(s):</b>	10-12
<b>Discipline/Course:</b>	Technology Education
<b>Course Title:</b>	Transportation Technology III: Intermediate Auto Maintenance and Servicing
<b>Prerequisite(s):</b>	Transportation Technology II or teacher permission
<b>Course Description:</b> <i>Program of Studies</i>	Students will continue the study of Auto Maintenance and Servicing, with a deeper exploration of basic auto maintenance and servicing practices. Students will build on their previous knowledge of basic automobile maintenance and servicing through exploration of more complex systems of the Automobile. Hands-on experience in the Automotive Lab as well as theory of operation will be employed. Additional elements of the course will include the investigation of other forms of transportation and transportation systems.
<b>Course Essential Questions:</b>	<ul style="list-style-type: none"> <li>● How do mechanical skills and technological problem solving methods interact to diagnose and repair automotive systems?</li> <li>● How do various technologies in mechanical, electrical and fuel systems play a role in the function, efficiency, and emission control of automotive systems?</li> <li>● How do alternate sources of energy provide an alternative to present and future automotive systems?</li> <li>● How do I troubleshoot problems that arise during mechanical repair?</li> <li>● How do I evaluate success while working on mechanical projects?</li> </ul>
<b>Course Enduring Understandings:</b>	<ul style="list-style-type: none"> <li>● Transportation systems utilize natural resources which benefit society.</li> <li>● Mechanical skills and technological problem solving can be rewarding to diagnose and repair automotive systems and related technologies.</li> <li>● Various technologies in mechanical, electrical and fuel systems play an important role in the function, efficiency, and emission control of automotive systems.</li> <li>● Sources of energy are being utilized in automotive systems both now and in the future.</li> <li>● Logical problem solving methods are utilized to efficiently and correctly use resources, tools and machines to diagnose and repair automotive systems.</li> </ul>

	<ul style="list-style-type: none"> <li>Math and science concepts are applied in automotive systems to solve practical mechanical problems.</li> </ul>
<b>Duration: Credit:</b>	1 year; 1 credit
<b>Course Materials/ Resources:</b>	Equipment and Consumables Textbook - Modern Automotive Technology - by J. E. Duffy
<b>FPS Course Academic Expectation(s):</b>	EU - Exploring and Understanding CC - Creating and Constructing
<b>Year at a Glance (Units)</b>	Unit 1 - Safety in the Automobile Repair Facility (2 weeks) Unit 2 - Engine Fundamentals and Design (2-3 weeks) Unit 3 - On Board Diagnostics and Troubleshooting (3-4 weeks) Unit 4 - Brake Servicing, Anti-Lock Brakes, Traction and Stability Control (6-7 weeks) Unit 5 - Basic Electricity/Electronics (5-6 weeks) Unit 6 - Ignition Systems & Computer Systems (4-5 weeks) Unit 7 - Charging Systems & Starting Systems (2-3 weeks) Unit 8 - Fuel and Emissions Systems (3-4 weeks) Unit 9 - Fuel Systems (3-4 weeks) Unit 10 -Steering and Suspension Systems (4-5 week) Unit 11- Hybrid and EV Systems Exploration (4-5 weeks)

