



Automotive Services **Course Outline**

Course Description

This 519 hour year-long course is designed to prepare students for entry level employment in the automotive repair field. Students learn skills through a variety of exercises utilizing passenger cars or light-duty trucks. 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. The activities emphasize theory of operation, hands-on exercises, and general service and repair.

Course Details

Length of Program and Academic Credits Earned:

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

30 total credits (15/semester):

- 30 non-a–g elective credits (15/semester)

Pre-Requisites:

- High School Junior or Senior, or 16 years or older

CTE Classification:

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

Work-Based Learning:

Eligible students may be selected to participate in a 6 week internship at a local dealership.

Certifications & State Tests:

- SVCTE Certificate of Completion awarded with a “C” or better average for both semesters.

Community College Articulations

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

Evergreen Community College – 3.5 units More info at: www.evc.edu

Possible Education & Career Pathways

| College & Career Pathways: | Career Opportunities | O*NET Codes |
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| <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"> ● Tire Repairer and Changer ● Automotive Service Technician and Mechanic ● Auto Mechanic (assistant) ● Automotive Specialty Technician ● Automobile Mechanic (assistant) ● Helper, Transmission Mechanic | <p>49-3093.00 49-3023.00 49-9098.00 49-3023.02 49-3023.01 49-3023.01</p> |
| <p><u>Community College Majors & Degrees:</u></p> <ul style="list-style-type: none"> ● AA or AS in Automotive Technology, Electrical-engine Performance, Mechanical Engineering | <ul style="list-style-type: none"> ● Mechanical Engineering Technologist ● Automotive Service Technician and Mechanic ● Automotive Master Mechanic ● Motorcycle Mechanic ● Automotive Specialty Technician ● Automotive Engineering Technician ● Electronic Equipment Installer and Repairers, Motor Vehicle ● Auto Tester | <p>17-3029.07 49-3023.00 49-3023.01 49-3052.00 49-3023.02 17-3027.01 49-2096.00 53-6051.07</p> |
| <p><u>University Majors & Degrees:</u></p> <ul style="list-style-type: none"> ● BA or BS in Automotive Technology, Mechanical Engineering | <ul style="list-style-type: none"> ● Mechanical Engineer ● Automotive Master Mechanic ● Electronics Engineer | <p>17-2141.00 49-3023.01 17-2072.00</p> |
| <p><u>Post-Baccalaureate Degrees</u></p> <ul style="list-style-type: none"> ● MA or MS in Automotive Technology, Mechanical Engineering ● MBA - Masters in Business Administration | <ul style="list-style-type: none"> ● Mechanical Engineer ● Automotive Master Mechanic ● Sales Manager ● General and Operations Manager | <p>17-2141.00 49-3023.01 11-2022.00 11-1021.00</p> |

Ongoing Unit: Career Readiness & Professionalism **30 hours**

Students will develop personal and professional skills in the classroom and lab, which are transferable to the workplace.

- Time management, punctuality and organization
- Interpersonal skills and effective communication
- Industry standard tools
- Creative thinking, teamwork and problem solving
- Job search skills including: resume, job applications and effective interview skills
- Dress code

Standards Alignments:
CCSS: RLST 11-12.3, 11-12.10; WS 11-12.4, 11-12.6

| Key Assignments | CTE Anchor Standards | CTE Pathway Standards |
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| <p>✓ Key Assignment: Students will participate in mock interviews with industry professionals, peers and instructors to increase their communication, interpersonal and employability skill-set.</p> <p>Assessment: rubric, observation of role playing, peer and self- assessment</p> | 2.1, 2.2, 2.3, 2.4, 2.5 | |
| <p>✓ Key Assignment: Students will prepare a portfolio including a cover letter and resume through workshop, self and peer editing, and teacher instruction and demonstration.</p> <p>Assessment: peer and instructor feedback, written documents</p> | 2.4, 11.5 | |
| <p>✓ Key Assignment: Students will have the opportunity to participate in a SkillsUSA Competition. In preparation for competition, students will fund raise, attend meetings, meet all requirements and dates and prepare for competition. At competition, students will compete in categories such as: brakes, alignment, engines, electrical, engine performance.</p> <p>Assessment: observation, teacher-student conference, community feedback</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 | C 2.0, C 4.0, C 6.0, C 7.0, C 8.0 |

Ongoing Unit : Customer Relations and Sales Skills

30 hours

Good customer relations will be practiced in class and lab to assist students with learning skills necessary to maintain employment in the collision industry.

- Communication Skills
- Acknowledge and greet customer/client
- Listen to customer needs
- Collect information and identify customer/client needs and expectation
- Cooperative attitude
- Customer de-escalation
- Positive attitude
- Professional appearance
- Negotiation skills to obtain mutual agreement

Standards Alignments:

CCSS: RLST 11-12.3; WS 11-12.4

| Key Assignments | CTE Anchor Standards | CTE Pathway Standards |
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| <p>✓ Key Assignment: 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>Assessment: peer evaluation, customer survey, debriefing, self reflection</p> | 1.0, 2.1, 2.2, 2.3, 5.0, 7.2, 8.1, 10.1, 11.0 | C 4.0 |
| <p>✓ Key Assignment: Students will role play a customer/service provider interaction where the customer becomes upset. One student will take the role of client, the other will take the role of estimator. They will demonstrate to class the proper way to handle the situation in a mature and professional manner. Peers will critique and offer suggestions.</p> <p>Assessment: peer evaluation, customer survey, debriefing, self reflection</p> | 1.0, 2.1, 2.2, 2.3, 5.0, 7.2, 8.1, 10.1, 11.0 | C 4.0 |
| <p>✓ Key Assignment: Students will create a customer satisfaction survey to give to clients after each repair highlighting customer service interaction and quality of work. Students will self-evaluate based on customer feedback.</p> <p>Assessment: teacher input, written survey, self reflection</p> | 1.0, 2.1, 2.2, 2.3, 5.0, 7.2, 8.1, 10.1, 11.0 | C 4.0 |

Unit 1: Safety and Environmental Inspection **30 hours**

Students will learn how to identify safety hazards in the lab and learn how to maintain a safe work environment.

