



# Electrical Vehicle - Automotive Services

## Course Outline - Full Year

### Course Description

This 519 hour full-year course is designed to prepare students for entry level employment in the automotive repair field with an emphasis in electrical troubleshooting and exploring electrical vehicle technologies. Students learn skills through a variety of exercises utilizing passenger cars, electrical circuit board trainers, various types of EV transportation, and use of specific industry tools. The successful student will expand their critical thinking skills within a collaborative learning environment. The course units are differentiated and designed in a tiered structure. The course focuses on problem based, project based, and challenged based lessons. All students will complete the units 0.1 to 13. In Semester 2, students will select a pathway from Units 14 to 20 depending on interest and performance criteria. As the students master the skills, they will rotate within the units. Auto Services Advanced 2nd year students are able to attend the Electrical Vehicle course in Semester 2. This program is certified by the National Automotive Technicians Education Foundation (NATEF) and closely follows NATEF curriculum guidelines and standards for instruction and course content.

### Course Details

#### Length of Program and Academic Credits Earned:

Year-long 3 hour course = 519 hours total (~261/semester)

30 total units (15/semester):

- 20 non-a–g elective credits (10/semester)
- 10 UC “d” lab science (Physics) or “g” elective credits (5/5 semester)
- C or higher in grade level Math
- C or higher Physics or Geometry introduction course

#### Auto Services Advanced 2nd Year Students:

- Students may apply to attend Advanced Electrical Vehicles course that are in good academic, behavioral, and career readiness standing

#### CTE Classification:

- Industry Sector: Transportation
- Industry Pathway: System Diagnostic, Services and Repair Pathway
- CA Basic Education Data System (CBEDS) Code: 5655

<p><b>Work-Based Learning:</b></p> <ul style="list-style-type: none"> <li>Eligible students may be selected to participate in an internship, job shadow program or sponsored by an OEM dealership.</li> </ul>	<p><b>Certifications &amp; State Tests:</b></p> <ul style="list-style-type: none"> <li>SVCTE Certificate of Completion awarded “C” or better average for the full year</li> </ul>
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## Community College Dual Enrollment / Articulations

Students completing the Electrical Vehicle - Automotive Services course with a grade of “C” or better may be granted college units:

- Evergreen Valley Community College – AUTO117 Automotive Principles - 1.5 Units
  - Students will be eligible to attend EVC during Summer session for AUTO102 Automotive Systems - 3.5 Units
  - More info: [catalog.evc.edu/degrees-certificates/automotive-technology/#coursestext](http://catalog.evc.edu/degrees-certificates/automotive-technology/#coursestext).
- UC “D” Articulation Science Equivalent - Pending Approval

## Possible Education & Career Pathways

College & Career Pathways	Career Opportunities	O*NET Codes
<p><u>Post-Secondary:</u> Students with a high school diploma and having successfully completed this course have a number of entry-level career opportunities, as well as continuing their education.</p>	<ul style="list-style-type: none"> <li>Automotive Service Technician</li> <li>Auto Mechanic (assistant)</li> <li>Automotive Specialty Technician</li> <li>Automobile Mechanic (assistant)</li> <li>○</li> </ul>	<ul style="list-style-type: none"> <li>49-3023.00</li> <li>49-9098.00</li> <li>49-3023.02</li> <li>49-3023.01</li> </ul>
<p><u>Community College Majors &amp; Degrees:</u></p> <ul style="list-style-type: none"> <li>AA or AS in Automotive Technology, Electrical-engine Performance, Mechanical Engineering</li> </ul>	<ul style="list-style-type: none"> <li>Mechanical Engineering Technologist</li> <li>Automotive Service Technician</li> <li>Automotive Master Mechanic</li> <li>Motorcycle Mechanic</li> <li>Automotive Specialty Technician</li> <li>Automotive Engineering Technician</li> <li>Electronic Equipment Installer and Repairers, Motor Vehicle</li> <li>Auto Tester</li> </ul>	<ul style="list-style-type: none"> <li>17-3029.07</li> <li>49-3023.00</li> <li>49-3023.01</li> <li>49-3052.00</li> <li>49-3023.02</li> <li>17-3027.01</li> <li>49-2096.00</li> <li>53-6051.07</li> </ul>

<u>University Majors &amp; Degrees:</u> <ul style="list-style-type: none"> <li>BA or BS in Automotive Technology, Mechanical Engineering</li> </ul>	<ul style="list-style-type: none"> <li>Mechanical Engineer 17-2141.00</li> <li>Automotive Master Mechanic 49-3023.01</li> <li>Electronics Engineer 17-2072.00</li> </ul>
<u>Post-Baccalaureate Degrees</u> <ul style="list-style-type: none"> <li>MA or MS in Automotive Technology, Mechanical Engineering</li> <li>MBA - Masters in Business Administration</li> </ul>	<ul style="list-style-type: none"> <li>Mechanical Engineer 17-2141.00</li> <li>Automotive Master Mechanic 49-3023.01</li> <li>Sales Manager 11-2022.00</li> <li>General and Operations Manager 11-1021.00</li> </ul>

<b>Unit 0.1: Career Readiness, Professionalism &amp; The Automotive Industry</b>			<b>6 hours</b>
Students will develop personal and professional skills in the classroom and lab, which are transferable to the workplace.			
<ul style="list-style-type: none"> <li>Time management, punctuality and organization</li> <li>Interpersonal skills and effective communication</li> </ul>	<ul style="list-style-type: none"> <li>Industry standard tools</li> <li>Creative thinking, teamwork and problem solving</li> </ul>	<ul style="list-style-type: none"> <li>Job search skills including: resume, job applications and effective interview skills</li> <li>Dress code</li> </ul>	
<b>Standards Alignments:</b> <b>CCSS:</b> RLST 11-12.3, 11-12.10; <b>WS</b> 11-12.4, 11-12.6 <b>NGSS:</b>			
<b>Key Assignments</b>	<b>CTE Anchor Standards</b>	<b>CTE Pathway Standards</b>	
<b>Key Assignment:</b> Students will participate in mock interviews with industry professionals, peers and instructors to increase their communication, interpersonal and employability skill-set.	2.1, 2.2, 2.3, 2.4, 2.5	C5.0	

<p><b>Assessment:</b> rubric, observation of role playing, peer and self- assessment</p> <p><b>Key Assignment:</b> Students will prepare a portfolio including a cover letter, resume, and industry certifications through workshop, self and peer editing, and teacher instruction, e-learning programs and demonstration.</p> <p><b>Assessment:</b> peer and instructor feedback, written documents</p>	<p>1.0, 2.1, 2.2, 2.3, 2.4, 2.5, 3.0, 4.1, 5.0, 9.0, 10.0, 11.5</p>	<p>C 2.0, C 4.0, C 6.0, C 7.0, C 8.0</p>
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<b>Unit 0.2: Customer Relations, Sales Skills &amp; Ownership Experience</b>	<b>6 hours</b>
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Good customer relations will be practiced in class and lab to assist students with learning skills necessary to maintain employment in the automotive industry.

<ul style="list-style-type: none"> <li>● Communication Skills</li> <li>● Acknowledge and greet customer/client</li> <li>● Listen to customer needs</li> </ul>	<ul style="list-style-type: none"> <li>● Collect information and identify customer/client needs</li> <li>● Cooperative attitude</li> <li>● Customer de-escalation</li> </ul>	<ul style="list-style-type: none"> <li>● Positive attitude</li> <li>● Professional appearance</li> <li>● Negotiation skills to obtain mutual agreement</li> </ul>
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**Standards Alignments:**  
**CCSS:** RLST 11-12.3; **WS** 11-12.4  
**NGSS:**

Key Assignments	CTE Anchor Standards	CTE Pathway Standards
<p><b>Key Assignment:</b> Students will role play a customer/service provider interaction. One student will take the role of client, the other will take the role of estimator. They will demonstrate to class the proper customer relations including greeting, appearance, attitude and client concerns, needs and expectations and explanation of repair procedures and timelines, customer consent for vehicle repair and proper sales strategies.</p>	<p>1.0, 2.1, 2.2, 2.3, 5.0, 7.2, 8.1, 10.1, 11.0</p>	<p>C 4.0</p>