<b>Unit Number and Title:</b>	Unit 1 – Safety in the Automobile Repair Facility
<b>Duration:</b>	2 Weeks
<b>Resource(s):</b>	Textbook, Equipment & Consumables
<b>Unit Overview:</b>	Students will learn how to actively incorporate safety while working in a mechanics shop/lab and practice general shop safety practices.
<b>Learning Goals</b>	
<b>Standard(s):</b>	<p>AUTO.01 Students demonstrate the value and necessity of practicing personal and occupational safety and protecting the environment by using materials and processes in accordance with manufacturer and industry standards.</p> <p>AUTO.01.04 Describe a safe working environment for both employees and the shop environment.</p> <p>AUTO.01.05 Demonstrate and explain knowledge of personal safety practices such as eyewear, clothing, footwear, and personal protective equipment (PPE).</p> <p>AUTO.01.06 Demonstrate and explain knowledge of shop safety procedures when performing tasks, such as raising a vehicle with a floor jack.</p> <p>AUTO.01.07 Identify basic hand tools and their usage in the automotive industry.</p> <p>AUTO.03.05 Describe principles of pneumatic and hydraulic power and their applications.</p>
<b>Essential Question(s):</b>	<ul style="list-style-type: none"> <li>• How can I demonstrate the value and necessity of practicing personal and occupational safety and protecting the environment by using materials and processes in accordance with manufacturer and industry standards?</li> </ul>
<b>Enduring Understanding(s):</b>	<ul style="list-style-type: none"> <li>• Technology and engineering are fundamental human activities requiring a range of skills</li> <li>• Technology and engineering are interdisciplinary, requiring the application of knowledge and skills related to science, math, and the arts</li> <li>• Safety is a lifestyle which impacts our entire environment</li> </ul>
<b>Learning Goal(s):</b> <i>Students will know and will be able to use their learning</i>	<p><b>Content:</b> (Students will know...)</p> <ul style="list-style-type: none"> <li>• safety rules and procedures for the transportation/auto shop.</li> <li>• application of selected tools and machines for working on automobiles.</li> </ul>

<i>to:</i> (Content/ Skills)	<b><i>Skills:</i></b> (Students will be able to...) <ul style="list-style-type: none"><li>● demonstrate proper tool use.</li><li>● demonstrate proper safety skills.</li><li>● use common automotive repair tools properly.</li><li>● demonstrate how to use several of the common measuring tools used in auto diagnoses and repair with proper techniques.</li></ul>
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<b>Unit Number and Title:</b>	Unit 2– Engine Fundamentals and Design
<b>Duration:</b>	2-3 weeks
<b>Resource(s):</b>	Equipment & Consumables
<b>Unit Overview:</b>	Students will gain an understanding of common engine design configurations, components and operation fundamentals
<b>Learning Goals</b>	
<b>Standard(s):</b>	<p>AUTO.03 Explain scientific principles in relation to chemical, mechanical, and physical functions for various engine and vehicle systems.</p> <p>AUTO.03.01 Demonstrate the operating principles of internal and external combustion engines</p> <p>AUTO.03.02 Describe basic valve train operation and configuration, such as DOHC, SOHC, OHV, and flathead.</p> <p>AUTO.03.03 Describe basic engine cylinder configurations such as V, inline, and horizontally opposed.</p> <p>AUTO.03.04 Identify and describe the function of the basic engine components.</p>
<b>Essential Question(s):</b>	<ul style="list-style-type: none"> <li>• What is the impact of the internal combustion engine on our society?</li> </ul>
<b>Enduring Understanding(s):</b>	<ul style="list-style-type: none"> <li>• Technology and engineering are fundamental human activities requiring a range of skills</li> <li>• Technology and engineering are interdisciplinary, requiring the application of knowledge and skills related to science, math, and the arts</li> </ul>
<b>Learning Goal(s):</b> <i>Students will know and will be able to use their learning to:</i> (Content/ Skills)	<p><b>Content:</b> (Students will know...)</p> <ul style="list-style-type: none"> <li>• operating principles of internal and external combustion engines</li> <li>• basic engine parts and their function</li> <li>• basic function of the major parts of an automotive engine</li> </ul> <p><b>Skills:</b> (Students will be able to...)</p> <ul style="list-style-type: none"> <li>• describe different engine design classifications.</li> <li>• identify the major parts of a typical automotive engine.</li> <li>• describe the four stroke cycle.</li> <li>• identify different types of engine design.</li> </ul>