- Environmental laws
- Proper waste disposal and recycling
- Introduction to tools
- Vehicle service history
- Hydraulic lift operation
- MSDS (materials safety data sheet)
- Safety glasses and other personal protective equipment

Standards Alignments:
 CCSS: RLST 11-12.3
 NGSS: SEP 4; CC 7; PS 1,1.B

| Key Assignments | CTE Anchor Standards | CTE Pathway Standards |
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| <p>✓ Key Assignment: Using a checklist aligned with EPA standards provided by instructor, students will individually explore the lab looking for safety violations in electrical, fire, chemical and solid waste material. Students will then suggest improvement and corrective action in written form.</p> <p>Assessment: checklist, observation, oral and written defense, peer and instructor feedback</p> | 6.1, 6.2, 6.3, 6.4 6.5, 6.6 | C 1.1, C 1.2, C 1.3, C 1.4, C 1.5 |
| <p>✓ Key Assignment: 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.</p> <p>Assessment: checklist, observation, oral and written defense, peer and instructor feedback</p> | 10.1, 10.2, 11.2 | C 4.1, C 4.3 |
| <p>✓ Key Assignment: In teams of four, students will properly follow all shop procedures to safely set up a shop car on the vehicle lifts (4 post and 2 post).</p> <p>Assessment: visual inspection, instructor observation</p> | 10.1, 10.2, 11.2 | C 4.1, C 4.3 |

Unit 2: Gaskets, Seals and Lubricant Systems **15 hours**

In this unit, students will learn the basics of gasket and seal replacement. They will identify information from the online service manuals and apply this information to the lab while making repairs to the automobile.

- Identify gaskets & seals for a four stroke engine
- Oil change
- Filter change
- Engine inspection for leaks
- Oil pressure sensor and switches
- Industry vocabulary
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| Standards Alignments: CCSS: RLST 11-12.3, 11-12.10; LS 11-12.1 NGSS: SEP 1, 2, 3, 4, 6, 8 | | |
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| Key Assignments | CTE Anchor Standards | CTE Pathway Standards |
| <p>✓ Key Assignment: In collaborative groups using industry standard repair manuals, students will individually remove and replace a gasket and seal to demonstrate their competency to peers and instructor.</p> <p>Assessment: teacher observation and feedback, demonstration, oral defense, quiz, test</p> | 7.1, 8.4, 9.3 9.6 | C 4.3, C 6.2 |
| <p>✓ Key Assignment: Students will individually and in groups locate the seal, research and consult the service manual, follow all procedures and replace the defective seal to industry standards.</p> <p>Assessment: teacher observation and feedback, demonstration, oral defense, quiz, test</p> | 9.7, 10.1, 10.2 | C 4.2, C 4.3 |
| <p>✓ Key Assignment: Following the Manufacturer Service Inspection Guide, students will individually and in pairs change the oil and oil filter. Students will follow the correct procedures to reset the maintenance service light, then demonstrate and explain the procedure to the instructor.</p> <p>Assessment: teacher observation and feedback, demonstration, oral defense, quiz, test</p> | 9.3, 9.7, 10.2, 11.1 | C 4.1, C 7.2 |

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| Unit 3: Engine Problem Diagnosis | 15 hours |
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| <p>Students will work in the classroom and lab to learn the skills necessary to diagnose a variety of engine problems.</p> <ul style="list-style-type: none"> ● Vacuum test ● Compression test ● Cylinder leakage test ● Oil pressure test <p>Standards Alignments: CCSS: RLST 11-12.3, 11-12.10; LS 11-12.1; WS 11-12.4 NGSS: SEP 1, 2, 3, 4, 6, 8</p> | | |
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| Key Assignments | CTE Anchor Standards | CTE Pathway Standards |
| <p>✓ Key Assignment: Students will be introduced to a variety of tools including compression gauge, vacuum gauge, oil pressure gauge, oil filter wrench, oil drain pan, oil grade, oil filter and a</p> | 7.1, 7.7, 8.5 | C 2.2, C 4.3 |

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| <p>variety hand tools. Students will choose the correct diagnostic tools to perform the required engine test and explain in a repair order why they chose the tools to solve the internal mechanical problem.</p> <p>Assessment: student questioning, teacher observation and feedback, demonstration, oral defense, quiz, test</p> | | |
| <p>✓ Key Assignment: Working as a collaborative team, students will use the manufacturer service manual to correctly collect information and perform diagnostic tests including: compression, cylinder leakage and oil pressure to diagnose and measure the internal engine mechanical problem(s). Students will write a repair order including accurate documentation and suggestion for mechanical repair.</p> <p>Assessment: written documentation, teacher observation and feedback, demonstration, oral defense, quiz, test</p> | 7.1, 7.7, 9.6, 9.7, 10.1 | C 4.3, C 5.6, C 8.3 |

