

# Course Outline

**Transportation**

**REVISED: August/2017**

**Job Title:**

Diesel Technician

**Career Pathway:**

Systems Diagnostics and Service

**Industry Sector:**

Transportation

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

49-3031.00

**CBEDS Title:**

Diesel Equipment Mechanics

**CBEDS No.:**

5657

**79-90-57**

**Auto Tech: Diesel/2**

**Credits:** 15

**Hours:** 180

**Course Description:**

This competency-based course is one in a sequence of three courses designed to meet the Automotive Service Excellence (ASE) Program Certification Standards set by the National Automotive Technicians Education Foundation (NATEF). It provides students with technical instruction and practical experience with diesel engines incorporating sustainable and green vehicle technologies. Instruction includes classroom and workplace policies and procedures in accordance with federal, state, and local safety and environmental regulations. Emphasis is placed on the techniques in the following areas of diesel engine diagnosis and repair: lubrication, cooling, air induction, exhaust, fuel supply, and electronic fuel management systems, and the engine brakes. It also reviews the proper use, maintenance, and storage of diesel repair tools and equipment, the effective use of service manuals and computerbased information systems, trade mathematics, resource management, and employability skills. The course also presents an introduction to entrepreneurship. The competencies in this course are aligned with the California High School Academic Content Standards and the California CareerTechnical Education Model Curriculum Standards.

**Prerequisites:**

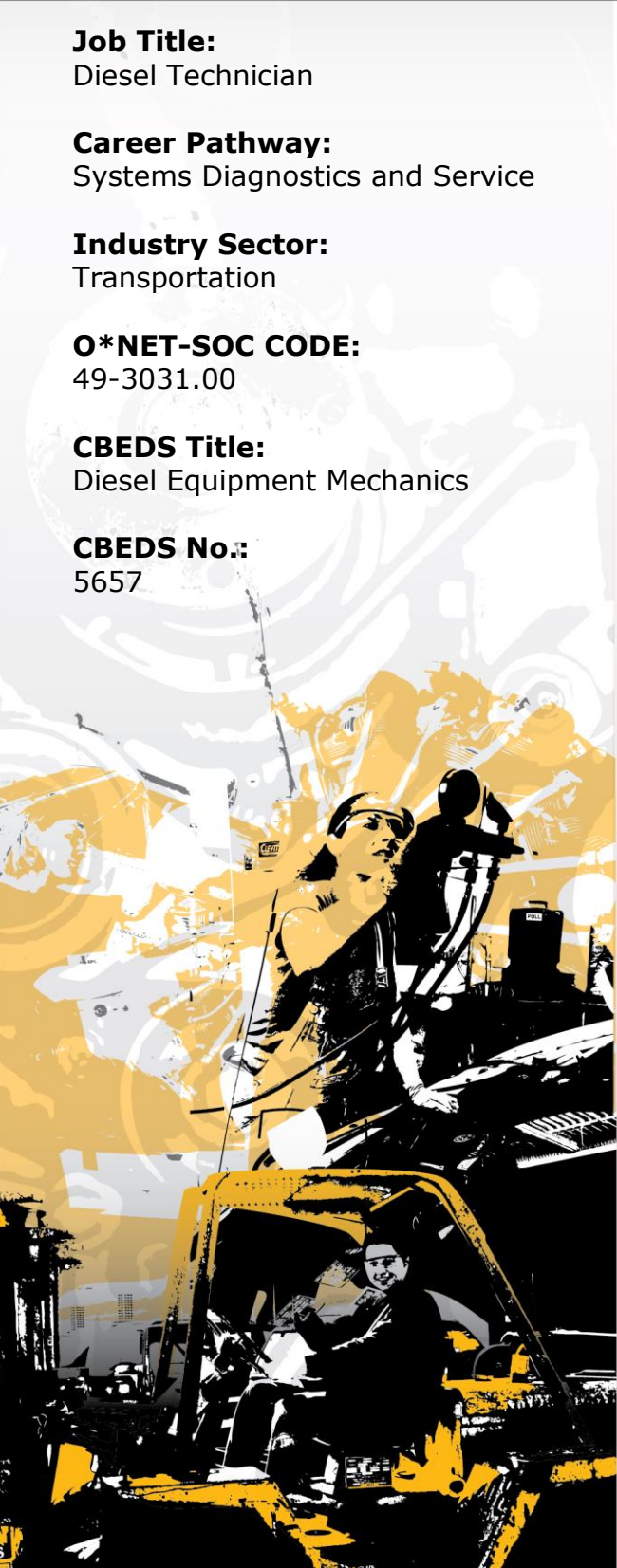
Enrollment requires successful completion of the Auto Tech: Diesel/1 (79-90-55) course.