<b>Unit Number and Title:</b>	Unit 3 – On Board Diagnostics and Troubleshooting
<b>Duration:</b>	3-4 weeks
<b>Resource(s):</b>	Equipment & Consumables
<b>Unit Overview:</b>	Students will be able to understand the purpose and operation of on-board diagnostic systems and the use of scan tools to diagnose commonly found diagnostic trouble codes on today's autos. Students will use the scan tool to scan for problems in the engine and its support systems, the emission system, the transmission, the suspension system, the anti-lock brake system, and other vehicle systems.
<b>Learning Goals</b>	
<b>Standard(s):</b>	AUTO.07 Engine Performance: Describe the components and functions of the various systems that are related to engine performance. AUTO.07.04 Explain the use of a computer scanner to read Diagnostic Trouble Codes (DTC).
<b>Essential Question(s):</b>	<ul style="list-style-type: none"> <li>• Why is it important to understand relationships between systems which function together?</li> <li>• How does knowledge from other content areas (Math, Science, the Arts), help us solve problems?</li> </ul>
<b>Enduring Understanding(s):</b>	<ul style="list-style-type: none"> <li>• Technology and engineering are fundamental human activities requiring a range of skills</li> <li>• Technology and engineering are interdisciplinary, requiring the application of knowledge and skills related to science, math, and the arts</li> </ul>
<b>Learning Goal(s):</b> <i>Students will know and will be able to use their learning to:</i> (Content/ Skills)	<p><b>Content:</b> (Students will know...)</p> <ul style="list-style-type: none"> <li>• modern automotive computer systems, their functions and how they are designed to detect problems and indicate where issues might be located.</li> <li>• how to check the operation of electrical-electronic parts in major vehicle systems.</li> <li>• how to use a scan tool to detect operating conditions of major automobile systems.</li> </ul> <p><b>Skills:</b> (Students will be able to...)</p> <ul style="list-style-type: none"> <li>• discuss the purpose and operation of on-board diagnostic systems.</li> </ul>

- explain the use of scan tools to simplify reading of trouble codes.
- locate the data link connector on most makes and models of cars.
- activate on-board diagnostics and read trouble codes with a scan tool.
- erase diagnostic trouble codes.
- scan for problems in the engine and its support systems.
- use a scan tool to monitor the operation of electrical and electronic components.



<b>Unit Number and Title:</b>	Unit 4 – Brake Servicing, Anti-Lock Brakes, Traction and Stability Control
<b>Duration:</b>	6-7 weeks
<b>Resource(s):</b>	Equipment & Consumables
<b>Unit Overview:</b>	Students will be able to diagnose common brake system problems, inspect and maintain a brake system, and explain how to service disc and drum brake assemblies.
<b>Learning Goals</b>	
<b>Standard(s):</b>	<p>AUTO.09 Demonstrate function and principles of automotive drivetrain, steering and suspension, brake, and tire and wheel components and systems in accordance with portable national industry standards.</p> <p>ENG.09.01 Identify what causes resistance in a fluid system.</p> <p>ENG.09.02 Describe the following components and applications of fluid power principles: reservoir, fluid conductors, valves, pumps, actuators, Pascal’s Law, and Bernoulli’s Principle.</p> <p>ENG.09.03 Describe components of hydraulic and pneumatic systems.</p> <p>ENG.09.04 Describe work in electrical, mechanical, fluid and thermal systems. ENG.09.05 Explain rate in electrical, mechanical, fluid and thermal systems. ENG.09.06 Describe resistance in electrical, mechanical, fluid and thermal systems.</p>
<b>Essential Question(s):</b>	<ul style="list-style-type: none"> <li>● What problem solving steps should be used to diagnose a condition</li> <li>● How can we choose the best tools to use for a particular task or to solve a problem?</li> <li>● How does knowledge from other content areas (Math, Science, the Arts), help us solve problems?</li> </ul>
<b>Enduring Understanding(s):</b>	<ul style="list-style-type: none"> <li>● Mechanical skills and technological problem-solving can be rewarding to diagnose and repair automotive systems and related technologies.</li> </ul>
<b>Learning Goal(s):</b> <i>Students will know and will be able to use their learning to:</i> (Content/ Skills)	<b>Content:</b> (Students will know...) <ul style="list-style-type: none"> <li>● brake system components and how they operate.</li> <li>● the major functions of a brake system.</li> <li>● how anti-lock brakes, traction control, and stability control help in controlling a modern vehicle.</li> <li>● the hydraulic and mechanical principles of a brake system.</li> </ul>

**Skills:** (Students will be able to...)

- diagnose and repair a vehicle's brake system.
- explain how to service disc and drum brake systems.
- describe procedures for bleeding a brake system
- identify the major parts of an automotive brake system.
- identify the major parts of a typical anti-lock brake system.
- describe the operation of anti-lock brake systems. .
- inspect and maintain a brake system.
- compare disc and drum brakes.
- describe the purpose and operation of traction control and stability control systems.