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| Unit 4: Disassembling an Engine | 15 hours |
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Students will learn how to disassemble an engine and be introduced to all associated technical and industry standard vocabulary necessary to understand and apply:

- Engine holding fixture (engine stand)
- Service manuals and information
- Proper use of hand tools
- Proper use of air power tools
- Safety and protective equipment
- Cylinder head parts, front engine cover, short block parts

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

| Key Assignments | CTE Anchor Standards | CTE Pathway Standards |
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| <p>✓ Key Assignment: While disassembling an engine, students will individually and in groups identify, label and describe the function of each of the long block engine components (including the fasteners) and categorize each part in an individual written document which may include illustration.</p> <p>Assessment: illustration review, critique, written documentation, observation, test</p> | 3.3, 7.1, 7.3, 11.1, 11.5 | C 1.5, C 4.3, C 4.4 |

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| Unit 5: Bottom end Services (Short Block) | 15 hours |
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Students will work on a variety of shop and customer automobiles to include:

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| <ul style="list-style-type: none"> ● Block, crankshaft and crankshaft bearings ● Repair of damaged threads ● Measure cylinder wear | <ul style="list-style-type: none"> ● Hone cylinders ● Connecting rods ● Pistons and piston ring | <ul style="list-style-type: none"> ● Balance shafts ● Vibration damper ● Oil pump |
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Standards Alignments:

CCSS: LS 11-12.1; WS 11-12.4

NGSS: CC 4,6; ETS 1.A, B

| Key Assignments | CTE Anchor Standards | CTE Pathway Standards |
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| <p>✓ Key Assignment: Using a checklist, students will perform a visual inspection of a short block for cracks, core, gallery plug condition, surface warp and determine necessary action for repair. Students will write up their assessment on a work order and present this order to their instructor and peers while defending their analysis.</p> <p>Assessment: written documentation, teacher observation and feedback, demonstration, oral defense, quiz, test</p> | 4.1, 4.6, 6.3, 6.4 | C 2.3, C 4.3, C 8.6 |

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| Unit 6: Crankshaft and Bearings | 15 hours |
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Students will explore all aspects of crankshaft and bearings while utilizing industry standard tools on class and customer vehicles.

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| <ul style="list-style-type: none"> ● Telescopic gauge ● Outside micrometer ● Inside micrometer ● Thread repair inserts ● Cylinder block | <ul style="list-style-type: none"> ● Straightedge ● Various hand tools ● Various air and electric drills ● Various air power tools | <ul style="list-style-type: none"> ● Service manuals ● Crankshaft out of round and taper ● Correcting rod journals ● Main bearing journals |
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Standards Alignments:

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

NGSS: SEP 1, 2, 3, 4, 6, 8; ETS 1.A, B

| Key Assignments | CTE Anchor Standards | CTE Pathway Standards |
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| <p>✓ Key Assignment: Following the manufacturer's specifications, students will collaboratively use the straight edge and feeler gauge to evaluate warp of the cylinder block deck surface and write a repair order with proof of documentation attached and present a powerpoint (or other visual display) to graphically represent proof of their claim.</p> <p>Assessment: written documentation, teacher observation and feedback, demonstration, oral defense, quiz, test</p> | <p>1.0, 2.0, 7.2, 9.1, 9.3, 9.7</p> | <p>C 2.5, C 4.3, C 4.4</p> |
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| Unit 7: Cylinder Head and Valve Train | 15 hours |
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Students will learn the associated industry tools, terminology and practices associated with:

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| ● Cylinder head inspection | ● Cylinder head assembly | ● Replace valve seals |
| ● Inspect and service valve train parts | ● Valve timing components | ● Valve adjustment |

Standards Alignments:

CCSS: WS 11-12.4, 11-12.6, 11-12.9

NGSS: SEP 1, 2, 3, 4, 5, 6, 7, 8; ETS 1.A, B, C

| Key Assignments | CTE Anchor Standards | CTE Pathway Standards |
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| <p>✓ Key Assignment: After learning the purpose of a variety of valve train tools including valve spring compressor, air pressure hose, straight edge, feeler gauges, various hand tools, hole gauges, air power tools, outside and inside micrometers and telescopic gauges, students will research, collect and analyze service information regarding the valve train and determine the appropriate tools to use to disassemble the valve train components. Students will then verbally convey their findings to instructor.</p> <p>Assessment: citation of sources, observation, oral defense, peer and instructor feedback, self reflection, quiz, test</p> | <p>1.0, 2.0, 4.1, 5.1, 5.2, 5.3, 5.4, 10.1, 11.0</p> | <p>C 2.1, C 2.3, C 2.4, C 4.3</p> |

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| Unit 8: Engine Bottom Assembly & Cylinder Head | 45 hours |
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Students will engage in a variety of hands-on practice and academic skills training about:

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| ● Engine bottom end | ● Engine holding fixture | ● Plastigage |
| ● Ring compressor | ● Service information & manuals | ● Dial indicator |
| ● Torque wrench | ● Engine oil | ● Ring compressor |

- Balance shafts
- Oil pan & oil pump

Standards Alignments:

CCSS: WS 11-12.4, 11-12.6, 11-12.9

NGSS: SEP 1, 2, 3, 4, 5, 6, 7, 8; **ETS** 1.A,B,C

| Key Assignments | CTE Anchor Standards | CTE Pathway Standards |
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| <p>✓ Key Assignment: Students will individually select an engine bottom type from a teacher provided list and investigate the engine classification and specifications. Students will synthesize this information into a powerpoint presentation to include graphic, written and visual information to instruct their peers on their engine type.</p> <p>Assessment: citation of sources, observation, oral defense, peer and instructor feedback, self reflection, quiz, test, gallery walk</p> | 1.0, 2.0, 5.0, 10.0 | C 2.3, C 2.4, C 2.5, C 4 .1 |
| <p>✓ Key Assignment: By identifying and using the proper tools, students will collaboratively rebuild/reassemble the engine short block that they previously disassembled. Students will take turns individually demonstrating and justifying the tool choice and measurements as specified in the manufacturer service manual. They will record their findings in their notebook and include associated terms and illustrations as necessary</p> <p>Assessment: written documentation, teacher observation and feedback, demonstration, oral defense, quiz, test</p> | 1.0, 2.0, 5.0, 10.0 | C 2.1, C 2.2, C 2.5, C 4.1 |
| <p>✓ Key Assignment: Working as a team, students will install the valve timing components and front cover to the engine using correct procedural steps and a checklist to verify work.</p> <p>Assessment: written documentation, teacher observation and feedback, demonstration, oral defense, quiz, test</p> | 1.0, 2.0, 5.0, 10.0 | C 2.3, C 4.1, C 4.4 |

Unit 9: Coolant System

15 hours

Students will engage in hands-on activities working on shop cars to:

- Test coolant system
- Flush and bleed the coolant system
- Replace valves and hoses
- Replace the coolant pump
- Replace radiator
- Replace and remove thermostat

| Standards Alignments: CCSS: LS 11-12.1; WS 11-12.4 NGSS: SEP 1, 2, 3, 4, 5, 6, 7, 8; ETS 1.A,B,C | | |
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| Key Assignments | CTE Anchor Standards | CTE Pathway Standards |
| <p>✓ Key Assignment: While demonstrating correct use of the refractometer, various coolant testers, temperature tester, hand tools, drain pans and safety equipment, students will diagnose the coolant system for leaks and suggest corrective action and repair to factory standards.</p> <p>Assessment: teacher observation and feedback, demonstration, oral defense, quiz, test</p> | 1.0, 2.0, 5.0, 10.0 | C 3.7, C 6.1, C 6.2 |

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| Unit 10: Basic Electrical Theory | 27 hours |
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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 and shop.

- Key terms
- Basic circuit types
- Electrical current
- Electricity
- Voltage drop testing
- Multimeter, test light
- Voltage testing
- Electrical resistance

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

| Key Assignments | CTE Anchor Standards | CTE Pathway Standards |
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| <p>✓ Key Assignment: 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>Assessment: 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>✓ Key Assignment: 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>Assessment: unit quiz, observation, written documentation, peer feedback</p> | 1.0, 2.4, 4.1, 9.0, 10.1 | C 2.0, C 3.7 |

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| <p>✓ Key Assignment: 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>Assessment: unit quiz, observation, written documentation, peer feedback, module test</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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| Unit 11: Batteries and Battery Testing | 9 hours |
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Students will work hands on in the classroom and lab to inspect, diagnose and service 12 volt automotive batteries to industry standards.

- Construction and operation of a 12 volt automotive battery
- Battery testing
- Battery inspection and servicing
- Measure parasitic draw

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

| Key Assignments | CTE Anchor Standards | CTE Pathway Standards |
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| <p>✓ Key Assignment: 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>Assessment: unit quiz, observation, written documentation, peer feedback</p> | <p>1.0, 2.4, 4.1, 5.0, 9.0, 10.1</p> | <p>C 2.0, C 3.7, C 4.0, C 5.6, C 7.2</p> |
| <p>✓ Key Assignment: Using a multimeter, students will measure the parasitic draw of the vehicle and record and defend their findings to peers and instructor.</p> <p>Assessment: unit quiz, observation, peer feedback, oral defense and questioning</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 7.2</p> |
| <p>✓ Key Assignment: 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>Assessment: unit quiz, observation, written documentation, peer feedback, module test</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 7.2</p> |

Unit 12: OHM’S Law **15 hours**

Students will dissect electrical circuits mathematically using Ohm’s Law of Properties.

- Ohm’s Law
- Basic math and algebraic equations as related to electrical circuits
- Calculator
- Rules related to series, parallel and series-parallel circuits

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, 8; **PS** 3.C

| Key Assignments | CTE Anchor Standards | CTE Pathway Standards |
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| <p>✓ Key Assignment: 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>Assessment: unit quiz, observation, written documentation, peer feedback, module test</p> | 1.0, 2.4, 4.1, 5.0, 9.0, 10.1, 10.2 | C 3.5 |

Unit 13: Advanced Electrical **15 hours**

Students will engage in classroom and lab activities to explore advanced electrical principles and components.

