

# Course Outline

Transportation

REVISED: August/2017

**Job Title**

Auto Technician

**Career Pathway:**

Systems Diagnostics and Service

**Industry Sector:**

Transportation

**O\*NET-SOC CODE:**

49-3023.02

**CBEDS Title:**

Automotive Service

**CBEDS No.:**

5668

**79-90-85**

## Technology/2: Automotive Systems

**Credits:** 5

**Hours:** 90

**Course Description:**

This competency-based course is the second in a sequence of two designed to introduce automotive systems. It provides students with project-based experiences in automotive technologies including alternative and green vehicle technology. Instruction includes an introduction, classroom and workplace policies and procedures, and reviews of resource management, measurements, tools and equipment, and employability skills as well as basic entrepreneurial skills. Emphasis is placed on foreign car engine designs, the ignition systems, fuel systems, exhaust systems, emission control, major engine operations, and alternative power sources for automobiles. The competencies in this course are aligned with the California High School Academic Content Standards and the California Career Technical Education Model Curriculum Standards.

**Prerequisites:**

Enrollment requires successful completion of the Technology/1: Automotive Systems (79-90-83) course.

**NOTE:** For Perkins purposes this course has been designated as a **capstone** course.

This course cannot be repeated once a student receives a Certificate of Completion.



## **COURSE OUTLINE COMPETENCY-BASED COMPONENTS**

A course outline reflects the essential intent and content of the course described. Acceptable course outlines have six components. (Education Code Section 52506). Course outlines for all apportionment classes, including those in jails, state hospitals, and convalescent hospitals, contain the six required elements:

(EC 52504; 5CCR 10508 [b]; Adult Education Handbook for California [1977], Section 100)

### **COURSE OUTLINE COMPONENTS**

### **LOCATION**

#### **GOALS AND PURPOSES**

Cover

The educational goals or purposes of every course are clearly stated and the class periods are devoted to instruction. The course should be broad enough in scope and should have sufficient educational worth to justify the expenditure of public funds.

The goals and purpose of a course are stated in the COURSE DESCRIPTION. Course descriptions state the major emphasis and content of a course, and are written to be understandable by a prospective student.

#### **PERFORMANCE OBJECTIVES OR COMPETENCIES**

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Objectives should be delineated and described in terms of measurable results for the student and include the possible ways in which the objectives contribute to the student's acquisition of skills and competencies.

Performance Objectives are sequentially listed in the COMPETENCY-BASED COMPONENTS section of the course outline. Competency Areas are units of instruction based on related competencies. Competency Statements are competency area goals that together define the framework and purpose of a course. Competencies fall on a continuum between goals and performance objectives and denote the outcome of instruction.

Competency-based instruction tells a student before instruction what skills or knowledge they will demonstrate after instruction. Competency-based education provides instruction which enables each student to attain individual goals as measured against pre-stated standards.

Competency-based instruction provides immediate and continual repetition and In competency-based education the curriculum, instruction, and assessment share common characteristics based on clearly stated competencies. Curriculum, instruction and assessment in competency-based education are: explicit, known, agreed upon, integrated, performance oriented, and adaptive.

**COURSE OUTLINE COMPETENCY-BASED COMPONENTS**  
**(continued)**

**COURSE OUTLINE COMPONENTS**

**LOCATION**

**INSTRUCTIONAL STRATEGIES**

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Instructional techniques or methods could include laboratory techniques, lecture method, small-group discussion, grouping plans, and other strategies used in the classroom.

Instructional strategies for this course are listed in the TEACHING STRATEGIES AND EVALUATION section of the course outline. Instructional strategies and activities for a course should be selected so that the overall teaching approach takes into account the instructional standards of a particular program, i.e., English as a Second Language, Programs for Adults with Disabilities.

**UNITS OF STUDY, WITH APPROXIMATE HOURS ALLOTTED FOR EACH UNIT**

Cover

The approximate time devoted to each instructional unit within the course, as well as the total hours for the course, is indicated. The time in class is consistent with the needs of the student, and the length of the class should be that it ensures the student will learn at an optimum level.

pp. 7-14

Units of study, with approximate hours allotted for each unit are listed in the COMPETENCY AREA STATEMENT(S) of the course outline. The total hours of the course, including work-based learning hours (community classroom and cooperative vocational education) is listed on the cover of every CBE course outline. Each Competency Area listed within a CBE outline is assigned hours of instruction per unit.

**EVALUATION PROCEDURES**

pp. 17-18

The evaluation describes measurable evaluation criteria clearly within the reach of the student. The evaluation indicates anticipated improvement in performances as well as anticipated skills and competencies to be achieved.

Evaluation procedures are detailed in the TEACHING STRATEGIES AND EVALUATION section of the course outline. Instructors monitor students' progress on a continuing basis, assessing students on attainment of objectives identified in the course outline through a variety of formal and informal tests (applied performance procedures, observations, and simulations), paper and pencil exams, and standardized tests.