<b>Unit Number and Title:</b>	Unit 5 – Basic Electricity/Electronics
<b>Duration:</b>	5-6 weeks
<b>Resource(s):</b>	Equipment & Consumables
<b>Unit Overview:</b>	Students will develop an understanding as to how electricity and electronics function in a vehicle. Construction of basic electricity and electronic circuitry will be explored.
<b>Learning Goals</b>	
<b>Standard(s):</b>	<p>AUTO.06 Demonstrate the function, principles, and operation of electrical and electronic systems using manufacturer and industry standards.</p> <p>AUTO.06.06 Differentiate between series and parallel circuits.</p> <p>AUTO.06.07 Define volts, amperes, and resistance.</p> <p>AUTO.06.08 Perform simple calculations for volts, amperes, and resistance using Ohm’s Law.</p> <p>ENG.08 Demonstrate the application of science and math principles to the electrical engineering process.</p> <p>ENG.08.02 Describe and apply the following electricity principles: Ohm's, Watt's, series, parallel, combination circuits, AC/DC systems, and conductors/insulators</p> <p>ENG.08.03 Use appropriate electrical units to solve problems.</p> <p>ENG.08.04 Draw a circuit diagram and lay out the circuit.</p> <p>ENG.08.05 Describe work in electrical systems.</p> <p>ENG.08.06 Explain rate in electrical systems.</p> <p>ENG.08.07 Describe resistance in electrical systems</p>
<b>Essential Question(s):</b>	<ul style="list-style-type: none"> <li>• Why is knowledge of how electricity functions essential in modern auto repair?</li> <li>• How does knowledge from other content areas (Math, Science, the Arts), help us solve problems?</li> </ul>
<b>Enduring Understanding(s):</b>	<ul style="list-style-type: none"> <li>• Transportation systems use electrical energy to work</li> <li>• Technology and engineering are fundamental human activities requiring a range of skills</li> <li>• Technology and engineering are interdisciplinary, requiring the application of knowledge and</li> </ul>

	skills related to science, math, and the arts
<b>Learning Goal(s):</b> <i>Students will know and will be able to use their learning to:</i> (Content/ Skills)	<p><b>Content:</b> Students will know...</p> <ul style="list-style-type: none"> <li>● how electricity functions in basic electrical and electronic components in a vehicle.</li> <li>● the process of building simple electronic components for specific applications.</li> </ul> <p><b>Skills:</b> (Students will be able to...)</p> <ul style="list-style-type: none"> <li>● identify basic electricity and electronic terms and components.</li> <li>● build a simple electronic circuit board.</li> <li>● compare voltage, current and resistance.</li> <li>● explain the principles of electricity.</li> <li>● describe the action of basic electric circuits and devices.</li> <li>● describe the principles of magnetism and magnetic fields.</li> <li>● apply electrical troubleshooting methods to determine circuit problems.</li> </ul>

<b>Unit Number and Title:</b>	Unit 6 – Ignition Systems & Computer Systems
<b>Duration:</b>	4-5 weeks
<b>Resource(s):</b>	Equipment & Consumables
<b>Unit Overview:</b>	Students will develop an understanding of ignition systems and computer systems in a vehicle. Construction of basic electricity and electronic circuitry will be explored.
<b>Learning Goals</b>	
<b>Standard(s):</b>	AUTO.06 Demonstrate the function, principles, and operation of electrical and electronic systems using manufacturer and industry standards. AUTO.06.01 Maintain, diagnose, and repair electrical systems. AUTO.07 Engine Performance: Describe the components and functions of the various systems that are related to engine performance. AUTO.07.01 Describe the purpose, operation, and basic components of the ignition system AUTO.07.04 Explain the use of a computer scanner to read Diagnostic Trouble Codes
<b>Essential Question(s):</b>	<ul style="list-style-type: none"> <li>• Why is knowledge of how electricity functions essential in modern auto repair?</li> <li>• How does knowledge from other content areas (Math, Science, the Arts), help us solve problems?</li> </ul>
<b>Enduring Understanding(s):</b>	<ul style="list-style-type: none"> <li>• Transportation systems use electrical energy to work</li> <li>• Technology and engineering are fundamental human activities requiring a range of skills</li> <li>• Technology and engineering are interdisciplinary, requiring the application of knowledge and skills related to science, math, and the arts</li> </ul>
<b>Learning Goal(s):</b> <i>Students will know and will be able to use their learning to:</i> (Content/ Skills)	<b>Content:</b> (Students will know...) <ul style="list-style-type: none"> <li>• operating principles of an automotive ignition system.</li> <li>• the function of major ignition system components.</li> <li>• how a computer uses sensor inputs to determine correct outputs.</li> <li>• how electronics, ignition systems and computers operate to efficiently control an automobile.</li> </ul>