- Magnetism
- Wires
- Protection Devices
- Repair procedures
- Switches and relays
- Advanced circuit construction
- Watts and capacitors
- Semiconductors

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>✓ Key Assignment: 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 instructor for feedback and evaluation.</p> <p>Assessment: unit quiz, observation, written documentation, peer feedback</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 |
| <p>✓ Key Assignment: Using various switches and components, students will work in collaborative teams to construct many types of advanced circuits (window motor, cooling</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 |

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| fan, turn signal, headlight/tail light, relay operated devices) and demonstrate functioning circuits to peers and instructor. Assessment: unit quiz, observation, written documentation, peer feedback | | |
| ✓ Key Assignment: Using the Ohm's Law Power Formula, students will calculate watts in relation to volts and amps. Students will demonstrate their understanding through proper documentation and correct mathematical calculations. Assessment: unit quiz, observation, written documentation, peer feedback | 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 |
| ✓ Key Assignment: Using a multimeter in the diode check mode, students will inspect diodes and transistors to confirm if they are operational and document their findings. Assessment: unit quiz, observation, written documentation, peer feedback, module test | 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 |

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| Unit 14: Electrical Systems Troubleshooting | 18 hours |
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Students will learn a variety of diagnostic techniques to evaluate automotive electrical systems.

- Electrical schematics
- Troubleshooting techniques
- Diagnosis
- Key-off current draw testing (parasitic draw)
- Common electrical problems (unwanted resistance, shorts, opens)
- Troubleshooting testing methods (dividing the circuit, jumper wire, voltage drop testing)

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 |
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| ✓ Key Assignment: 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. Assessment: unit quiz, observation, written documentation, peer feedback | 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 |
| ✓ Key Assignment: 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. Assessment: unit quiz, observation, written documentation, peer feedback, module test | 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 15: Starting and Charging Systems

30 hours

In the classroom and lab, students will have the opportunity to learn about automotive ignition, charging systems and gain skills necessary to test and diagnose a full array of problems.

- Components and operation
- Diagnose starting system and charging problems
- Test power side and control side of control circuit

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 |
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| <p>✓ Key Assignment: Students will work collaboratively with peers to select an automobile of their choice to research and investigate the ignition 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>Assessment: unit quiz, observation, written documentation, peer feedback</p> | 1.0, 2.3, 2.4, 2.5, 4.1, 4.3, 5.0, 9.0, 10.1, 10.2, 10.3 | C 2.0, C 3.7, C 4.0, C 5.6, C 7.0 |
| <p>✓ Key Assignment: Using instructional materials to record observations, students will identify, label and record all components and operations of the ignition and charging systems in an automobile.</p> <p>Assessment: unit quiz, observation, written documentation, peer feedback</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 |
| <p>✓ Key Assignment: Students will use volt meters, test lights and carbon pile testers to perform on-car diagnostic tests of the various components of the starting and charging systems in a fully functional vehicle to document proper electrical values to later compare with non working systems.</p> <p>Assessment: unit quiz, observation, written documentation, peer feedback</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 |
| <p>✓ Key Assignment: Building upon their knowledge of functional charging and ignition systems, students will be presented with repair orders describing problems with the</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 |

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| <p>starting and charging circuit. Students must then properly diagnose the faulty components or wiring and provide written documentation of their repair proposed strategies.</p> <p>Assessment:unit quiz, observation,written documentation, peer feedback, module test</p> | | |
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| Unit 16: Brake Systems | 15 Hours |
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Using shop vehicles, students will use a hands-on approach to learn about a variety of brake systems.

- Introduction to vehicle brakes
- Brake system concerns
- Vehicle service history, service precautions, and technical service bulletins
- Component Identification
- Measure components & compare to specifications
- Repair orders (Complaint, Cause, & Correction)
- Estimating

Standards Alignments:
CCSS: WS 11-12.6; SLS 11-12.1; WS 11-12.10; A-CED 4
NGSS: PS 2.A; CC 2,3,4,5

| Key Assignments | CTE Anchor Standards | CTE Pathway Standards |
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| <p>✓ Key Assignment: Students will utilize the textbook to identify and label key components and their purpose for brake systems, which will allow for students to understand the standard industry vocabulary. (Repeated throughout the course).</p> <p>Assessment: class discussion, talking points</p> | 1.0, 10.0 | C 4.0, C 8.0 |
| <p>✓ Key Assignment: In groups of four, using a shop vehicle and/or customer automobile, students will: identify the customer complaint, fill out a repair order, troubleshoot the problem, research and compare to factory specs, as well as generate an estimate (using ShopKey and handwritten) which will include the cost of parts, labor and tax. The Students will inform the instructor or customer of needed repairs and total cost. (Repeated throughout year on multiple types of vehicles)</p> <p>Assessment: teacher observation, student conference, written work order, specs review, oral defense, peer and self-assessment, oral quiz and unit test</p> | 4.0, 10.0, 11.0 | C 4.0, C 8.0 |
| <p>✓ Key Assignment: Using a previously estimated shop and/or customer automobile, students work collaboratively in teams to perform a variety of repairs on brake systems including: hydraulic system repair, anti-lock brake systems, disc brake system and drum brake system to manufacturer specifications. Students will consult with the customer regarding the work performed and</p> | 4.0, 10.0, 11.0 | C 4.0, C 8.0 |

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| <p>demonstrate proper customer service interaction. (Repeated throughout year on multiple types of vehicles).</p> <p>Assessment: teacher observation, student conference, written work order, specs review, oral defense, peer and self-assessment, oral quiz and unit test</p> | | |
| <p>✓ Key Assignment: Using precision measuring tools such as micrometer and dial indicator, students will accurately measure and compare specifications on brake systems to determine if components can be serviced or need replacement. Students will indicate their results on a work order or vehicle inspection sheet to defend their findings. (Repeated throughout year on multiple types of vehicles).</p> <p>Assessment: teacher observation, student conference, written work order, specs review, oral defense, peer and self-assessment, oral quiz and unit test</p> | 4.0, 10.0, 11.0 | C 4.0, C 8.0 |

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| Unit 17: Brake System Hydraulics | 15 Hours |
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Students will be introduced to brake system hydraulics through a variety of hands-on and academic activities.