<p><b>Assessment:</b> peer evaluation, customer survey, debriefing, self reflection</p> <p><b>Key Assignment:</b> They will demonstrate to the class the proper way to handle the situation in a mature and professional manner. Peers will critique and offer suggestions.</p> <p><b>Assessment:</b> peer evaluation, customer survey, debriefing, self reflection</p>	<p>1.0, 2.1, 2.2, 2.3, 5.0, 7.2, 8.1, 10.1, 11.0</p>	<p>C 4.0</p>
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Unit 0.3: Safety and Environment Inspection & Repair Facilities			9 hours
Students will learn how to identify safety hazards in the lab and learn how to maintain a safe work environment.			
<ul style="list-style-type: none"> <li>● Environmental laws</li> <li>● Proper waste disposal and recycling</li> <li>● Research</li> <li>● Documentation</li> </ul>	<ul style="list-style-type: none"> <li>● Introduction to tools</li> <li>● Vehicle service history</li> <li>● Hydraulic lift operation</li> </ul>	<ul style="list-style-type: none"> <li>● MSDS (materials safety data sheet)</li> <li>● Safety glasses and other personal protective equipment</li> </ul>	
<p><b>Standards Alignments:</b>            CCSS: RLST 11-12.3            NGSS: SEP 4; CC 7; PS 1,1.B</p>			
Key Assignments	CTE Anchor Standards	CTE Pathway Standards	
<p><b>Key Assignment:</b> In collaborative groups using industry standard repair manuals, students will complete a shop safety tour and demonstrate safety and hazmat knowledge to their peers and instructor.</p> <p><b>Assessment:</b> teacher observation and feedback, demonstration, oral defense, quiz</p>	<p>6.1, 6.2, 6.3, 6.4 6.5, 6.6</p>	<p>C 1.1, C 1.2, C 1.3, C 1.4, C 1.5</p>	

<p><b>Key Assignment:</b> Students will identify and locate VIN (vehicle identification number), emissions certification label, refrigerant identification label and research the necessary specifications for repair. Students will present to the instructor for inspection. <b>Assessment:</b> checklist, observation, oral and written defense, peer and instructor feedback</p>	10.1, 10.2, 11.2	C 4.1, C 4.3
<p><b>Key Assignment:</b> In groups, students will properly follow all shop procedures to safely set up a shop car on the vehicle lifts. <b>Assessment:</b> visual inspection, instructor observation</p>	10.1, 10.2, 11.2	C 4.1, C 4.3

<b>Unit 0.4: Collaborative Learning Strategies &amp; Dual Enrollment</b>			<b>6 hours</b>
<p>The student will be introduced to the Auto Services - Electrical course within the Canvas platform, working together in a collaborative learning environment, expectations and timelines, and strategies for individual success.</p>			
<ul style="list-style-type: none"> <li>● Teamwork</li> <li>● Group Presentations</li> <li>● Collaboration</li> <li>● Critical Thinking</li> <li>● Documentation</li> </ul>	<ul style="list-style-type: none"> <li>● Decision Analysis</li> <li>● Researching</li> <li>● Organizational Skills</li> <li>● Problem Solving</li> <li>● Flowchart introduction</li> </ul>	<ul style="list-style-type: none"> <li>● Time Management</li> <li>● Focus</li> <li>● Prioritizing</li> <li>● Peer Feedback Discussion Process</li> <li>● Cross Training With Lessons</li> </ul>	
<p><b>Standards Alignments:</b>  <b>CCSS:</b> LS 11-12.3; <b>WS</b> 11-12.1, 11-12.4, 11-12.10  <b>NGSS:</b> SEP 1, 2, 3, 4, 5, 6, 8; <b>PS</b> 2.A, 2.B, 3.C</p>			
<b>Key Assignments</b>	<b>CTE Anchor Standards</b>	<b>CTE Pathway Standards</b>	

<p><b>Key Assignment:</b> Using instructor provided materials and directions, students will engage collaboratively in creating several team building activities. They will include the Marshmallow Tower, Reverse Pyramid, and Deserted Island scenario. Enrollment and review of the goals and objectives of the Evergreen Valley College course AUTO117 Automotive Principles dual enrollment college course.</p> <p><b>Assessment:</b> observation, completion of activity project, peer feedback discussion. Enrollment in EVC and Canvas course in AUTO117 Automotive Principles.</p>	5.0, 4.0, 9.0, 10.1, 10.2	C4.0, C2.6
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<b>Unit 0.5: Service Information Resources, Tools &amp; Equipment &amp; Vehicle Care</b>	<b>6 hours</b>
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The student will be introduced to the various automotive service information resources. They will also enroll in OEM factory certificate e-learning training programs.

<ul style="list-style-type: none"> <li>● OEM Information Systems</li> <li>● ShopKeyPro</li> <li>● Repair Orders</li> </ul>	<ul style="list-style-type: none"> <li>● OEM Certification</li> <li>● Troubleshooting Database</li> <li>● Owner’s Manuals</li> </ul>	<ul style="list-style-type: none"> <li>● Service Manuals</li> <li>● VIN Decoding</li> <li>● Wiring Diagrams</li> </ul>
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**Standards Alignments:**

**CCSS:** LS 11-12.3; **WS** 11-12.1, 11-12.4, 11-12.10

**NGSS:** SEP 1, 2, 3, 4, 5, 6, 8; **PS** 2.A, 2.B, 3.C

Key Assignments	CTE Anchor Standards	CTE Pathway Standards
<p><b>Key Assignment:</b> Using instructor provided worksheets and computer programs, students will work collaboratively researching data specific to automotive repair procedures.</p> <p><b>Assessment:</b> observation, written documentation, completed activities, peer feedback discussions</p>	4.0, 10.1, 10.2, 11.2	C2.6, C4.0, C4.3

**Unit 0.6: Automotive Career Exploration** **6 hours**

The student will be introduced to various employment and career choices.

<ul style="list-style-type: none"> <li>• Service Advisor</li> <li>• Service Management</li> <li>• Technician</li> </ul>	<ul style="list-style-type: none"> <li>• Parts Advisor</li> <li>• Parts Management</li> </ul>	<ul style="list-style-type: none"> <li>• Sales Consultant</li> <li>• Porter</li> </ul>
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**Standards Alignments:**

**CCSS:** LS 11-12.3; **WS** 11-12.1, 11-12.4, 11-12.10

**NGSS:** SEP 1, 2, 3, 4, 5, 6, 8; **PS** 2.A, 2.B, 3.C

Key Assignments	CTE Anchor Standards	CTE Pathway Standards
<p><b>Key Assignment:</b> Working with assignments specific to automotive industry careers, students will work individually and collaboratively researching various positions at the independent shop, dealership and OEM level. They will examine the types of jobs available, technical skills required, and the academic level needed to be successful.</p> <p><b>Assessment:</b> observation, written documentation, role play activities, peer feedback discussions</p>	3.0, 3.1, 3.4, 10.1, 10.2, 11.2	C4.0, C5.0

**Unit 0.7: Vehicle Inspection & Various Automotive Systems** **6 hours**

The student will be introduced to inspecting and evaluating a vehicle.

<ul style="list-style-type: none"> <li>• Decision Analysis</li> <li>• Critical Thinking</li> <li>• Documentation</li> <li>• Vehicle Specifications</li> </ul>	<ul style="list-style-type: none"> <li>• Prioritizing</li> <li>• Researching</li> <li>• Shop Safety</li> <li>• Teamwork</li> </ul>	<ul style="list-style-type: none"> <li>• Flat Rate Time Management</li> <li>• Technical Skills</li> <li>• Tools / Equipment</li> </ul>
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<b>Standards Alignments:</b> <b>CCSS:</b> LS 11-12.3; <b>WS</b> 11-12.1, 11-12.4, 11-12.10 <b>NGSS:</b> SEP 1, 2, 3, 4, 5, 6, 8; <b>PS</b> 2.A, 2.B, 3.C		
Key Assignments	CTE Anchor Standards	CTE Pathway Standards
<b>Key Assignment:</b> An instructor provided worksheet will be used to guide the student in checking key areas of an automotive vehicle. OEM factory interactive computer programs will highlight the evaluation and inspection procedure. <b>Assessment:</b> observation, completion of activity project, computer interactive Q&A, peer feedback discussion	5.0, 5.1, 6.4, 9.2, 10.0	C 2.0, C 3.7