**Skills:** (Students will be able to...)

- identify and describe the function of an automotive ignition system's components
- use a scan tool to detect abnormal operating conditions.
- maintain, diagnose, and repair electrical systems
- measure electrical voltage, resistance and amperage in auto components and systems

<b>Unit Number and Title:</b>	Unit 7 – Charging & Starting Systems
<b>Duration:</b>	2-3 weeks
<b>Resource(s):</b>	Equipment & Consumables
<b>Unit Overview:</b>	Students will develop an understanding of charging and starting systems in a vehicle. Construction of basic electricity and electronic circuitry will be explored.
<b>Learning Goals</b>	
<b>Standard(s):</b>	AUTO.06 Demonstrate the function, principles, and operation of electrical and electronic systems using manufacturer and industry standards. AUTO.06.01 Maintain, diagnose, and repair electrical systems. AUTO.06.03 Describe the purpose, operation, and components of basic starting systems. AUTO.06.04 Describe the purpose, operation, and components of basic charging systems.
<b>Essential Question(s):</b>	<ul style="list-style-type: none"> <li>• Why is knowledge of how electricity functions essential in modern auto repair?</li> <li>• How does knowledge from other content areas (Math, Science, the Arts), help us solve problems?</li> </ul>
<b>Enduring Understanding(s):</b>	<ul style="list-style-type: none"> <li>• Transportation systems use electrical energy to work</li> <li>• Technology and engineering are fundamental human activities requiring a range of skills</li> <li>• Technology and engineering are interdisciplinary, requiring the application of knowledge and skills related to science, math, and the arts</li> </ul>
<b>Learning Goal(s):</b> <i>Students will know and will be able to use their learning to:</i> (Content/ Skills)	<b>Content:</b> (Students will know...) <ul style="list-style-type: none"> <li>• the purpose, operation, and components of basic starting systems.</li> <li>• the purpose, operation, and components of basic charging systems.</li> </ul> <b>Skills:</b> (Students will be able to...) <ul style="list-style-type: none"> <li>• compare voltage, current and resistance in charging and starting system components</li> <li>• diagnose common problems in charging and starting system components</li> <li>• replace system components on a vehicle.</li> <li>• apply electrical and mechanical troubleshooting methods to determine problems</li> </ul>

<b>Unit Number and Title:</b>	Unit 8 –Fuel and Emission Controls
<b>Duration:</b>	3-4 weeks
<b>Resource(s):</b>	Equipment & Consumables
<b>Unit Overview:</b>	Students will develop an understanding of fuel systems and emission control systems in a vehicle. Construction of basic electricity and electronic circuitry will be explored.
<b>Learning Goals</b>	
<b>Standard(s):</b>	<p>Auto.07 Engine Performance: Describe the components and functions of the various systems that are related to engine performance.</p> <p>AUTO.07.02 Describe the purpose, operation, and basic components of fuel and air induction systems.</p> <p>AUTO.07.03 Describe the purpose, operation, and basic components of exhaust and exhaust emissions system</p> <p>AUTO.07.04 Explain the use of a computer scanner to read Diagnostic Trouble Codes</p> <p>AUTO.07.05 Identify the differences between carburetion and fuel injection.</p> <p>AUTO.07.06 Describe the purpose, operation, and basic components of evaporative emission control systems.</p>
<b>Essential Question(s):</b>	<ul style="list-style-type: none"> <li>• How is engine performance managed by the fuel and emissions systems in a modern automobile?</li> <li>• How does knowledge from other content areas (Math, Science, the Arts), help us solve problems?</li> </ul>
<b>Enduring Understanding(s):</b>	<ul style="list-style-type: none"> <li>• Technology and engineering are fundamental human activities requiring a range of skills</li> <li>• Technology and engineering are interdisciplinary, requiring the application of knowledge and skills related to science, math, and the arts</li> </ul>
<b>Learning Goal(s):</b> <i>Students will know and will be able to use their learning</i>	<p><b>Content:</b> (Students will know...)</p> <ul style="list-style-type: none"> <li>• the purpose, operation, and basic components of fuel systems</li> <li>• the purpose, operation, and basic components exhaust emissions system</li> </ul>