- Hydraulic system identification
- Pascal’s Law
- Hydraulic system pressure
- Brake bleeding procedures
- Component identification

Standards Alignments:
CCSS: WS 11-12.6; A-SSE 2.1; WS 11-12.10
NGSS: CC 2, 3, 4, 5

| Key Assignments | CTE Anchor Standards | CTE Pathway Standards |
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| <p>✓ Key Assignment: Using precision brake pressure gauges, students will work in groups to accurately measure and compare specifications on brake system pressure to determine necessary repairs and produce a written work order specific to vehicle being serviced.</p> <p>Assessment: teacher observation, student conference, written work order, specs review, oral defense, peer and self-assessment, oral quiz and unit test</p> | 10.0, 11.0 | C 4.0, C 8.0 |
| <p>✓ Key Assignment: Using ShopKey (computerized repair manual and estimating system) students will work in groups to research and identify correct bleeding procedure for specific makes and models of vehicles, bleed procedures according to manufacturer specifications and perform a brake pedal height and firmness check.</p> | 4.0, 10.0, 11.0 | C 4.0, C 8.0 |

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| Assessment: teacher observation, student conference, written work order, specs review, oral defense, peer and self-assessment, oral quiz and unit test | | |
| ✓ Key Assignment: Following instructor procedural checklist, student will individually use appropriate industry tools to remove and replace a master cylinder including proper demonstration of bench bleeding to peers and instructor. Assessment: teacher observation, student conference, oral defense, peer and self-assessment, oral quiz and demonstration | 10.0, 11.0 | C 4.0, C 8.0 |

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| Unit 18: Drum Brake Systems | 15 Hours |
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In both the classroom and lab students will work on shop vehicles to learn proper diagnosis, repair and replacement of drum brakes.

- Components of drum brake system
- Brake drum diameter measurement
- Diagnosis of drum brake system
- Brake drum resurfacing
- Parking brake adjustment
- Brake shoes lubrication
- Drum brakes adjustment

Standards Alignments:
 CCSS: WS 11-12.6, 11-12.10; A-SSE 2.1; A-CED 4
 NGSS: CC 2, 3, 4, 5; PS 2A

| Key Assignments | CTE Anchor Standards | CTE Pathway Standards |
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| ✓ Key Assignment: Working in groups, students will diagnose problems with drum brake systems which may include: poor stopping, noise, vibration, pulling, grabbing, dragging or pedal pulsation concerns. Students will prepare a computer generated written estimate that highlights their findings. (Repeated throughout year on multiple types of vehicles). Assessment: teacher observation, student conference, written work order, specs review, oral defense, peer and self-assessment, oral quiz and unit test | 4.0, 10.0, 11.0 | C 4.0, C 8.0 |
| ✓ Key Assignment: Utilizing the work orders generated by class, students will remove, clean, and inspect brake shoes, springs, pins, clips, levers, adjusters/self-adjusters, other related brake hardware, and backing support plates. They will lubricate and reassemble to manufacturer specifications for final instructor inspection where they will describe and defend their choices and process. (Repeated throughout year on multiple types of vehicles). Assessment: teacher observation, student conference, written work order, specs review, oral defense, peer and self-assessment, oral quiz and unit test | 4.0, 10.0, 11.0 | C 4.0, C 8.0 |

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| <p>✓ Key Assignment: Working on shop and customer cars, students will inspect wheel cylinders for leaks and proper operation. Students will report findings to instructor and propose repairs, contact customer regarding repair order and remove and replace as needed. (Repeated throughout year on multiple types of vehicles).</p> <p>Assessment: teacher observation, student conference, written work order, specs review, oral defense, peer and self-assessment, oral quiz and unit test</p> | 4.0, 10.0, 11.0 | C 4.0,C 8.0 |
| <p>✓ Key Assignment: Working with a variety of class or customer cars and a brake drum micrometer, students will work in groups to refinish brake drums and measure final drum diameter to compare with specifications. Pre-adjust brake shoes and parking brake, install brake drums or drum/hub assemblies and wheel bearings and perform final checks and adjustments to industry specifications.</p> <p>Assessment: teacher observation, student conference, written work order, specs review, oral defense, peer and self-assessment, oral quiz and unit test</p> | 4.0, 10.0, 11.0 | C 4.0, C 8.0 |

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| Unit 19: Disc Brake Systems | 15 Hours |
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Students will work on a variety of shop vehicles to learn about disc brake systems.