<b>Unit 1: Basic Electrical Theory</b>		<b>30 hours</b>
Students will be exposed to the basics of electrical theory as it relates to automotive services. Students will engage in hands-on activities in the classroom, lab, and shop.		
<ul style="list-style-type: none"> <li>● Key terms</li> <li>● Electricity</li> <li>● Static and dynamic voltage testing</li> </ul>	<ul style="list-style-type: none"> <li>● Basic circuit types</li> <li>● Voltage drop testing</li> <li>● Current flow</li> <li>● Electrical resistance</li> </ul>	<ul style="list-style-type: none"> <li>● Electrical current</li> <li>● Digital Multimeter</li> <li>● Circuit test light</li> </ul>
<b>Standards Alignments:</b> <b>CCSS:</b> LS 11-12.3; <b>WS</b> 11-12.1, 11-12.4, 11-12.10 <b>NGSS:</b> SEP 1, 2, 4, 5, 8; <b>PS</b> 1.A, 3.A		
Key Assignments	CTE Anchor	CTE Pathway

	Standards	Standards
<p><b>Key Assignment:</b> Using instructor provided worksheets, students will work collaboratively with industry standard voltage, amps and resistance measurement tools to test a variety of electrical items in a test board to compare properly working circuits with faulty circuits and document their findings.</p> <p><b>Assessment:</b> unit quiz, observation, written documentation, peer feedback</p>	1.0, 2.4, 4.1, 9.0, 10.1	C 2.0, C 3.7, C 4.0, C 5.6, C 7.0
<p><b>Key Assignment:</b> Working in collaborative teams, students will identify, define and label all parts and functions of a digital multimeter. Students will use this to test a variety of circuits for proper operation.</p> <p><b>Assessment:</b> unit quiz, observation, written documentation, peer feedback</p>	1.0, 2.4, 4.1, 9.0, 10.1	C 2.0, C 3.7
<p><b>Key Assignment:</b> Students will build the 3 types of electrical circuits (series, parallel, series-parallel) using test boards, power supplies, jumper wires and measure voltage, current and resistance while recording all of their findings.</p> <p><b>Assessment:</b> observation, written documentation, peer feedback, and completion of circuit board circuits</p>	1.0, 2.4, 4.1, 5.0, 9.0, 10.1, 10.2	C 2.0, C 3.7, C 4.0, C 5.6, C 7.0

Unit 2: Battery and Testing		27 hours
Students will work hands-on in the classroom, lab, and shop to inspect, diagnose and service 12 volt automotive batteries to industry standards.		
<ul style="list-style-type: none"> <li>Construction and operation of a 12 volt automotive battery</li> <li>Battery inspection and servicing</li> </ul>	<ul style="list-style-type: none"> <li>Battery testing with various tools and equipment</li> </ul>	<ul style="list-style-type: none"> <li>Measure parasitic draw</li> <li>Measure current with DMM with inductive clamp</li> </ul>
<p><b>Standards Alignments:</b>            CCSS:LS 11-12.3; WS 11-12.1, 11-12.4, 11-12.10            NGSS: SEP 1, 3, 4, 8; PS 3.C</p>		
Key Assignments	CTE Anchor	CTE Pathway

	Standards	Standards
<p><b>Key Assignment:</b> Using a carbon pile tester such as a VAT40 battery load tester, students will work together to test and diagnose 12 volt automotive batteries and determine state of the battery and propose corrective action.</p> <p><b>Assessment:</b> unit quiz, observation, written documentation, peer feedback</p>	1.0, 2.4, 4.1, 5.0, 9.0, 10.1	C 2.0, C 3.7, C 4.0, C 5.6, C 7.2
<p><b>Key Assignment:</b> Using a multimeter, students will measure the parasitic draw of the vehicle and record and defend their findings to peers and instructor.</p> <p><b>Assessment:</b> unit quiz, observation, peer feedback, oral defense and questioning</p>	1.0, 2.4, 4.1, 5.0, 9.0, 10.1, 10.2	C 2.0, C 3.7, C 4.0, C 5.6, C 7.2
<p><b>Key Assignment:</b> Using a structured form provided by instructor, students will test, perform a visual inspection, make recommendations for necessary repairs and service an automotive battery using industry standard equipment and procedures.</p> <p><b>Assessment:</b> observation, written documentation, peer feedback, module test</p>	1.0, 2.4, 4.1, 5.0, 9.0, 10.1, 10.2	C 2.0, C 3.7, C 4.0, C 5.6, C 7.2

Unit 3: Ohms Law Theory & DMM Introduction		15 hours
Students will use electrical circuit calculations using Ohm’s Law to determine the relationship between volts, resistance and amperage.		
<ul style="list-style-type: none"> <li>• Ohm’s Law</li> <li>• Basic math and algebraic equations as related to electrical circuits</li> </ul>	<ul style="list-style-type: none"> <li>• Calculator</li> </ul>	<ul style="list-style-type: none"> <li>• Rules related to series, parallel and series-parallel circuits</li> </ul>
<p><b>Standards Alignments:</b>  <b>CCSS:</b> LS 11-12.3 <b>WS</b> 11-12.1, 11-12.4, 11-12.10; A-CED 1, 4  <b>NGSS:</b> SEP 1, 3, 4, 5, 6, 8; PS 3.C</p>		
Key Assignments	CTE Anchor Standards	CTE Pathway Standards

<p><b>Key Assignment:</b> Students will be provided multiple electrical diagrams with missing information and will calculate for the unknown properties using Ohm’s Law. By using related math the students will solve for the missing elements for all 3 circuit types.</p> <p><b>Assessment:</b> module quiz, observation, written documentation, peer feedback, and correct problem diagnosis and repair procedures</p>	<p>1.0, 2.4, 4.1, 5.0, 9.0, 10.1, 10.2</p>	<p>C 3.5</p>
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<b>Unit 4: Advanced Electrical</b>	<b>27 hours</b>
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Students will engage in classroom and lab activities to explore advanced electrical principles and components.

<ul style="list-style-type: none"> <li>● Magnetism</li> <li>● Wires</li> <li>● Protection Devices</li> </ul>	<ul style="list-style-type: none"> <li>● Repair procedures</li> <li>● Switches and relays</li> <li>● Advanced circuit construction</li> </ul>	<ul style="list-style-type: none"> <li>● Watts and capacitors</li> <li>● Semiconductors</li> </ul>
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**Standards Alignments:**  
**CCSS:** LS 11-12.3; **WS** 11-12.1, 11-12.4, 11-12.10  
**NGSS:** SEP 1, 2, 3, 4, 5, 6, 8; **PS** 2.A, 2.B, 3.C

Key Assignments	CTE Anchor Standards	CTE Pathway Standards
<p><b>Key Assignment:</b> Students will perform multiple wire repairs using solder, soldering irons, stripping tools, crimp connectors, crimping tools, heat shrink tubing and heat gun and present to the instructor for feedback and evaluation.</p> <p><b>Assessment:</b> observation, written documentation, peer feedback, and completed wiring repair</p>	<p>1.0, 2.4, 4.1, 5.0, 9.0, 10.1, 10.2</p>	<p>C 2.0, C 3.7, C 4.0, C 5.6, C 7.0</p>
<p><b>Key Assignment:</b> Using various switches and components, students will work in collaborative teams to construct many types of advanced circuits (window motor, cooling fan, turn signal, headlight/tail light, relay operated devices) and demonstrate functioning circuits to peers and instructor.</p> <p><b>Assessment:</b> unit quiz, observation, written documentation, peer feedback</p>	<p>1.0, 2.4, 4.1, 5.0, 9.0, 10.1, 10.2</p>	<p>C 2.0, C 3.7, C 4.0, C 5.6, C 7.0</p>
<p><b>Key Assignment:</b> Using the Ohm’s Law Power Formula, students will calculate watts in</p>		

<p>relation to volts and amps. Students will demonstrate their understanding through proper documentation and correct mathematical calculations.</p> <p><b>Assessment:</b> observation, written documentation, peer feedback, case study and completed diagnosis and repair</p> <p><b>Key Assignment:</b> Using a DMM in the diode check mode, students will inspect diodes and transistors to confirm if they are operational and document their findings.</p> <p><b>Assessment:</b> observation, written documentation, peer feedback</p>	<p>1.0, 2.4, 4.1, 5.0, 9.0, 10.1, 10.2</p> <p>1.0, 2.4, 4.1, 5.0, 9.0, 10.1, 10.2</p>	<p>C 2.0, C 3.7, C 4.0, C 5.6, C 7.0</p> <p>C 2.0, C 3.7, C 4.0, C 5.6, C 7.0</p>
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<b>Unit 5: Troubleshooting &amp; Problem Solving</b>	<b>36 hours</b>
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Students will learn a variety of diagnostic techniques and problem analysis to evaluate automotive electrical systems.