<i>to:</i> (Content/ Skills)	<ul style="list-style-type: none"><li>● explain the use of a computer scanner to read Diagnostic Trouble Codes</li><li>● the purpose, operation, and basic components of evaporative emission control systems.</li></ul> <p><b>Skills:</b> (Students will be able to...)</p> <ul style="list-style-type: none"><li>● identify the differences between carburetion and fuel injection.</li><li>● describe how a fuel system functions</li><li>● evaluate the condition and operation of a fuel system</li><li>● describe how an emission system functions</li><li>● evaluate the condition and operation of an emission system</li><li>● use a computer scanner to read Diagnostic Trouble Codes</li></ul>
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<b>Unit Number and Title:</b>	Unit 9 -Suspension and Steering
<b>Duration:</b>	3-4 weeks
<b>Resource(s):</b>	Equipment & Consumables
<b>Unit Overview:</b>	Students will focus on identifying and understanding components that make up suspension and steering systems and their functions on modern automobiles .
<b>Learning Goals</b>	
<b>Standard(s):</b>	AUTO.08 Suspension and Steering: Identify and describe the function of the components that make up suspension and steering systems. AUTO.08.01 Describe the purpose, operation, and basic components of the steering system. AUTO.08.02 Describe the purpose, operation, and basic components of the suspension system. AUTO.08.03 Explain caster, camber, and toe-in wheel alignment angles. AUTO.08.04 Identify factors that cause abnormal tire wear.
<b>Essential Question(s):</b>	<ul style="list-style-type: none"> <li>• How do the components that make up suspension and steering systems impact vehicle performance?</li> <li>• How does knowledge from other content areas (Math, Science, the Arts), help us solve problems?</li> </ul>
<b>Enduring Understanding(s):</b>	<ul style="list-style-type: none"> <li>• Technology and engineering are fundamental human activities requiring a range of skills</li> <li>• Technology and engineering are interdisciplinary, requiring the application of knowledge and skills related to science, math, and the arts</li> </ul>
<b>Learning Goal(s):</b> <i>Students will know and will be able to use their learning to:</i> (Content/ Skills)	<b>Content:</b> (Students will know...) <ul style="list-style-type: none"> <li>• the purpose, operation, and basic components of the steering system.</li> <li>• the purpose, operation, and basic components of the suspension system.</li> </ul> <b>Skills:</b> (Students will be able to...) <ul style="list-style-type: none"> <li>• explain caster, camber, and toe-in wheel alignment angles.</li> </ul>

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|  | <ul style="list-style-type: none"><li>● identify factors that cause abnormal tire wear.</li><li>● evaluate the condition of suspension and steering components</li><li>● perform repairs of worn components</li></ul> |
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<b>Unit Number and Title:</b>	Unit 10 –Hybrid and EV Systems Exploration
<b>Duration:</b>	4-5 weeks
<b>Resource(s):</b>	Textbook, Equipment & Consumables
<b>Unit Overview:</b>	In this unit students will be exploring typical hybrid and EV drive systems. The exploration of hybrid and EV systems will include the major assemblies: batteries, motors, motor-generators, internal combustion engines, control systems, charging systems and cooling systems.
<b>Learning Goals</b>	
<b>Standard(s):</b>	AUTO.06 Demonstrate the function, principles, and operation of electrical and electronic systems using manufacturer and industry standards. AUTO.06.01 Maintain, diagnose, and repair electrical systems. AUTO.06.02 Explain the process for performing battery diagnosis and service.
<b>Essential Question(s):</b>	<ul style="list-style-type: none"> <li>• How is engine performance managed by the fuel and emissions systems on a modern automobile?</li> <li>• How does knowledge from other content areas (Math, Science, the Arts), help us solve problems?</li> </ul>
<b>Enduring Understanding(s):</b>	<ul style="list-style-type: none"> <li>• Technology and engineering are fundamental human activities requiring a range of skills</li> <li>• Technology and engineering are interdisciplinary, requiring the application of knowledge and skills related to science, math, and the arts</li> </ul>
<b>Learning Goal(s):</b> <i>Students will know and will be able to use their learning to:</i> (Content/ Skills)	<p><b>Content:</b> (Students will know...)</p> <ul style="list-style-type: none"> <li>• types of hybrid drive systems: full hybrid, series hybrid, parallel hybrid, series-parallel hybrid</li> <li>• components of typical hybrid systems</li> <li>• components of typical EV drive systems</li> </ul> <p><b>Skills:</b> (Students will be able to...)</p> <ul style="list-style-type: none"> <li>• describe the differences between hybrid and EV systems</li> </ul>