**REPETITION POLICY THAT PREVENTS PERPETUATION OF STUDENT ENROLLMENT**

Cover

After a student has completed all the objectives of the course, he or she should not be allowed to reenroll in the course. There is, therefore, a need for a statement about the conditions for possible repetition of a course to prevent perpetuation of students in a particular program for an indefinite period of time.

## ***ACKNOWLEDGMENTS***

Thanks to PAUL PIDOUX and MARCELA BAKER for developing and editing this curriculum. Acknowledgment is also given to ERICA ROSARIO for designing the original artwork for the course covers.

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# **CALIFORNIA CAREER TECHNICAL EDUCATION MODEL CURRICULUM STANDARDS**

## ***Transportation Industry Sector Knowledge and Performance Anchor Standards***

### **1.0 Academics**

Analyze and apply appropriate academic standards required for successful industry sector pathway completion leading to postsecondary education and employment. Refer to the Transportation academic alignment matrix for identification of standards.

### **2.0 Communications**

Acquire and accurately use Transportation 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 Transportation 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 Transportation 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 Transportation 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 Transportation 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 as practiced in the SkillsUSA career technical student organization

### **10.0 Technical Knowledge and Skills**

Apply essential technical knowledge and skills common to all pathways in the Transportation sector, following procedures when carrying out experiments or performing technical tasks.

### **11.0 Demonstration and Application**

Demonstrate and apply the knowledge and skills contained in the Transportation anchor standards, pathway standards, and performance indicators in classroom, laboratory, and workplace settings, and through the SkillsUSA career technical student organization.

## **Transportation Pathway Standards**

### **C. Systems Diagnostics and Service Pathway**

The Systems Diagnostics and Service pathway prepares students for postsecondary education and employment in the transportation industry, which includes but is not limited to motor vehicles, rail systems, marine applications, and small-engine and specialty equipment.

Sample occupations associated with this pathway:

- ◆ Service Technician/Maintenance Worker/Shop Foreman
- ◆ Technical Writer
- ◆ Dispatcher
- ◆ Engineer
- ◆ Investigator/Inspector

- 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.
- C2.0 Practice the safe and appropriate use of tools, equipment, and work processes.
- C3.0 Use scientific principles in relation to chemical, mechanical, and physical functions for various engine and vehicle systems.
- C4.0 Perform and document maintenance procedures in accordance with the recommendations of the manufacturer.
- C5.0 Apply and understand appropriate business practices.
- C6.0 Demonstrate the application, operation, maintenance, and diagnosis of engines, including but not limited to two- and four-stroke and supporting subsystems.
- C7.0 Demonstrate the function, principles, and operation of electrical and electronic systems using manufacturer and industry standards.
- 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.