<ul style="list-style-type: none"> <li>● Electrical schematics</li> <li>● Troubleshooting techniques</li> <li>● Diagnosis</li> </ul>	<ul style="list-style-type: none"> <li>● Key-off current draw testing (parasitic draw)</li> </ul>	<ul style="list-style-type: none"> <li>● Common electrical problems (unwanted resistance, shorts, opens)</li> <li>● Troubleshooting testing methods (dividing the circuit, jumper wire, voltage drop testing)</li> </ul>
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**Standards Alignments:**  
**CCSS:** LS 11-12.3; **WS** 11-12.1, 11-12.4, 11-12.10; **A-CED** 1,4  
**NGSS:** SEP 1, 3, 4, 5, 6, 7, 8, PS 2.B, 3.C

Key Assignments	CTE Anchor Standards	CTE Pathway Standards
<p><b>Key Assignment:</b> Instructor will provide students with multiple scenarios depicting faulty circuits. Students will work in teams to research, analyze and diagnose problematic circuits using electrical schematics. They will identify power side, ground side and components and determine where the problem lies.</p> <p><b>Assessment:</b> unit quiz, observation, written documentation, peer feedback</p>	<p>1.0, 2.4, 4.1, 5.0, 9.0, 10.1, 10.2</p>	<p>C 2.0, C 3.7, C 4.0, C 5.6, C 7.0</p>

<p><b>Key Assignment:</b> Students will be provided multiple repair orders stating a variety of customer complaints. Students will use ShopKey Pro program to find the appropriate diagnostic strategies to isolate the electrical problem, problem area and suggest a repair strategy in written form.</p> <p><b>Assessment:</b> observation, written documentation, peer feedback, and completed diagnosis and repair</p>	<p>1.0, 2.4, 4.1, 5.0, 9.0, 10.1, 10.2</p>	<p>C 2.0, C 3.7, C 4.0, C 5.6, C 7.0</p>
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<h2>Unit 6: Starting System</h2>	<h2>27 hours</h2>
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In the classroom, lab, and shop students will have the opportunity to learn about the automotive starting systems and gain the skills necessary to test, troubleshoot, and repair circuit problems.

<ul style="list-style-type: none"> <li>• Starter components and operation</li> </ul>	<ul style="list-style-type: none"> <li>• Diagnose starting system problems</li> </ul>	<ul style="list-style-type: none"> <li>• Power side and control side of control of starting circuit</li> <li>• Testing starter current draw</li> </ul>
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**Standards Alignments:**  
**CCSS:** LS 11-12.3; **WS** 11-12.1, 11-12.4, 11-12.6, 11-12.9, 11-12.10  
**NGSS:** SEP 1, 3, 4, 5, 6, 8, PS 2.A, 3.C

Key Assignments	CTE Anchor Standards	CTE Pathway Standards
<p><b>Key Assignment:</b> Students will work collaboratively with peers to select an automobile of their choice to research and investigate the starting system of that vehicle. They will use technical manuals and schematics to produce a PowerPoint (or like software) presentation to inform their peers of the specifics of their starting system. They will identify the components and the operation for each. Students will develop a diagnostic test procedure for a no crank condition. Peers in the audience will be provided a rubric to give feedback to the presenters.</p> <p><b>Assessment:</b> unit quiz, observation, written documentation, peer feedback</p>	<p>1.0, 2.3, 2.4, 2.5, 4.1, 4.3, 5.0, 9.0, 10.1, 10.2, 10.3</p>	<p>C 2.0, C 3.7, C 4.0, C 5.6, C 7.0</p>

<p><b>Key Assignment:</b> Using instructional materials to record observations, students will identify, label and record all components and operations of the starting systems in an automobile.</p> <p><b>Assessment:</b> unit quiz, observation, written documentation, peer feedback</p>	<p>1.0, 2.4, 4.1, 5.0, 9.0, 10.1, 10.2</p>	<p>C 2.0, C 3.7, C 4.0, C 5.6, C 7.0</p>
<p><b>Key Assignment:</b> Students will use volt meters, test lights and carbon pile testers to perform on-car diagnostic tests of the various components of the starting systems in a fully functional vehicle to document proper electrical values to later compare with non working systems.</p> <p><b>Assessment:</b> unit quiz, observation, written documentation, peer feedback</p>	<p>1.0, 2.4, 4.1, 5.0, 9.0, 10.1, 10.2</p>	<p>C 2.0, C 3.7, C 4.0, C 5.6, C 7.0</p>
<p><b>Key Assignment:</b> Building upon their knowledge of functional starting systems, students will be presented with repair orders describing problems with the starting and circuit. Students must then properly diagnose the faulty components or wiring and provide written documentation of their repair proposed strategies.</p> <p><b>Assessment:</b> unit quiz, observation, written documentation, peer feedback</p>	<p>1.0, 2.4, 4.1, 5.0, 9.0, 10.1, 10.2</p>	<p>C 2.0, C 3.7, C 4.0, C 5.6, C 7.0</p>

<b>Unit 7: Charging System</b>	<b>27 hours</b>	
<p>In the classroom, lab, and shop students will have the opportunity to learn about the automotive charging systems and gain the skills necessary to test, troubleshoot, and diagnose circuit problems.</p>		
<ul style="list-style-type: none"> <li>● Alternator component operation</li> </ul>	<ul style="list-style-type: none"> <li>● Diagnosing charging system problems</li> </ul>	<ul style="list-style-type: none"> <li>● Testing maximum current output</li> <li>● Testing voltage output</li> </ul>
<b>Standards Alignments:</b>		

**CCSS:** LS 11-12.3; **WS** 11-12.1, 11-12.4, 11-12.6, 11-12.9, 11-12.10

**NGSS:** SEP 1, 3, 4, 5, 6, 8, PS 2.A, 3.C

Key Assignments	CTE Anchor Standards	CTE Pathway Standards
<p><b>Key Assignment:</b> Students will work collaboratively with peers to select an automobile of their choice to research and investigate the charging system of that vehicle. They will use technical manuals and schematics to produce a Google Slides presentation (or like software) presentation to inform their peers of the specifics of their charging system. They will identify the components and the operation for each. Students will develop a diagnostic test procedure for a no charging condition. Peers in the audience will be provided a rubric to give feedback to the presenters.</p> <p><b>Assessment:</b> unit quiz, observation, written documentation, peer feedback</p>	<p>1.0, 2.3, 2.4, 2.5, 4.1, 4.3, 5.0, 9.0, 10.1, 10.2, 10.3</p>	<p>C 2.0, C 3.7, C 4.0, C 5.6, C 7.0</p>
<p><b>Key Assignment:</b> Using instructional materials to record observations, students will identify, label and record all components and operations of the charging systems in an automobile.</p> <p><b>Assessment:</b> unit quiz, observation, written documentation, peer feedback</p>	<p>1.0, 2.4, 4.1, 5.0, 9.0, 10.1, 10.2</p>	<p>C 2.0, C 3.7, C 4.0, C 5.6, C 7.0</p>
<p><b>Key Assignment:</b> Students will use volt meters, test lights and carbon pile testers to perform on-car diagnostic tests of the various components of the starting systems in a fully functional vehicle to document proper electrical values to later compare with non working systems.</p> <p><b>Assessment:</b> unit quiz, observation, written documentation, peer feedback</p>	<p>1.0, 2.4, 4.1, 5.0, 9.0, 10.1, 10.2</p>	<p>C 2.0, C 3.7, C 4.0, C 5.6, C 7.0</p>
<p><b>Key Assignment:</b> Building upon their knowledge of functional charging systems, students will be presented with repair orders describing problems with the charging and circuit. Students must then properly diagnose the faulty components or wiring and provide written documentation of their repair proposed strategies.</p> <p><b>Assessment:</b> unit quiz, observation, written documentation, peer feedback</p>	<p>1.0, 2.4, 4.1, 5.0, 9.0, 10.1, 10.2</p>	<p>C 2.0, C 3.7, C 4.0, C 5.6, C 7.0</p>



## Unit 8: Advanced Troubleshooting Techniques 15 hours

Main focus of the series of lessons is to apply the Kepner Tregoe method of Decision and Problem analysis to finding the root cause of incident problems.