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|  | <ul style="list-style-type: none"><li>● describe how different systems apply torque to the vehicle's drive train.</li><li>● describe how series-parallel hybrid systems can recharge the HV battery</li><li>● evaluate the advantages various hybrid and EV systems</li></ul> |
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<b>Unit Number and Title:</b>	Unit 11 – Engineering Design Experience
<b>Duration:</b>	4-5 weeks
<b>Resource(s):</b>	Equipment & Consumables
<b>Unit Overview:</b>	Using design-based learning approaches students will design, build and evaluate a fixed path or variable path transportation system. Exploration of various systems including electrical, aerodynamics and other vehicle design factors will be evaluated.
<b>Learning Goals</b>	
<b>Standard(s):</b>	<p>ITEEA (International Technology and Engineering Educators Association) Standards for Technological and Engineering Literacy (STEL)</p> <p>STEL-2M. Differentiate between inputs, processes, outputs, and feedback in technological systems.</p> <p>STEL-3G. Explain how knowledge gained from other content areas affects the development of technological products and systems</p> <p>STEL-7N. Practice successful design skills.</p> <p>STEL-7O. Apply tools, techniques and materials in a safe manner as part of the design process.</p> <p>STEL-7Q. Apply the technology and engineering design process.</p> <p>STEL-7V. Improve essential skills necessary to successfully design.</p> <p>TRAN.02 Define transportation technology systems.</p> <p>TRAN.02.04 Design, build and evaluate a simple fixed path or variable path transportation system.</p> <p>TRAN.02.07 Identify, design and apply and the uses of different energy and power technologies.</p> <p>TRAN.02.08 Use design-based learning approaches that intentionally integrate the content and process of science and/or mathematics education with the content and process of technology and/or engineering education.</p>
<b>Essential Question(s):</b>	<ul style="list-style-type: none"> <li>● How does knowledge from other content areas (Math, Science, the Arts), help us solve problems?</li> <li>● How do electrical inputs and outputs impact vehicle function?</li> <li>● What type of front, top and rear end design will benefit the aerodynamics of the vehicle?</li> <li>● How does vehicle design factor into its efficiencies and performance?</li> </ul>

<b>Enduring Understanding(s):</b>	<ul style="list-style-type: none"> <li>● Transportation systems use energy sources to work</li> <li>● Technology and engineering are fundamental human activities requiring a range of skills</li> <li>● Technology and engineering are interdisciplinary, requiring the application of knowledge and skills related to science, math, and the arts</li> </ul>
<b>Learning Goal(s):</b> <i>Students will know and will be able to use their learning to:</i> (Content/ Skills)	<p><b>Content:</b> (Students will know...)</p> <ul style="list-style-type: none"> <li>● the benefits of understanding aerodynamics related to vehicle design</li> <li>● how design factors influence vehicle performance</li> <li>● the impact of vehicle weight on efficiency</li> </ul> <p><b>Skills:</b> (Students will be able to...)</p> <ul style="list-style-type: none"> <li>● design, build, a vehicle to meet design parameters</li> <li>● create a scale drawing of the vehicle to be built</li> <li>● design a vehicle considering aerodynamics and weight and friction factors</li> <li>● test a vehicle design to evaluate design criteria</li> </ul>