**CBE**  
**Competency-Based Education**

**COMPETENCY-BASED COMPONENTS**  
**for the Technology/2: Automotive Systems Course**

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>A. INTRODUCTION AND SAFETY</p> <p>Review, apply, and evaluate classroom and workplace policies and procedures used in accordance with federal, state, and local safety and environmental regulations.</p> <p>(2 hours)</p>	<ol style="list-style-type: none"> <li>1. Review the scope and propose of the course.</li> <li>2. Review the overall course content as a part of the Linked Learning Initiative.</li> <li>3. Review classroom policies and procedures.</li> <li>4. Review classroom and workplace first aid and emergency procedures.</li> <li>5. Review the different occupations in the Transportation Industry Sector which have an impact on the role of the auto technicians.</li> <li>6. Review the California Occupational Safety and Health Administration (Cal/OSHA) workplace requirements for auto technicians.</li> <li>7. Review the opportunities available for promoting gender equity and the representation of non-traditional populations in automotive science.</li> <li>8. Review the impact of Environmental Protection Agency (EPA) legislation on Transportation Industry Sector practices in protecting and preserving the environment.</li> <li>9. Review the impact of California Air Resources Board (ARB) legislation on Transportation Industry Sector.</li> <li>10. Review the Bureau of Automotive Repair (BAR) standards for safety and environmental protection.</li> <li>11. Review and demonstrate the use of the Material Safety Data Sheet (MSDS) as it applies to the automotive industry.</li> <li>12. Review the safety items required by the federal, state, and local regulations.</li> <li>13. Review the role of the National Automotive Technicians Education Foundation (NATEF) in auto technician training.</li> <li>14. Review and demonstrate the NATEF standards regarding proper use of protective clothing and gloves in an auto shop.</li> <li>15. Review and demonstrate the NATEF standards regarding proper use of the protective respiratory gear in an auto shop.</li> <li>16. Review and demonstrate the NATEF standards regarding proper use of protective eye gear in an auto shop.</li> <li>17. Review and demonstrate NATEF standards regarding proper handling.</li> <li>18. Review and demonstrate NATEF standards regarding proper handling.</li> <li>19. Pass the safety exam with 100%.</li> </ol>	<p><b>Career Ready Practice:</b> 3, 7, 8, 9, 12</p> <p><b>CTE Anchor:</b> Career Planning and Management: 3.3, 3.4, 3.6 Health and Safety: 6.2, 6.4, 6.5, 6.6, 6.7 Ethics and Legal Responsibilities: 8.2, 8.3, 8.4, 8.5, 8.6 Leadership and Teamwork: 9.3, 9.5, 9.6, 9.7 Technical Knowledge and Skills: 10.1, 10.2, 10.4</p> <p><b>CTE Pathway:</b> C1.1, C1.2, C1.3, C1.4, C1.5, C4.2</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p><b>B. RESOURCE MANAGEMENT REVIEW</b></p> <p>Review, apply, and evaluate the resource management principles and techniques in the auto repair and maintenance business.</p> <p>(1 hour)</p>	<ol style="list-style-type: none"> <li>1. Define the following:               <ol style="list-style-type: none"> <li>a. resources</li> <li>b. management</li> <li>c. sustainability</li> </ol> </li> <li>2. Describe the management of the following resources in the auto repair and maintenance business:               <ol style="list-style-type: none"> <li>a. time</li> <li>b. materials</li> <li>c. personnel</li> </ol> </li> <li>3. List specific examples of effective management of the following in the auto repair and maintenance business:               <ol style="list-style-type: none"> <li>a. time</li> <li>b. materials</li> <li>c. personnel</li> </ol> </li> <li>4. Describe the benefits of effective resource management in the auto repair and maintenance business:               <ol style="list-style-type: none"> <li>a. profitability</li> <li>b. sustainability</li> <li>c. company growth</li> </ol> </li> <li>5. Describe the economic benefits and liabilities of managing resources in an environmentally responsible way.</li> </ol>	<p><b>Career Ready Practice:</b> 1, 2, 12</p> <p><b>CTE Anchor:</b> Career Planning and Management: 3.7 Responsibility and Flexibility: 7.1, 7.2, 7.4, 7.6 Technical Knowledge and Skills: 10.1 Demonstration and Application: 11.1</p> <p><b>CTE Pathway:</b> C1.1, C5.2, C5.3, C5.4</p>
<p><b>C. MEASUREMENTS REVIEW</b></p> <p>Review, apply, and evaluate the principles of precision measurement and the use of precision measuring instruments.</p> <p>(5 hours)</p>	<ol style="list-style-type: none"> <li>1. Review and describe the features and functions of the following automotive measuring tools:               <ol style="list-style-type: none"> <li>a. steel ruler</li> <li>b. Vernier calipers</li> <li>c. combination square</li> <li>d. inside calipers</li> <li>e. outside calipers</li> <li>f. micrometer depth gauges</li> <li>g. telescoping gauges</li> <li>h. hole gauges</li> <li>i. plastic gauges</li> </ol> </li> <li>2. Review and demonstrate the following:               <ol style="list-style-type: none"> <li>a. proper use of a conversion chart</li> <li>b. measuring to 1/64 inch with a steel ruler</li> <li>c. measuring to 1/100 inch with a steel ruler</li> <li>d. measuring to .5mm with a steel ruler</li> <li>e. measuring to .005 with micrometers</li> <li>f. measuring to 1/100mm with micrometers</li> <li>g. measuring to 1/1000 mm with Vernier calipers</li> <li>h. measuring to .05mm with Vernier calipers</li> <li>i. qualifying, setting up, and reading dial indicators</li> </ol> </li> <li>3. Compare measurement pre-test scores with post-test scores.