<ul style="list-style-type: none"> <li>● Problem Analysis Ranking</li> <li>● Decision Ranking</li> <li>● Creativity</li> </ul>	<ul style="list-style-type: none"> <li>● Critical Thinking</li> <li>● Collaborative Learning</li> <li>● Team Building Activities</li> </ul>	<ul style="list-style-type: none"> <li>● Objective and Subjective Decisions</li> <li>● Quantifiable Evidence</li> <li>● Determining Root Causes</li> </ul>
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### Standards Alignments:

CCSS:

NGSS:

Key Assignments	CTE Anchor Standards	CTE Pathway Standards
<p><b>Key Assignment:</b> Using the KT method of Decision and Problem Analysis, students will research automotive incident problems. They will evaluate and rank the three most probable solutions to determine the actual root cause. By determining what is properly functioning, the root cause will appear within the highest ranking choices.</p> <p><b>Assessment:</b> observation, written documentation, peer feedback discussion</p>	<p>4.0, 4.1, 4.3, 4.4, 9.0, 9.7, 10.1</p>	<p>C 3.5</p>

## Unit 9: Computer Systems 15 hours

Main focus of these lessons are to understand the automotive Electronic Control Module (ECM), driving patterns, and parameters they can use within the modern automotive vehicle. Various computer control systems such as the Body Control Module (BCM) and the multiplex signals to operate them.

<ul style="list-style-type: none"> <li>● Integrated Circuits</li> <li>● Random Access Memory (RAM)</li> </ul>	<ul style="list-style-type: none"> <li>● DMM</li> <li>● Scan Tool</li> </ul>	<ul style="list-style-type: none"> <li>● Inputs</li> <li>● Outputs</li> </ul>
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<ul style="list-style-type: none"> <li>• Read Only Memory (ROM)</li> </ul>	<ul style="list-style-type: none"> <li>• Computer Programming</li> </ul>	<ul style="list-style-type: none"> <li>• Binary Code</li> </ul>
<p><b>Standards Alignments:</b>  <b>CCSS:</b> LS 11-12.3; <b>WS</b> 11-12.1, 11-12.4, 11-12.10  <b>NGSS:</b> SEP 1, 2, 3, 4, 5, 6, 8; <b>PS</b> 2.A, 2.B, 3.C</p>		
Key Assignments	CTE Anchor Standards	CTE Pathway Standards
<p><b>Key Assignment:</b> Using OEM training worksheets, powerpoint presentations, and hands-on activities the student will identify the major parts of a computer control unit. They will research the ECM operation and develop a group presentation.</p> <p><b>Assessment:</b> observation, written documentation, peer feedback discussion, rubric presentation grading</p>	4.1, 4.2, 4.3, 5.0, 5.3, 9.1, 9.7, 10.1	C 2.0, C 3.7, C 4.0, C 5.6, C 7.0

<b>Unit 10: Electronic Fuel Injection &amp; Engine Management</b>	<b>27 hours</b>
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Main focus in these series of lessons is to understand the main components in EFI systems and the relationship between sensors, computer programming and actuators.

<ul style="list-style-type: none"> <li>• Component Identification</li> <li>• Computer Driveability Map</li> <li>• Fuel Pressure Gauge</li> <li>• Wiring Diagram Analysis</li> </ul>	<ul style="list-style-type: none"> <li>• Sensors</li> <li>• Actuators</li> <li>• Solenoids</li> <li>• Types of Fuel Delivery</li> </ul>	<ul style="list-style-type: none"> <li>• AC signals</li> <li>• DC signals</li> <li>• DMM Testing</li> <li>• Reading Codes</li> </ul>
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**Standards Alignments:**  
**CCSS:** LS 11-12.3; **WS** 11-12.1, 11-12.4, 11-12.10  
**NGSS:** SEP 1, 2, 3, 4, 5, 6, 8; **PS** 2.A, 2.B, 3.C

Key Assignments	CTE Anchor Standards	CTE Pathway Standards
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<p><b>Key Assignment:</b> Using OEM training worksheets, powerpoint presentations, and hands-on activities the student will identify the major parts of an EFI system. They will research the EFI operation and develop a group presentation.</p> <p><b>Assessment:</b> observation, written documentation, peer feedback discussion, rubric presentation grading</p>	<p>4.1, 4.2, 4.3, 5.0, 5.3, 9.1, 9.7, 10.1</p>	<p>C 2.0, C 3.7, C 4.0, C 5.6, C 7.0</p>
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<b>Unit 11: Ignition System &amp; Tune Up and Maintenance</b>	<b>15 hours</b>
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Main focus in these series of lessons are to understand the types of various ignition systems, ignition system components, and analyzing common problems by testing.

<ul style="list-style-type: none"> <li>● Ignition Coils</li> <li>● Spark Plugs</li> <li>● Component Identification</li> </ul>	<ul style="list-style-type: none"> <li>● Ignition Wires</li> <li>● Firing Order</li> <li>● Sensors</li> </ul>	<ul style="list-style-type: none"> <li>● Tools / Equipment</li> <li>● Ignition Relay</li> <li>● TDC</li> </ul>
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**Standards Alignments:**  
**CCSS:** LS 11-12.3; **WS** 11-12.1, 11-12.4, 11-12.10  
**NGSS:** SEP 1, 2, 3, 4, 5, 6, 8; **PS** 2.A, 2.B, 3.C

Key Assignments	CTE Anchor Standards	CTE Pathway Standards
<p><b>Key Assignment:</b> Using OEM training worksheets, powerpoint presentations, and hands-on activities the student will identify the major parts of the Ignition System. They will research the related parts and their operation to develop a group presentation.</p> <p><b>Assessment:</b> observation, written documentation, peer feedback discussion, rubric presentation grading</p>	<p>4.0, 4.1, 4.3, 4.4, 9.0, 9.7, 10.1</p>	<p>C 2.0, C 3.7, C 4.0, C 5.6, C 7.0</p>

<b>Unit 12: Emission System Control &amp; Exhaust System</b>	<b>15 hours</b>
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Main focus in these series of lessons is to gain greater understanding of emission control components incorporated in vehicles to reduce harmful emissions, improve driveability performance, and learn about OEM regulations during manufacturing.

<ul style="list-style-type: none"> <li>● Catalytic Converters</li> <li>● Air Fuel Mixture Ratio</li> <li>● Component Identification</li> </ul>	<ul style="list-style-type: none"> <li>● Charcoal Canister</li> <li>● 5 Gas Analyzer</li> <li>● Oxygen Sensor</li> </ul>	<ul style="list-style-type: none"> <li>● Solenoids</li> <li>● Fuel Pressure Regulator</li> <li>● Exhaust System Components</li> </ul>
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**Standards Alignments:**

CCSS: LS 11-12.3; WS 11-12.1, 11-12.4, 11-12.10

NGSS: SEP 1, 2, 3, 4, 5, 6, 8; PS 2.A, 2.B, 3.C

Key Assignments	CTE Anchor Standards	CTE Pathway Standards
<p><b>Key Assignment:</b> Using OEM training worksheets, powerpoint presentations, and hands-on activities the student will identify the major parts of the Emission System and alternative fuel sources to drive powertrains. They will research the related parts and their operation to develop a group presentation.</p> <p><b>Assessment:</b> observation, written documentation, peer feedback discussion, rubric presentation grading</p>	4.0, 4.1, 4.3, 4.4, 9.0, 9.7, 10.1	C 2.0, C 3.7, C 4.0, C 5.6, C 7.0

<b>Unit 13: On-Board Diagnostics &amp; Scan Tools</b>	<b>15 hours</b>
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Main focus in this series of lessons is to understand the parts of the OBD II systems, reading and evaluating malfunction indicator light codes, and using Scan Tools to retrieve on-board diagnostic specifications.