- Disc brake system identification
- Disc brake rotor measurement
- Diagnose: poor stopping, noise, vibration, pulling, grabbing, dragging, or pulsation concerns; determine necessary action.
- Brake rotor resurfacing
- Brake pads installation and lubrication

Standards Alignments:
 CCSS: WS 11-12.6, 11-12.10; A-SSE 2.1; A-CED 4
 NGSS: CC 2, 3, 4 ,5; PS 2.A

| Key Assignments | CTE Anchor Standards | CTE Pathway Standards |
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| <p>✓ Key Assignment: Students will clean and inspect rotor, measure rotor thickness using a micrometer (thickness and variation) and a dial indicator (lateral runout) and prepare work order stating necessary action. Students will propose the repair plan including a parts list and cost analysis to instructor or client for approval before completing the work.</p> <p>Assessment: teacher observation, student conference, written work order, specs review, oral defense, peer and self-assessment, oral quiz and unit test</p> | 4.0, 10.0, 11.0 | C 4.0, C 8.0 |
| <p>✓ Key Assignment: Students will work in groups on classroom vehicles to remove and replace caliper and pads; lubricate related hardware; seat pads and inspect for leaks. Students will demonstrate</p> | 4.0, 10.0, 11.0 | C 4.0, C 8.0 |

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| <p>their skills to instructor and peers for feedback. They will orally defend their choice of procedure and describe their approach when asked.</p> <p>Assessment: teacher observation, student conference, written work order, specs review, oral defense, peer and self-assessment, oral quiz and unit test</p> | | |
| <p>✓ Key Assignment: Using the brake lathe, students will resurface a brake rotor to factory specifications following all procedural norms and demonstrate their skill to instructor and peers.</p> <p>Assessment: teacher observation, student conference, written work order, specs review, oral defense, peer and self-assessment, oral quiz and unit test</p> | 4.0, 10.0, 11.0 | C 4.0, C 8.0 |

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| Unit 20: Anti-Lock Brake Systems | 15 Hours |
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In the shop lab, students will work on shop vehicles to diagnose and repair anti-lock brake systems.

- Anti-lock brake system diagnosis and repair
- Power-Assist Units
- Scanner diagnostics
- Wheel speed sensors

Standards Alignments:
CCSS: WS 11-12.6; A-SSE 2.1; WS 11-12.10
NGSS: CC 2, 3, 4, 5

| Key Assignments | CTE Anchor Standards | CTE Pathway Standards |
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| <p>✓ Key Assignment: Using a scanner students will identify fault codes to determine necessary repairs in an anti-lock brake system, including testing and comparing wheel speed sensor values.</p> <p>Assessment: teacher observation, student conference, written work order, specs review, oral defense, peer and self-assessment</p> | 4.0, 10.0, 11.0 | C 4.0, C 8.0 |
| <p>✓ Key Assignment: Students will check brake pedal travel with, and without, engine running to verify proper power booster operation, and compare brake pressure to specifications</p> <p>Assessment: teacher observation, student conference, written work order, specs review, oral defense, peer and self-assessment</p> | 10.0, 11.0 | C 4.0, C 8.0 |

Unit 21: Steering and Suspension Systems 45 Hours

Students will:

- Disable and enable supplemental restraint system (SRS)
- Inspect steering linkage and tie-rod ends
- Remove and reinstall power steering pump
- Diagnose short and long arm suspension system
- Inspect rear suspension system
- Inspect and measure ball joint assemblies
- Remove and install shocks on a short-long arm suspension
- Diagnose power steering gear
- Diagnose rack and pinion
- Inspect and replace power steering hoses and fittings
- Diagnose strut suspension system
- Inspect, remove and install strut cartridge or assembly
- Inspect bushings at control arms, strut rods, and sway bars
- Student will mount and balance on Rim Clamp machine

Standards Alignments:

CCSS: WS 11-12.6, 11-12.10; A-SSE 2.1; G-CO 12; A-CED 4

NGSS: SEP 1, 2, 3, 4, 5, 6, 7, 8

| Key Assignments | CTE Anchor Standards | CTE Pathway Standards |
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| <p>✓ Key Assignment: Using the Rim-Clamp tire machine and computerized wheel balancer student will dismount, inspect, and remount tire on wheel; balance wheel and tire assembly (static and dynamic); Inspect tire condition; identify tire wear patterns; check for correct tire size and application (load and speed ratings) and adjust air pressure. After this diagnosis, students will determine necessary action and demonstrate process to peers and instructor.</p> <p>Assessment: teacher observation, student conference, written work order, specs review, oral defense, peer and self-assessment</p> | 4.0, 10.0, 11.0 | C 4.0, C 8.0 |
| <p>✓ Key Assignment: Student groups will inspect and measure front suspension components, remove and install front suspension system on a SLA type suspension system including: removing control arms, steering knuckles, sway bars, ball joints, shocks & bushings to industry standard. Students will document the process and demonstrate their competence to instructor for feedback.</p> <p>Assessment: teacher observation, student conference, written work order, specs review, oral defense, peer and self-assessment</p> | 4.0, 10.0, 11.0 | C 4.0, C 8.0 |
| <p>✓ Key Assignment: Student groups will inspect, remove and install strut style suspension system cartridge or assembly, strut coil spring, insulators (silencers), and upper strut bearing mount. Student will use the strut press to safely compress coil spring. Students will document the process and demonstrate their competence to instructor for feedback.</p> | 4.0, 10.0, 11.0 | C 4.0, C 8.0 |