</li> </ol>	<p><b>Career Ready Practice:</b> 1, 5</p> <p><b>CTE Anchor:</b> Technical Knowledge and Skills: 10.1 Demonstration and Application: 11.1</p> <p><b>CTE Pathway:</b> C2.3, C2.4, C2.5, C2.7</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p><b>D. TOOLS AND EQUIPMENT</b></p> <p>Understand, apply, and evaluate the use, maintenance, and storage techniques for automotive tools and equipment.</p> <p>(2 hours)</p>	<ol style="list-style-type: none"> <li>1. Review and describe the features and functions of the most common automotive hand tools.</li> <li>2. Review and demonstrate the following:               <ol style="list-style-type: none"> <li>a. selection of the appropriate hand tool for each job</li> <li>b. procedures for checking out hand tools from the tool room</li> <li>c. safe use of the most common hand tools</li> </ol> </li> <li>3. Review and describe the features and functions of the most common power tools and equipment.</li> <li>4. Review and demonstrate the following:               <ol style="list-style-type: none"> <li>a. selection of the appropriate power tools and equipment for each job</li> <li>b. procedures for checking out power tools and equipment from the tool room</li> <li>c. safe use of power tools and equipment</li> </ol> </li> </ol>	<p><b>Career Ready Practice:</b> 1, 4</p> <p><b>CTE Anchor:</b> Problem Solving and Critical Thinking: 5.2, 5.3, 5.4 Health and Safety: 6.3, 6.4, 6.5, 6.6</p> <p><b>CTE Pathway:</b> C1.4, C2.2</p>
<p><b>E. ENGINE DESIGNS: FOREIGN</b></p> <p>Understand, apply, and evaluate the principles of engine design found in foreign cars.</p> <p>(5 hours)</p>	<ol style="list-style-type: none"> <li>1. Identify and discuss the features and functions of the following:               <ol style="list-style-type: none"> <li>a. major parts of an automobile engine</li> <li>b. different types of cylinder configurations</li> <li>c. valve arrangements                   <ol style="list-style-type: none"> <li>i. overhead valve</li> <li>ii. overhead cam</li> <li>iii. double overhead cam</li> <li>iv. multiple valve heads</li> </ol> </li> </ol> </li> <li>2. Define four-stroke cycle.</li> <li>3. Explain advantages and disadvantages of the various cylinder configurations of foreign vehicles.</li> </ol>	<p><b>Career Ready Practice:</b> 1, 4, 5, 11</p> <p><b>CTE Anchor:</b> Problem Solving and Critical Thinking: 5.1, 5.2, 5.3, 5.4</p> <p><b>CTE Pathway:</b> C1.5</p>
<p><b>F. IGNITION SYSTEMS</b></p> <p>Understand, apply, and evaluate the principles and procedures used for ignition systems.</p>	<ol style="list-style-type: none"> <li>1. Identify and discuss the features and functions of the following ignition systems:               <ol style="list-style-type: none"> <li>a. breaker point ignition system</li> <li>b. electronic ignition system                   <ol style="list-style-type: none"> <li>i. primary ignition voltage</li> <li>ii. secondary ignition voltage</li> </ol> </li> <li>c. distributorless ignition system</li> </ol> </li> <li>2. Identify and/or discuss the following:               <ol style="list-style-type: none"> <li>a. types of spark plugs according to shape and heat range</li> <li>b. purpose of ballast resistors</li> <li>c. operation of the coil</li> <li>d. methods of advancing the spark</li> <li>e. operation of breakerless ignitions</li> <li>f. operation of computerized ignitions</li> </ol> </li> <li>3. Describe and demonstrate the following:               <ol style="list-style-type: none"> <li>a. performing common tests used to find ignition system trouble</li> <li>b. diagnosing symptoms produced by faulty ignition systems components</li> </ol> </li> </ol>	<p><b>Career Ready Practice:</b> 1, 4, 5, 11</p> <p><b>CTE Anchor:</b> Problem Solving and Critical Thinking: 5.1, 5.3, 5.4 Demonstration and Application: 11.1</p> <p><b>CTE Pathway:</b> C3.1, C3.6, C3.7, C5.6, C6.3, C6.4, C7.1</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(9 hours)	<ul style="list-style-type: none"> <li>c. replacing or repairing faulty ignition system parts</li> <li>d. adjusting ignition timing where applicable</li> <li>e. performing routine ignition system service</li> </ul>	