<ul style="list-style-type: none"> <li>● Component Parts Identification</li> <li>● Scan Tool Reading</li> <li>● Parameters of the Codes</li> </ul>	<ul style="list-style-type: none"> <li>● Computer Memory</li> <li>● Types of Codes</li> <li>● Erase Codes</li> </ul>	<ul style="list-style-type: none"> <li>● Malfunction Indicator Light</li> <li>● Warning Codes</li> </ul>
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**Standards Alignments:**

CCSS:

NGSS:

<b>Key Assignments</b>	<b>CTE Anchor</b>	<b>CTE Pathway</b>
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	Standards	Standards
<p><b>Key Assignment:</b> Using OEM training worksheets, powerpoint presentations, and hands-on activities the student will identify OBD II codes and failures. They will research the various body, powertrain, safety codes and develop a group presentation.</p> <p><b>Assessment:</b> observation, written documentation, peer feedback discussion, rubric presentation grading</p>	4.0, 4.1, 4.3, 4.4, 9.0, 9.7, 10.1	

<b>Unit 14: Special Projects 101 (Advanced Circuit Test Board)</b>	<b>36 hours</b>
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In this Academy Leadership Lounge activity, the student will build advanced circuit board systems with the DAKTIC Advanced Electrical Trainer.		
<ul style="list-style-type: none"> <li>Build advanced level automotive circuits with the DAKTIC MD-4000-22 and Electromagnetism trainers</li> <li>Application of electrical theory to create operating circuits</li> </ul>	<ul style="list-style-type: none"> <li>Self paced curriculum</li> <li>Group collaboration</li> <li>Individual achievement</li> <li>Critical Thinking skills</li> <li>Problem Solving</li> </ul>	<ul style="list-style-type: none"> <li>Use of DMM for voltage, current, and resistance testing</li> <li>Wiring diagram analysis</li> <li>Following logical troubleshooting path</li> </ul>

**Standards Alignments:**  
**CCSS:** LS 11-12.3; **WS** 11-12.1, 11-12.4, 11-12.10  
**NGSS:** SEP 1, 2, 3, 4, 5, 6, 8; **PS** 2.A, 2.B, 3.C

Key Assignments	CTE Anchor Standards	CTE Pathway Standards
<p><b>Key Assignment:</b> Students will build automotive electrical type circuits and test a series of components on the Daktic advanced level circuit trainer. Group collaboration to follow directions completing the electrical circuit and testing points with the DMM.</p> <p><b>Assessment:</b> Completion of the assigned project, observations, written documentation, and peer feedback</p>	4.0, 4.1, 4.3, 4.4, 9.0, 9.7, 10.1	C 2.0, C 3.7, C 4.0, C 5.6, C 7.0

**Unit 15: Special Projects 102 (Switch EV Lab) 36 hours**

In this Academy Leadership Lounge activity, the student will complete a series of curriculum lessons to understand the electrical drivetrain of the Switch EV Lab Trainer vehicle.

<ul style="list-style-type: none"> <li>• Switch EV Lab Components</li> <li>• Familiarization of Tools /Equipment</li> <li>• Safety Precautions</li> </ul>	<ul style="list-style-type: none"> <li>• Relay Kit</li> <li>• Collaboration</li> <li>• Teamwork</li> </ul>	<ul style="list-style-type: none"> <li>• Time Management</li> <li>• Following Procedures</li> <li>• Cross Training Within Lesson Plans</li> </ul>
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**Standards Alignments:**  
**CCSS:** LS 11-12.3; **WS** 11-12.1, 11-12.4, 11-12.10  
**NGSS:** SEP 1, 2, 3, 4, 5, 6, 8; **PS** 2.A, 2.B, 3.C

Key Assignments	CTE Anchor Standards	CTE Pathway Standards
<p><b>Key Assignments:</b> Students will follow the Switch EV lab curriculum worksheets under the instructors guidance. Groups will have an introductory instructor lesson before assigned groups for chassis, electric motor, computer relay circuits, and powertrain. These groups will become proficient in the build process before starting assembly.</p> <p><b>Assessment:</b> Completion of the assigned timelines, observations, written documentation, and peer feedback discussion.</p>	4.0, 4.1, 4.3, 4.4, 9.0, 9.7, 10.1	C 2.0, C 3.7, C 4.0, C 5.6, C 7.0

**Unit 16: Special Projects 103 (Switch EV Shop) 120 hours**

In this Academy Leadership Service Bay activity, the selected group will apply the team knowledge of the Switch EV Lab Trainer to assemble the Switch EV lab trainer vehicle.

<ul style="list-style-type: none"> <li>● Collaboration</li> <li>● Teamwork</li> <li>● Electrical Theory Application</li> <li>● Tools / Equipment</li> </ul>	<ul style="list-style-type: none"> <li>● Analyzing Wiring Diagrams</li> <li>● Relay Circuits</li> <li>● Powertrain assembly</li> <li>● Battery Construction</li> </ul>	<ul style="list-style-type: none"> <li>● Completing Timelines</li> <li>● Crimping Wiring, Soldering, Routing</li> <li>● Torque Specifications</li> <li>● Safety Precautions</li> </ul>
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**Standards Alignments:**

**CCSS:** LS 11-12.3; **WS** 11-12.1, 11-12.4, 11-12.10

**NGSS:** SEP 1, 2, 3, 4, 5, 6, 8; **PS** 2.A, 2.B, 3.C

Key Assignments	CTE Anchor Standards	CTE Pathway Standards
<p><b>Key Assignments:</b> Students will follow the Switch EV lab assembly worksheets under the instructors guidance. Students will have been assigned to the chassis team, electric motor team, computer relay circuits team, and powertrain team. These teams will comprise the building team to assemble the Switch EV Lab Kit.</p> <p><b>Assessment:</b> Completion of the assigned timelines, observations, written documentation, and peer feedback discussion.</p>	4.0, 4.1, 4.3, 4.4, 9.0, 9.7, 10.1	C 2.0, C 3.7, C 4.0, C 5.6, C 7.0

**Unit 17: Special Projects 104 (Alternative Methods of Transportation) 36 hours**

Alternative methods of electric transportation will be examined. Projects may include electric scooters, electric bicycles, and retrofit projects.

<ul style="list-style-type: none"> <li>● Collaborative learning</li> <li>● Computer skills</li> <li>● Critical Thinking skills</li> <li>● Component retrofit designing</li> </ul>	<ul style="list-style-type: none"> <li>● Design and fabrication</li> <li>● Measuring and calculation of watts power and gear reduction</li> </ul>	<ul style="list-style-type: none"> <li>● Use of general hand tools</li> <li>● Time management</li> <li>● Troubleshooting</li> <li>● Problem solving</li> </ul>
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applications		
<b>Standards Alignments:</b> <b>CCSS: LS 11-12.3; WS 11-12.1, 11-12.4, 11-12.10</b> <b>NGSS: SEP 1, 2, 3, 4, 5, 6, 8; PS 2.A, 2.B, 3.C</b>		
<b>Key Assignments</b>	<b>CTE Anchor Standards</b>	<b>CTE Pathway Standards</b>
<b>Key Assignments:</b> Students will explore projects in alternative methods of transportation such as retrofitting a conventional bike with an electric powertrain system. Many of the same components used in automotive EV are used in other transportation kits and designs. Critical thinking, problem solving, design and creative retrofit engineering concepts will be used in the group activity. <b>Assessments:</b> Documented detail notes will be recorded each day and submitted through Canvas. Grades by group and thoroughness of documentation.	4.0, 4.1, 4.3, 4.4, 9.0, 9.7, 10.1	C 2.0, C 3.7, C 4.0, C 5.6, C 7.0

<b>Unit 18: Special Projects 105 (OEM Training Toyota, Ford, Subaru)</b>	<b>60 hours</b>
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In this Academy Leadership Lounge activity, the student will complete the Level 1 Subaru University OEM training, Toyota TECS courses, and assigned Ford NewFordTech ACE courses.