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| <p>Assessment: teacher observation, student conference, written work order, specs review, oral defense, peer and self-assessment, oral quiz and unit test</p> | | |
| <p>✓ Key Assignment: Student groups will inspect, diagnose and replace pitman arm, relay (centerlink/intermediate) rod, idler arm and mountings, and steering linkage damper, tie rod ends (sockets), tie rod sleeves, and clamps. Students will document the process and demonstrate their competence to instructor for feedback.</p> <p>Assessment:teacher observation, student conference, written work order, specs review, oral defense, peer and self-assessment</p> | 4.0, 10.0, 11.0 | C 4.0, C 8.0 |
| <p>✓ Key Assignment: Working in collaborative groups, students will inspect, assess the necessary repairs and replace rack and pinion style steering linkage. Students will inspect, replace, and adjust tie rod ends (sockets), tie rod sleeves, and clamps. Students will document the process and demonstrate their competence to instructor for feedback.</p> <p>Assessment:teacher observation, student conference, written work order, specs review, oral defense, peer and self-assessment, oral quiz and unit test</p> | 4.0, 10.0, 11.0 | C 4.0, C 8.0 |
| <p>✓ Key Assignment: Student groups will collaborate to determine the best strategy to disassemble, remove, inspect/diagnose, and reinstall/replace power steering pump, press fit power steering pump pulley, pulley and belt alignment, power steering hoses and fittings on shop vehicle. Students will document the process and demonstrate their competence to instructor for feedback.</p> <p>Assessment: teacher observation, student conference, written work order, specs review, oral defense, peer and self-assessment</p> | 4.0, 10.0, 11.0 | C 4.0, C 8.0 |
| <p>✓ Key Assignment: Using a scanner and ShopKey, student groups will identify and document the proper procedure for disabling and enabling supplemental restraint system (SRS).</p> <p>Assessment:teacher observation, student conference, written work order, specs review, oral defense, peer and self-assessment</p> | 4.0, 10.0, 11.0 | C 4.0, C 8.0 |

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| Unit 22: Wheel Alignment | 45 Hours |
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In both the classroom and lab students work on shop vehicles to learn the basics of wheel alignment.

- Vehicle wander, drift, pull, hard steering, bump steer, memory steer, torque steer, and steering return
- Pre-Alignment inspection
- 4 wheel alignment

Standards Alignments:
 CCSS: **WS** 11-12.6, 11-12.10; **A-SSE** 2.1, **G-CO** 12, **A-CED** 4
 NGSS: **SEP** 1, 2, 3, 4, 5, 6, 7, 8

| Key Assignments | CTE Anchor Standards | CTE Pathway Standards |
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| <p>✓ Key Assignment: Students will perform a pre-alignment inspection to determine the condition of steering and suspension components to ascertain if the vehicle is able to be aligned. Students will orally justify their reasoning and express why and how they arrived at their conclusion.</p> <p>Assessment: teacher observation, student conference, peer feedback, oral quiz and unit test</p> | 4.0, 10.0, 11.0 | C 4.0, C 8.0 |
| <p>✓ Key Assignment: Students will use a computerized wheel alignment machine to diagnose vehicle wander, drift, pull, hard steering, bump steer, memory steer, torque steer, and steering return concerns and determine necessary action to restore the automobile back to factory specifications for alignment.</p> <p>Assessment: teacher observation, student conference, peer feedback, oral quiz and unit test</p> | 4.0, 10.0, 11.0 | C 4.0, C 8.0 |
| <p>✓ Key Assignment: Student teams will prepare vehicle for wheel alignment on alignment machine, perform four-wheel alignment by checking and adjusting front and rear wheel caster, camber and toe as required, center steering wheel, toe-out-on-turns (turning radius), SAI (steering axis inclination) and included angle, rear wheel thrust angle, front wheel setback, front and/or rear cradle (subframe) alignment determine necessary action. Students will document the process and demonstrate their competence to instructor for feedback.</p> <p>Assessment: teacher observation, student conference, peer feedback, oral quiz and unit test, written documentation</p> | 4.0, 10.0, 11.0 | C 4.0, C 8.0 |
| <p>✓ Key Assignment: Using a scanner, student groups will reset steering angle sensor after alignment of a shop vehicle.</p> <p>Assessment: teacher observation, student conference, peer feedback, oral quiz and unit test</p> | 4.0,10.0, 11.0 | C 4.0, C 8.0 |

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| <p>✓ Key Assignment: Working in teams, students will research their assigned alignment angle and create a powerpoint presentation to the class that instructs and informs peers about their particular topic. After all groups present, class will discuss how the different parts and angles tie together to complete alignment.</p> <p>Assessment: teacher observation, student conference, peer feedback, presentation rubric</p> | <p>1.0, 2.0, 4.0, 10.0, 11.0</p> | <p>C 4.0, C 8.0</p> |
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Instructional Materials

| Textbooks: | Electronic Media/Supplemental Print Materials/Online Resources: |
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| <p>Modern Automotive Technology 8th edition Author James E. Duffy – The Goodheart-Willcox Company © 2014 ISBN: 978-1-61960-370-7</p> | <p>Modern Automotive Technology Workbook Author James E. Duffy – The Goodheart-Willcox Company © 2014 ISBN: 978-1-61960-375-2</p> <ul style="list-style-type: none"> ● Honda Online University ● Shopkey - Service manuals from 1973-present |

Standards Assessed in this Course

| CTE Anchor Standards: | |
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| 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

- CC 2 Cause and effect: Mechanism and explanation
- 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