<p>G. FUEL SYSTEMS</p> <p>Understand, apply, and evaluate the principles and procedures used for fuel systems.</p> <p>(9 hours)</p>	<ol style="list-style-type: none"> <li>1. Identify and discuss the features and functions of the following fuel systems: <ul style="list-style-type: none"> <li>a. mechanical fuel injection system</li> <li>b. electronic fuel injection system</li> <li>c. diesel fuel injection system</li> </ul> </li> <li>2. Identify and discuss the features and functions of the following fuel system components: <ul style="list-style-type: none"> <li>a. fuel tank</li> <li>b. fuel pump <ul style="list-style-type: none"> <li>i. mechanical</li> <li>ii. electrical</li> </ul> </li> <li>c. fuel filter</li> <li>d. fuel injectors</li> <li>e. carburetors <ul style="list-style-type: none"> <li>i. single-barrel</li> <li>ii. SU type</li> <li>iii. multi-barrel</li> <li>iv. electronic controlled</li> </ul> </li> </ul> </li> <li>3. Describe the following: <ul style="list-style-type: none"> <li>a. properties and characteristics of gasoline</li> <li>b. carburetor circuits</li> <li>c. turbochargers</li> </ul> </li> <li>4. Describe and demonstrate the following: <ul style="list-style-type: none"> <li>a. diagnosing fuel system malfunctions and their symptoms</li> <li>b. performing routine fuel system maintenance.</li> </ul> </li> </ol>	<p><b>Career Ready Practice:</b> 1, 4, 5, 11</p> <p><b>CTE Anchor:</b> Problem Solving and Critical Thinking: 5.1, 5.4</p> <p><b>CTE Pathway:</b> C1.1, C1.2, C2.6, C3.1, C3.7, C5.6, C6.1, C6.4</p>
<p>H. EXHAUST SYSTEMS</p> <p>Understand, apply, and evaluate the principles and procedures used for exhaust systems.</p>	<ol style="list-style-type: none"> <li>1. Identify and discuss the features and functions of the exhaust system.</li> <li>2. Identify and discuss the features and functions of the following exhaust system components: <ul style="list-style-type: none"> <li>a. exhaust manifold</li> <li>b. oxygen sensor</li> <li>c. catalytic converter</li> <li>d. muffler</li> <li>e. exhaust pipe</li> <li>f. tail pipe</li> </ul> </li> <li>3. Describe catalytic converter systems.</li> <li>4. Describe and demonstrate the following: <ul style="list-style-type: none"> <li>a. diagnosing exhaust system malfunctions and their symptoms</li> <li>b. performing exhaust system repairs</li> </ul> </li> </ol>	<p><b>Career Ready Practice:</b> 1, 4, 5, 11, 12</p> <p><b>CTE Anchor:</b> Problem Solving and Critical Thinking: 5.3 Technical Knowledge and Skills: 10.1 Demonstration and Application: 11.1</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(9 hours)		<b>CTE Pathway:</b> C1.3, C3.1, C3.7, C5.6
<p>I. EMISSION CONTROLS</p> <p>Understand, apply, and evaluate the principles and procedures used for emission controls.</p> <p>(9 hours)</p>	<ol style="list-style-type: none"> <li>1. Identify federal and state emission control rules and regulations.</li> <li>2. Describe the following sources of auto emissions: <ol style="list-style-type: none"> <li>a. evaporative emissions</li> <li>b. refueling losses</li> <li>c. exhaust emissions</li> </ol> </li> <li>3. Describe the following exhaust pollutants: <ol style="list-style-type: none"> <li>a. hydrocarbons</li> <li>b. nitrogen oxides</li> <li>c. carbon monoxide</li> <li>d. carbon dioxide</li> </ol> </li> <li>4. Describe the importance of emission control devices on automobiles.</li> <li>5. Identify and discuss the features and functions of emission control system components: <ol style="list-style-type: none"> <li>a. crankcase controls</li> <li>b. exhaust control</li> <li>c. exhaust gas recirculation (EGR) controls</li> <li>d. evaporative loss controls</li> </ol> </li> <li>6. Describe and demonstrate the following: <ol style="list-style-type: none"> <li>a. diagnosing emission control problems</li> <li>b. servicing crankcase controls</li> <li>c. servicing exhaust controls</li> <li>d. servicing EGR controls</li> <li>e. servicing evaporative loss controls</li> </ol> </li> </ol>	<p><b>Career Ready Practice:</b> 1, 4, 5, 11, 12</p> <p><b>CTE Anchor:</b> Problem Solving and Critical Thinking: 5.1, 5.3, 5.4 Health and Safety: 6.7 Ethics and Legal Responsibilities: 8.2 Technical Knowledge and Skills: 10.1, 10.2</p> <p><b>CTE Pathway:</b> C1.3, C1.5, C3.7, C5.6, C8.6</p>
<p>J. MAJOR ENGINE OPERATIONS</p> <p>Understand, apply, and evaluate the principles and procedures used for major engine problems.</p>	<ol style="list-style-type: none"> <li>1. Identify common symptoms of engine mechanical problems.</li> <li>2. Describe and demonstrate the following: <ol style="list-style-type: none"> <li>a. diagnosing engine mechanical problems</li> <li>b. preparing for engine removal</li> <li>c. removing an engine</li> <li>d. disassembling the engine</li> <li>e. using micrometers to measure wear on engine parts</li> <li>f. cleaning engine parts</li> <li>g. rebuilding bottom end of engine</li> <li>h. rebuilding cylinder head assemblies</li> <li>i. reassembling rebuilt engine</li> </ol> </li> </ol>	<p><b>Career Ready Practice:</b> 1, 4, 5, 11</p> <p><b>CTE Anchor:</b> Communications: 2.1 Problem Solving and Critical Thinking: 5.1, 5.2, 5.3, 5.4 Health and Safety: 6.2, 6.3, 6.4, 6.5, 6.6, 6.7 Technical Knowledge and Skills: 10.1, 10.2, 10.3</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(20 hours)		<b>CTE Pathway:</b> C2.2, C2.4, C2.5, C3.7, C5.6, C6.1