The Subaru Level 1 courses include: <ul style="list-style-type: none"> <li>● Repair Order Write Up</li> <li>● Subaru Technical Information System</li> <li>● Introduction to Subaru Service Manual</li> <li>● Basic Electrical 1</li> <li>● Basic Electrical 2</li> <li>● Remote Engine Start</li> <li>● Bluetooth</li> <li>● Generic Hybrid Overview</li> <li>● Noise, Vibration &amp; Harshness</li> </ul>	The Toyota courses include: <ul style="list-style-type: none"> <li>● Technical Introduction to Toyota</li> <li>● Using TIS</li> <li>● Toyota Maintenance &amp; General Service</li> <li>● Toyota Tire &amp; Wheel Service</li> <li>● Toyota Hybrid Electrified General Service</li> <li>● Toyota Brake Service</li> <li>● Toyota Recall &amp; Service Campaign</li> </ul>	<ul style="list-style-type: none"> <li>● Self paced curriculum</li> <li>● Individual achievement</li> <li>● Computer skills</li> <li>● Critical Thinking skills</li> </ul>
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<b>Standards Alignments:</b> <b>CCSS: LS 11-12.3; WS 11-12.1, 11-12.4, 11-12.10</b> <b>NGSS: SEP 1, 2, 3, 4, 5, 6, 8; PS 2.A, 2.B, 3.C</b>		
Key Assignments	CTE Anchor Standards	CTE Pathway Standards
<p><b>Key Assignments:</b> Subaru University, Toyota TECS and Ford ACE programs are offering high school level students basic technical training e-learning courses. Primary focus is understanding technical systems and procedures repairing vehicles but this knowledge transfers to other OEM brands. Hands on shop diagnosis and repair on OEM vehicles.</p> <p><b>Assessments:</b> Students will complete the training sessions and take the module questions within the programs. Final assessment is to gain a passing grade of 80% or higher to be certified. A certificate is available for recognition to be presented to instructor and potential dealership management. These are the same courses an entry-level OEM Technician's are required to complete.</p>	4.0, 4.1, 4.3, 4.4, 9.0, 9.7, 10.1	C 2.0, C 3.7, C 4.0, C 5.6, C 7.0

<b>Unit 19: Special Projects 106 (EV, Hybrids, and Natural Gas Vehicles)</b>		<b>36 hours</b>
Topics of study will include the Toyota Prius Hybrid, Honda Civic Hybrid & Natural Gas Vehicle (CNG), and other alternative fuel transportation.		
<ul style="list-style-type: none"> <li>● Familiarization with Toyota Prius EV</li> <li>● Customer Features and Advancements</li> <li>● General Service Maintenance Repairs</li> <li>● Hands-on Vehicle Identification</li> </ul>	<ul style="list-style-type: none"> <li>● Familiarization with Honda CNG</li> <li>● Hybrid Technology</li> <li>● Component Locations</li> </ul>	<ul style="list-style-type: none"> <li>● Researching Alternative Fuels</li> <li>● EV Power Plants</li> <li>● Hybrid Power Plants</li> </ul>
<b>Standards Alignments:</b> <b>CCSS: LS 11-12.3; WS 11-12.1, 11-12.4, 11-12.10</b>		

NGSS: SEP 1, 2, 3, 4, 5, 6, 8; PS 2.A, 2.B, 3.C		
Key Assignments	CTE Anchor Standards	CTE Pathway Standards
<p><b>Key Assignments:</b> Students will follow the OEM curriculum worksheets under the instructor's guidance. Self study videos, powerpoint presentations and hands-on activities from Ford, Tesla, Toyota and Honda guide the student to advanced collaborative learning. Hands-on shop diagnosis and repair on OEM vehicles.</p> <p><b>Assessment:</b> Completion of the assigned assignments, observations, written documentation, and peer feedback discussions.</p>	4.0, 4.1, 4.3, 4.4, 9.0, 9.7, 10.1	C 2.0, C 3.7, C 4.0, C 5.6, C 7.0

## Unit 20: Special Projects 107 (Work Experience)

Students can earn credit for industry related on-the-job work experience, job shadowing, or working on their own transportation vehicle. Special Projects 107 is designed to give students the flexibility to work after school to increase their knowledge of the automotive industry, time management, teamwork, and documenting what they have learned. Students learn transferable skills while working or by participating in an automotive shadow day at our partnership automotive dealerships. Managers will provide feedback for student improvement. Students can also receive credit for working on vehicles directly. They must follow the 5-Step troubleshooting in their documentation through Canvas. Text documentation, media videos, photos, and file uploads are accepted.

<ul style="list-style-type: none"> <li>● Future EV Technology</li> <li>● Electric Transportation Options</li> <li>● Critical Thinking</li> <li>● Structural Design</li> <li>● Hands-on Repair</li> <li>● Analyzing Wiring Diagrams</li> </ul>	<ul style="list-style-type: none"> <li>● Researching Customer Demands and Trends</li> <li>● Sales Projections</li> <li>● Safety Procedures</li> <li>● DMM Testing</li> <li>● Assembly of Project Kits</li> </ul>	<ul style="list-style-type: none"> <li>● Subjective and Objective Ranking</li> <li>● Collaborative Group Learning</li> <li>● Challenged Based Projects</li> <li>● Flowchart Design</li> <li>● Tools / Equipment</li> <li>● Creating Group Presentations</li> </ul>
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**Standards Alignments:**  
**CCSS:** LS 11-12.3; **WS** 11-12.1, 11-12.4, 11-12.10  
**NGSS:** SEP 1, 2, 3, 4, 5, 6, 8; PS 2.A, 2.B, 3.C

Key Assignments	CTE Anchor	CTE Pathway
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	Standards	Standards
<p><b>Key Assignments:</b> Students will receive pre-approval for Special Project 107 vehicle repair for at home or work. They will describe what they want to accomplish, how they will approach it, what tools and equipment will be needed, and using the 5-Step Troubleshooting process they will document it in a Repair Order format using the 3 C's. Students are encouraged to submit photos, videos and service manual procedures or wiring diagrams analysis to validate the repairs. Vehicle diagnosis or repairs do not have to be completed by demonstrating critical thinking, problem analysis and a troubleshooting logical path.</p> <p><b>Assessment:</b> Any transportation related diagnostic and repair is accepted with instructor prior approval. Submit service manual R&amp;R procedures followed, wiring diagram analysis, specification references, photos, videos, and documented notes through Canvas assignment. List dated running documentation synopsis, ask instructor for advice for guidance and feedback.</p>	4.0, 4.1, 4.3, 4.4, 9.0, 9.7, 10.1	C 2.0, C 3.7, C 4.0, C 5.6, C 7.0

Instructional Materials	
Textbooks	Electronic Media/Supplemental Print Materials/Online Resources:
<p><b>Modern Automotive Technology</b>, 9<sup>th</sup> edition            AUTHOR: James E. Duffy – The Goodheart Wilcox Company © 2017            ISBN: 978-1-63126-375-0</p>	<p><b>Modern Automotive Technology</b>, 9th Edition            AUTHOR: James E. Duffy - The Goodheart Wilcox Company © 2017            ISBN: 978-1-63126-381-1            Text + Online Learning Suite, 6yr. Classroom Subscription</p> <p><b>ShopKeyPro</b> - Service Manuals from 1973 -Present</p>

	<p><b>Honda Online University PACT</b> - e-Learning, basic electrical PowerPoint presentations, interactive programs, OEM worksheet curriculum</p> <p><b>A-Tech</b> - Basic electrical circuit boards and components</p> <p><b>Toyota TTEN TECS</b> - OEM e-Learning courses</p> <p><b>Subaru University</b> - OEM e-Learning courses</p> <p><b>Ford ACE Program</b> - OEM e-Learning courses</p> <p><b>Switch Vehicles, Inc.</b> - EV training lab and worksheet curriculum</p> <p><b>Daktic, Inc.</b> - Advanced electrical circuit boards and worksheet curriculum</p>
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## Standards Assessed in this Course

**CTE Anchor Standards:**

1.0 Academics: Academics standards are aligned to pathways; see below.

2.0 Communications: Acquire and use accurately sector terminology and protocols at the career and college readiness level for communicating effectively in oral, written, and multimedia formats.

3.0 Career Planning and Management: Integrate multiple sources of career information from diverse formats to make informed career decisions, solve problems, and manage personal career plans.

4.0 Technology: Use existing and emerging technology, to investigate, research, and produce products and services, including new

information, as required in the sector workplace environment.

5.0 Problem Solving and Critical Thinking: Conduct short, as well as more sustained, research to create alternative solutions to answer a question or solve a problem unique to the sector using critical and creative thinking, logical reasoning, analysis, inquiry, and problem-solving techniques.

6.0 Health and Safety: Demonstrate health and safety procedures, regulations, and personal health practices and determine the meaning of symbols, key terms, and domain-specific words and phrases as related to the sector workplace environment.

7.0 Responsibility and Flexibility: Initiate, and participate in, a range of collaborations demonstrating behaviors that reflect personal and professional responsibility, flexibility, and respect in the sector workplace environment and community settings.

8.0 Ethics and Legal Responsibilities: Practice professional, ethical, and legal behavior, responding thoughtfully to diverse perspectives and resolving contradictions when possible, consistent with applicable laws, regulations, and organizational norms.

9.0 Leadership and Teamwork: Work with peers to promote divergent and creative perspectives, effective leadership, group dynamics, team and individual decision making, benefits of workforce diversity, and conflict resolution.