<p>K. ALTERNATIVE POWER SOURCES</p> <p>Understand, apply, and evaluate the principles and procedures of alternative power sources.</p>	<ol style="list-style-type: none"> <li>1. Review the features and functions of the charging system in an internal combustion engine vehicle (ICEV).</li> <li>2. Identify and describe the following:               <ol style="list-style-type: none"> <li>a. conductive charging</li> <li>b. flywheel energy/power storage</li> <li>c. inductive charging</li> <li>d. inverter/converter</li> <li>e. assist hybrid</li> <li>f. full hybrid</li> <li>g. mild hybrid</li> <li>h. regenerative braking</li> <li>i. parallel hybrid</li> <li>j. series hybrid</li> <li>k. electrolysis</li> <li>l. hydrogen</li> <li>m. ethanol/methanol</li> </ol> </li> <li>3. Identify and describe the following types of alternative power source vehicles:               <ol style="list-style-type: none"> <li>a. battery electric vehicle (BEV)</li> <li>b. hybrid electric vehicle (HEV) or hybrid</li> <li>c. fuel cell electric vehicle (FCEV)</li> <li>d. flexible-fuel vehicle (FFV)</li> </ol> </li> <li>4. Describe the differences between a BEV and an ICEV in terms of:               <ol style="list-style-type: none"> <li>a. major components</li> <li>b. power system</li> <li>c. operation of accessories</li> <li>d. advantage and disadvantages</li> <li>e. major considerations when servicing a BEV</li> <li>f. commonsense precautions when working around a BEV</li> </ol> </li> <li>5. Describe the differences between an HEV and an ICEV in terms of:               <ol style="list-style-type: none"> <li>a. major components</li> <li>b. power system</li> <li>c. operation of accessories</li> <li>d. advantages and disadvantages</li> <li>e. major considerations when servicing an HEV</li> <li>f. commonsense precautions when working around an HEV</li> </ol> </li> <li>6. Describe the differences between an FCEV and an ICEV in terms of:               <ol style="list-style-type: none"> <li>a. major components</li> <li>b. power system</li> <li>c. operation of accessories</li> <li>d. advantage and disadvantages</li> <li>e. major considerations when servicing an FCEV</li> <li>f. commonsense precautions when working around an FCEV</li> </ol> </li> </ol>	<p><b>Career Ready Practice:</b> 1, 4, 5, 11, 12</p> <p><b>CTE Anchor:</b>            Problem Solving and Critical Thinking:            5.1, 5.2, 5.3, 5.4            Health and Safety:            6.2, 6.4, 6.5, 6.6, 6.7            Technical Knowledge and Skills:            10.1            Demonstration and Application:            11.1</p> <p><b>CTE Pathway:</b>            C1.4, C3.1, C3.4,            C3.5, C3.6, C7.2,            C7.3, C7.4, C7.5,            C7.6, C7.7, C8.6</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(15 hours)	7. Describe the differences between an FFV and an ICEV in terms of: <ol style="list-style-type: none"> <li>major components</li> <li>power system</li> <li>operation of accessories</li> <li>advantage and disadvantages</li> <li>major considerations when servicing an FFV</li> <li>commonsense precautions when working around an FFV</li> </ol>	
<b>L. EMPLOYABILITY SKILLS REVIEW</b>  Review, apply, and evaluate the employability skills required in auto repair and maintenance.	<ol style="list-style-type: none"> <li>Review Employer requirements for the following:               <ol style="list-style-type: none"> <li>punctuality</li> <li>attendance</li> <li>attitude toward work</li> <li>quality of work</li> <li>teamwork</li> <li>timeliness</li> <li>communication skills</li> <li>computer skills and software applications</li> </ol> </li> <li>Review list of potential employers through traditional and internet sources.</li> <li>Review the role of electronic social networking in job search.</li> <li>Finalize resumes and cover letters.</li> <li>Review the importance of filling out a job application legibly, with accurate and complete information.</li> <li>Complete sample job application forms correctly.</li> <li>Review the importance of enthusiasm on a job.</li> <li>Review the importance of appropriate appearance on a job.</li> <li>Review the importance of the continuous upgrading of job skills.</li> <li>Review customer service as a method of building permanent relationships between the organization and the customer.</li> <li>Review and demonstrate appropriate interviewing techniques.</li> <li>Review the informational materials and resources needed to be successful in an interview</li> <li>Finalize follow-up letters.</li> <li>Review and demonstrate appropriate follow-up procedures</li> </ol>	<b>Career Ready Practice:</b> 1, 2, 3, 6, 7, 9  <b>CTE Anchor:</b> Career Planning and Management: 3.1, 3.2, 3.3, 3.4, 3.5, 3.7, 3.9 Responsibility and Flexibility: 7.1, 7.2, 7.3, 7.6, 7.7 Ethics and Legal Responsibilities: 8.2, 8.3, 8.4 Technical Knowledge and Skills: 10.2, 10.4 Demonstration and Application: 11.2, 11.3, 11.4  <b>CTE Pathway:</b> C1.1, C1.5, C4.4, C5.2, C5.3, C5.4, C5.5
<b>M. ENTREPRENEURIAL SKILLS</b>  Understand, apply, and evaluate the process involved in becoming an entrepreneur in the auto repair and maintenance industry.	<ol style="list-style-type: none"> <li>Define entrepreneurship.</li> <li>Identify the necessary characteristics of successful entrepreneurs.</li> <li>Describe the contributions of entrepreneurs to the auto repair and maintenance industry.</li> <li>Explain the purpose and components of a business plan.</li> <li>Examine personal goals prior to starting a business.</li> <li>Evaluate sources of monetary investment in a business opportunity.</li> <li>Describe various licensing requirements in the auto repair and maintenance business.</li> </ol>	<b>Career Ready Practice:</b> 7, 8, 10, 11, 12  <b>CTE Anchor:</b> Communications: 2.2, 2.3, 2.4, 2.5 Career Planning and Management: 3.2, 3.3, 3.5, 3.6, 3.7

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(2 hours)	<ul style="list-style-type: none"> <li>8. Develop a scenario depicting the student as the repair and maintenance business owner.</li> <li>9. Differentiate between sustainable and green business practices and standard business practices.</li> </ul>	<p>Technology: 4.1, 4.2, 4.3</p> <p>Problem Solving and Critical Thinking: 5.1, 5.2, 5.4</p> <p>Health and Safety: 6.1, 6.2, 6.5</p> <p>Responsibility and Flexibility: 7.1, 7.2, 7.3, 7.4, 7.6, 7.7, 7.8</p> <p>Ethics and Legal Responsibilities: 8.1, 8.4, 8.7</p> <p>Leadership and Teamwork: 9.1, 9.3, 9.4, 9.6</p> <p><b>CTE Pathway:</b> C1.1, C5.1, C5.2, C5.3, C5.4, C5.5, C5.6</p>

## ***SUGGESTED INSTRUCTIONAL MATERIALS and OTHER RESOURCES***

### **TEXTBOOKS**

Duffy, James E. Modern Automotive Technology, 7<sup>th</sup> Edition. Goodheart-Willcox Publishing, 2009.

Erjavec, Jack. Automotive Suspension & Steering. Delmar Thomson Learning, 2006.

Halderman, James D. and Chase D. Mitchell. Steering and Suspension. Prentice Hall Professional Technical reference, 2003.

Johansson, Chris and Martin T. Stockel. Auto Suspension and Steering Technology. Goodheart-Willcox Publisher, 2000.

Knowles, Don. Today's Technician: Automotive Suspension & Steering Systems: ASE Class Manual & Shop Manual, 3rd Edition. Delmar Publishers, 2003.

Owen, Clifton E. Automotive Brake Systems: Today's Technician: Classroom & Shop Manual, 3<sup>rd</sup> Edition. Delmar Thomson Learning, 2004.

Rehkoph, Jeffrey and James D. Halderman. Automotive Brake Systems. Pearson Prentice Hall, 2006.

## **RESOURCES**

Employer Advisory Board members

Foundation Standards

<http://www.cde.ca.gov/ci/ct/sf/documents/transportation.pdf>

Automotive Retailing Today (ART) 8400 Westpark Dr., MS 2, McLean, VA 22102. Phone: (703) 556-8578.

Automotive Youth Educational Systems (AYES) 50 W. Big Beaver, Suite 145, Troy, MI 48084. Phone: (248) 526-1750. Fax: (248) 526-1751.

National Automobile Dealers Association (NADA) Public Relations Dept., 8400 Westpark Dr., McLean, VA 22102-3591. Phone: (703) 821-7000.

National Automotive Technicians Education Foundation (NATEF) 101 Blue Seal Dr. SE, Suite 101, Leesburg, VA 20175. Phone: (703) 669-6650. Fax: (703) 669-6125. [www.natef.org](http://www.natef.org)

National Institute for Automotive Service Excellence (ASE) 101 Blue Seal Dr. SE, Suite 101, Leesburg, VA 20175. Phone: (703) 669-6600.

SkillsUSA P.O. Box 3000, Leesburg, VA 20177-0300. Phone: (703) 777-8810. Fax: (703) 777-8999. [www.skillsusa.org](http://www.skillsusa.org)

[www.familycar.com](http://www.familycar.com)

[www.freeonlineautorepair.com/automotive\\_fuel\\_system.html](http://www.freeonlineautorepair.com/automotive_fuel_system.html)

[www.fueleconomy.gov](http://www.fueleconomy.gov)

## **COMPETENCY CHECKLIST**

## ***TEACHING STRATEGIES and EVALUATION***

### **METHODS AND PROCEDURES**

- A. Lecture and discussion
- B. Multimedia presentations
- C. Visual aids
- D. Projects
- E. Individualized instruction

### **EVALUATION**

SECTION A – Introduction and Safety – Pass the safety test with 100% accuracy.