10.0 Technical Knowledge and Skills: Apply essential technical knowledge and skills common to all pathways in the sector following procedures when carrying out experiments or performing technical tasks.

### **Transportation Sector — System Diagnostic, Services and Repair Pathway Standards**

C1.0 Demonstrate the practice of personal and occupational safety and protecting the environment by using materials and processes in accordance with manufacturer and industry standards.

C1.1 Know and understand common environmental conservation practices and their applications.

C1.2 Practice the safe handling and storage of chemicals and hazardous wastes in accordance with Material Safety Data Sheets (MSDS) and the requirements of local, state, and federal regulatory agencies.

C1.3 Understand the way in which waste gases, emissions, and other environmentally destructive substances are generated and the effects of these substances on the environment.

C1.4 Use appropriate personal protective equipment and safety practices.

C1.5 Evaluate the advantages and disadvantages of existing, new, and emerging systems and the effects of those systems on the environment.

C2.0 Practice the safe and appropriate use of tools, equipment, and work processes.

C2.1 Recognize the importance of calibration processes, systems, and techniques using various measurement and testing devices.

C2.2 Demonstrate and use appropriate tools and equipment—such as wrenches, sockets, and pliers—to diagnose, service, repair, and maintain systems and components.

C2.3 Use tools, equipment, and machines to safely measure, test, diagnose, and analyze components and systems (e.g., electrical and electronic circuits, alternating- and direct-current applications, fluid/hydraulic and air/pneumatic systems).

C2.4 Select and use the appropriate measurement device(s) and use mathematical functions necessary to perform required fabrication, maintenance, and operation procedures.

- C2.5 Use measurement scales, devices, and systems, such as dial indicators and micrometers, to design, fabricate, diagnose, maintain, and repair vehicles and components following recommended industry standards.
- C2.6 Demonstrate how to access technical reports, manuals, electronic retrieval systems, and related technical data resources.
- C2.7 Test and analyze the elements of precision measuring using standard and metric systems.
- C3.0 Use scientific principles in relation to chemical, mechanical, and physical functions for various engine and vehicle systems.
- C3.1 Describe the operating principles of internal and/or external combustion engines.
- C3.2 Describe the function and principles of air-conditioning and heating systems.
- C3.3 Describe the basic principles of pneumatic and hydraulic power and their applications.
- C3.4 Describe the applications of alternative power sources.
- C3.5 Practice the basic principles of electricity, electronics and electrical power generation, and distribution systems.
- C3.6 Explain the principles of converting energy from one form to another.
- C3.7 Perform necessary procedures to maintain, diagnose, service, and repair vehicle systems and malfunctions.
- C4.0 Perform and document maintenance procedures in accordance with the recommendations of the manufacturer.
- C4.1 Communicate the procedures and practices of various manufacturers regarding service, repair, and maintenance schedules.
- C4.2 Demonstrate how to properly document maintenance and repair procedures in accordance with applicable rules, laws, and regulations (e.g., Bureau of Auto Repair [BAR], Occupational Safety and Health Administration [OSHA], and the California Air Resources Board [ARB]).
- C4.3 Use reference books, technical service bulletins, and other documents and materials related to the service industry available in print and through electronic retrieval systems to accurately diagnose and repair systems, equipment, and vehicles.
- C4.4 Complete a work order, including customer information, description of repairs, and billing information, in accordance with applicable rules, laws, and regulations.
- C5.0 Apply and understand appropriate business practices.
- C5.1 Identify work-related systems common to the transportation service industry.
- C5.2 Know the laws and regulations applicable to recordkeeping and the appropriate handling and disposal of hazardous materials.
- C5.3 Explain the importance of and the procedures for maintaining accurate records (e.g., business licenses, repair orders, billing and tax records).
- C5.4 Practice the concept and application of accepted ethical business practices.
- C5.5 Practice the concept and application of acceptable customer relations practices.
- C5.6 Recognize, analyze, and evaluate the need for maintenance of components and systems and the conditions under which service and maintenance are required.
- C6.0 Demonstrate the application, operation, maintenance, and diagnosis of engines, including but not limited to two- and four-stroke and supporting subsystems.
- C6.1 Perform general engine maintenance, diagnosis, service, and repair in accordance with portable national industry standards, such as the

National Automotive Technicians Education Foundation and the Equipment and Engine Training Council.

C6.2 Maintain, diagnose, service, and repair lubrication and cooling systems.

C6.3 Practice how to maintain, diagnose, and repair computerized engine control systems and other engine-related systems.

C6.4 Maintain, diagnose, service, and repair ignition, electronic, and computerized engine controls and fuel management systems.

C7.0 Demonstrate the function, principles, and operation of electrical and electronic systems using manufacturer and industry standards.

C7.1 Practice maintenance, diagnosis, and repair of electrical systems.

C7.2 Maintain, diagnose, repair, and service batteries.

C7.3 Demonstrate maintenance, diagnosis, service, and repair of starting and charging systems.

C7.4 Diagnose, service, and repair lighting systems.

C7.5 Diagnose, service, and repair heating and air-conditioning systems and components.

C7.6 Diagnose, service, and repair horns, wipers/washers, and other accessories.

C7.7 Perform necessary procedures to maintain, diagnose, service, and repair vehicle electrical and electronic systems and malfunctions.

C8.0 Demonstrate the function and principles of automotive drivetrain, steering and suspension, brake, and tire and wheel components and systems in accordance with national industry standards.

C8.1 Describe how to maintain, diagnose, service, and repair hydraulic and power assist systems.

C8.2 Describe the function and operation of automatic and manual transmissions and transaxles.

C8.3 Diagnose, service, and repair disc brakes, drum brakes, anti lock brakes, and other brake systems as developed.

C8.4 Diagnose, service, and repair steering and suspension systems.

C8.5 Interpret tire and rim sizing to select appropriate wheels and tires for vehicles.

C8.6 Maintain, diagnose, service, and repair under-vehicle systems and malfunctions.

### **Common Core State Standards**

Language Standards – LS (Standard Area, Grade Level, Standard #)

LS 11-12.1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

LS 11-12.3 Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening.

Reading Standards for Literacy in Science and Technical Subjects – RLST (Standard Area, Grade Level, Standard #)

RLST 11-12.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text

RLST 11-12.10 By the end of grade 12 read and comprehend science/technical texts in the grades text complexity band independently and proficiently.

Writing Standards – WS (Standard Area, Grade Level, Standard #)

WS 11-12.1 Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

WS 11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

WS 11-12.6 Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.

WS 11-12.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.

WS 11-12.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.

Algebra – A-SSE – Seeing Structure in Expressions

A-SSE 1. Interpret expressions that represent a quantity in terms of its context

Algebra – A-CED – Creating Equations

A-CED 1. Create equations and inequalities in one variable including ones with absolute value and use them to solve problems in and out of context, including equations arising from linear functions.

A-CED 4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm’s law  $V = IR$  to highlight resistance  $R$ .

Geometry – G-CO – Congruence

G-CO 12. Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.

**Next Generation Science Standards:**

**Scientific and Engineering Practices – SEP**

SEP 1 Asking questions (for science) and defining problems (for engineering)



SEP 2 Developing and using models  
SEP 3 Planning and carrying out investigations  
SEP 4 Analyzing and interpreting data  
SEP 5 Using mathematics and computational thinking  
SEP 6 Constructing explanations (for science) and designing solutions (for engineering)  
SEP 7 Engaging in argument from evidence  
SEP 8 Obtaining, evaluating, and communicating information

**Disciplinary Core Ideas**

ETS 1 Engineering Design  
ETS 1.A Defining and Delimiting an Engineering Problem  
ETS 1.B Developing Possible Solutions  
ETS 1.C Optimizing the Design Solution  
ETS 1.E Optimizing the Design Solution  
ETS 2 Links Among Engineering, Technology, Science, and Society  
ETS 2.A Interdependence of Science, Engineering, and Technology  
PS 1 Structure and Properties of Matter  
PS 2 Motion and Stability: Forces and Interactions  
PS 2.C Forces and Motion  
PS 3.A Definitions of Energy  
PS 3.B Conservation of Energy and Energy Transfer  
PS 3.C Relationship Between Energy and Forces  
Crosscutting Concept – CC

**Mechanism and explanation**

CC 2 Cause and effect

CC 4 Systems and system models  
CC 5 Energy and matter: Flows,  
cycles, and conservation  
CC 6 Structure and function  
CC 7 Stability and change

**Draft 10**  
**05.30.23**