SECTION B – Resource Management Review – Pass all assignments and exams on resource management review with a minimum score of 80% or higher.

SECTION C – Measurements Review – Pass all assignments and exams on measurements review with a minimum score of 80% or higher.

SECTION D – Tools and Equipment Review – Pass all assignments and exams on tools and equipment review with a minimum score of 80% or higher.

SECTION E – Engine Designs: Foreign – Pass all assignments and exams on engine designs: foreign with a minimum score of 80% or higher.

SECTION F – Ignition Systems – Pass all assignments and exams on ignition systems with a minimum score of 80% or higher.

SECTION G – Fuel Systems – Pass all assignments and exams on fuel systems with a minimum score of 80% or higher.

SECTION H – Exhaust Systems – Pass all assignments and exams on exhaust systems with a minimum score of 80% or higher.

SECTION I – Emission Controls – Pass all assignments and exams on emission controls with a minimum score of 80% or higher.

SECTION J – Major Engine Operations – Pass all assignments and exams on major engine operations with a minimum score of 80% or higher.

SECTION K –Alternative Power Sources – Pass all assignments and exams on alternative power sources with a minimum score of 80% or higher.

SECTION L –Employability Skills Review – Pass all assignments and exams on employability skills review with a minimum score of 80% or higher.

SECTION M –Entrepreneurial Skills – Pass all assignments and exams on entrepreneurial skills with a minimum score of 80% or higher.

## DEFINITIONS OF TECHNICAL TERMS

ADJUST - to bring components to specified operational settings.

ALIGN - to restore the proper position of components.

ANALYZE - to assess the condition of a component or system.

ASSEMBLE (REASSEMBLE) - to fit together the components of a device or system.

BALANCE - to establish correct linear, rotational or weight relationship.

BLEED - to remove air from a closed system.

CAN – Controller Area Network. CAN is a network protocol (SAE J2284/ISO 15765-4) used to interconnect a network of electronic control modules

CHARGE - to bring to a specified state, e.g., battery or air conditioning system.

CHECK - to verify condition by performing an operational or comparative examination.

CLEAN - to rid component of foreign matter for the purpose of reconditioning, repairing, measuring or reassembling.

DEGLAZE – to remove a smooth glossy surface.

DETERMINE - to establish the procedure to be used to perform the necessary repair.

DETERMINE NECESSARY ACTION – indicates that the diagnostic routine(s) is the primary emphasis of a task. The student is required to perform the diagnostic steps and communicate the diagnostic outcomes and corrective actions required addressing the concern or problem. The training program determines the communication method (worksheet, test, verbal communication, or other means deemed appropriate) and whether the corrective procedures for these tasks are actually performed.

DIAGNOSE - to identify the cause of a problem.

DISASSEMBLE - to separate a component's parts as a preparation for cleaning, inspection or service.

DISCHARGE - to empty a storage device or system.

EVACUATE - to remove air, fluid or vapor from a closed system by use of a vacuum pump.

FLUSH - to internally clean a component or system.

HIGH VOLTAGE – voltages of 50 volts and higher.

HONE - to restore or resize a bore by using rotating cutting stones.

JUMP START - to use an auxiliary power supply to assist a battery to crank an engine.

LOCATE – to determine or establish a specific spot or area.

MEASURE - to determine existing dimensions/values for comparison to specifications.

NETWORK - a system of interconnected electrical modules or devices.

ON-BOARD DIAGNOSTICS (OBD) - diagnostic protocol which monitors computer inputs and outputs for failures.

PARASITIC DRAW - electrical loads which are still present when the ignition circuit is OFF.

PERFORM - to accomplish a procedure in accordance with established methods and standards.

PERFORM NECESSARY ACTION – indicates that the student is to perform the diagnostic routine(s) and perform the corrective action item. Where various scenarios (conditions or situations) are presented in a single task, at least one of the scenarios must be accomplished.

PURGE - to remove air or fluid from a closed system.

REMOVE - to disconnect and separate a component from a system.

REPAIR - to restore a malfunctioning component or system to operating condition.

REPLACE - to exchange a component; to reinstall a component.

RESURFACE – to restore correct finish.

SERVICE - to perform a procedure as specified in the owner's or service manual.

TEST - to verify condition through the use of meters, gauges or instruments.

TORQUE - to tighten a fastener to specified degree or tightness (in a given order or pattern if multiple fasteners are involved on a single component).

VERIFY - to confirm that a problem exists after hearing the customer's concern; or, to confirm the effectiveness of a repair.

VOLTAGE DROP - a reduction in voltage (electrical pressure) caused by the resistance in a component or circuit.

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### Statement for Civil Rights

All educational and vocational opportunities are offered without regard to race, color, national origin, gender, or physical disability.

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