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

Meets NATEF Standards and identifies priority tasks in medium/heavy truck diesel engine. Check the NATEF Manual for explanation of priority 1, 2, or 3 tasks.

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

Los Angeles Unified School District  
Division of Adult and Career Education  
Instructional and Counseling Services Unit  
Adult Curriculum Office  
www.wearedace.org



## **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**

pp. 7-16

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)**

<b>COURSE OUTLINE COMPONENTS</b>	<b>LOCATION</b>
<p><b>INSTRUCTIONAL STRATEGIES</b></p> <p>Instructional techniques or methods could include laboratory techniques, lecture method, small-group discussion, grouping plans, and other strategies used in the classroom.</p> <p>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.</p>	p. 19
<p><b>UNITS OF STUDY, WITH APPROXIMATE HOURS ALLOTTED FOR EACH UNIT</b></p> <p>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.</p> <p>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.</p>	Cover  pp. 7-16
<p><b>EVALUATION PROCEDURES</b></p> <p>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.</p> <p>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.</p>	pp. 19-20
<p><b>REPETITION POLICY THAT PREVENTS PERPETUATION OF STUDENT ENROLLMENT</b></p> <p>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.</p>	Cover

## **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 Auto Tech: Diesel/2 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>(5 hours)</p>	<ol style="list-style-type: none"> <li>1. Describe the scope and purpose of the course.</li> <li>2. Review the scope and purpose of the course.</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 diesel technician.</li> <li>6. Review the California Occupational Safety and Health Administration (Cal/OSHA) workplace requirements for diesel technicians.</li> <li>7. Review the impact of Environmental Protection Agency (EPA) legislation on Transportation Industry Sector practices in protecting and preserving the environment.</li> <li>8. Review the impact of the California Air Resources Board (ARB) legislation on the Transportation Industry Sector practices in protecting and preserving the environment.</li> <li>9. Review the Bureau of Automotive Repair (BAR) standards for safety and environmental protection.</li> <li>10. Review and demonstrate the use of the Material Safety Data Sheet (MSDS) as it applies to the diesel industry.</li> <li>11. Review the safety items required by federal, state, and local regulations.</li> <li>12. Review the role of the National Automotive Technicians Education Foundation (NATEF) in diesel technician training.</li> <li>13. Review and demonstrate the NATEF standards regarding proper use of protective clothing and gloves in a diesel shop.</li> <li>14. Review and demonstrate the NATEF standards regarding proper use of protective respiratory gear in a diesel shop.</li> <li>15. Review and demonstrate the NATEF standards regarding proper use of protective eye gear in a diesel shop.</li> <li>16. Review and demonstrate the NATEF standards regarding proper ventilation in a diesel shop.</li> <li>17. Review and demonstrate NATEF standards regarding proper handling, storage, and disposal of chemicals and materials used in a diesel shop.</li> <li>18. Pass the safety exam with 100% accuracy.</li> </ol>	<p><b>Career Ready Practice:</b> 1, 3, 6, 7</p> <p><b>CTE Anchor:</b> Career Planning and Management: 3.4 Health and Safety: 6.1, 6.3, 6.5, 6.6, 6.7 Ethics and Legal Responsibilities: 8.2 Demonstration and Application: 11.2</p> <p><b>CTE Pathway:</b> C1.1, C1.2, C1.3, C1.4, C5.2</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 diesel repair and maintenance business.</p> <p>(1 hour)</p>	<ol style="list-style-type: none"> <li>1. Review the following:               <ol style="list-style-type: none"> <li>a. resources</li> <li>b. management</li> <li>c. sustainability</li> </ol> </li> <li>2. Review the importance of managing the following resources in the diesel 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. Review specific examples of effective management of the following in the diesel 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. Review the benefits of effective resource management in the diesel 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. Review the economic benefits and liabilities of managing resources in an environmentally responsible way.</li> </ol>	<p><b>Career Ready Practice:</b> 1, 2, 3, 5, 8</p> <p><b>CTE Anchor:</b> Responsibility and Flexibility: 7.1, 7.4, 7.6</p> <p><b>CTE Pathway:</b> C5.3</p>
<p><b>C. TRADE MATHEMATICS REVIEW</b></p> <p>Understand, apply, and evaluate the mathematical requirements used in diesel repair and maintenance.</p>	<ol style="list-style-type: none"> <li>1. Review the practical applications of math in diesel technology.</li> <li>2. Review and demonstrate problem-solving techniques involving whole number problems, using addition, subtraction, multiplication, and division.</li> <li>3. Review and demonstrate problem-solving techniques involving various fraction problems, using arithmetic operations (addition, subtraction, multiplication, and division).</li> <li>4. Review and demonstrate problem-solving techniques involving various decimal problems, using arithmetic operations.</li> <li>5. Review and demonstrate techniques for changing fractions to decimals.</li> <li>6. Review and demonstrate techniques for changing decimals to fractions.</li> <li>7. Review the English system of measuring length.</li> <li>8. Review the English system of measuring weight.</li> <li>9. Review the English system of measuring volume or capacity.</li> <li>10. Review the relationships between various English system linear units of measurement, such as inches, feet, yards, and miles.</li> <li>11. Review the relationships between various English system units of volume or capacity, such as cups, pints, quarts, and gallons.</li> <li>12. Review and demonstrate problem-solving techniques for various English system measuring problems, using arithmetic operations.</li> <li>13. Review and demonstrate measuring techniques of various objects by using the English system measuring tools common to the trade.</li> <li>14. Review the metric system of measuring length.</li> <li>15. Review the metric system of measuring weight.</li> </ol>	<p><b>Career Ready Practice:</b> 1, 5</p> <p><b>CTE Anchor:</b> Problem Solving and Critical Thinking: 5.2</p> <p><b>CTE Pathway:</b> C2.4, C2.7</p>



COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(7 hours)	<ol style="list-style-type: none"> <li>16. Review the metric system of measuring volume or capacity.</li> <li>17. Review the relationships between various metric system linear units of measurement, such as millimeters, centimeters, and meters.</li> <li>18. Review the relationships between various metric system units of weight such as milligrams, grams, and kilograms</li> <li>19. Review and demonstrate problem-solving techniques for various metric system measuring problems involving addition, subtraction, multiplication, and division.</li> <li>20. Review and demonstrate measuring techniques of objects using metric system measuring tools common to the trade.</li> <li>21. Review and demonstrate problem-solving techniques for geometric problems.</li> <li>22. Review and demonstrate problem-solving techniques for algebraic problems.</li> <li>23. Review and demonstrate problem-solving techniques using percentages.</li> <li>24. Review and demonstrate techniques for reading and interpreting graphs.</li> <li>25. Review and demonstrate techniques for using a calculator.</li> </ol>	
<p>D. SERVICE MANUALS AND COMPUTER-BASED INFORMATION SYSTEMS</p> <p>Understand, apply, and evaluate the contents of service manuals and computer-based information systems as important sources of reference to a diesel technician.</p> <p>(1 hour)</p>	<ol style="list-style-type: none"> <li>1. Describe the different types of service manuals.</li> <li>2. Describe the different types of information that can be found in service manuals such as specifications, troubleshooting charts, and repair information.</li> <li>3. Describe and demonstrate the use of service manuals.</li> <li>4. Describe and demonstrate the use of CD-ROM (compact disc) and web-based search engines in finding diesel technical information.</li> <li>5. Describe the advantages of using CD-ROM and web-based search engines over service manuals in finding diesel technical information.</li> </ol>	<p><b>Career Ready Practice:</b> 1, 11</p> <p><b>CTE Anchor:</b> Communications: 2.3 Technology: 4.1, 4.2, 4.6</p> <p><b>CTE Pathway:</b> C2.6, C4.3</p>
<p>E. TOOLS AND EQUIPMENT</p> <p>Understand, apply, and evaluate the policies and procedures for using diesel tools and equipment in accordance with federal, state, and local safety and environment regulations.</p>	<ol style="list-style-type: none"> <li>1. Identify and demonstrate the proper use, maintenance, and storage techniques for the general shop hand tools.</li> <li>2. Identify and demonstrate the proper use, maintenance, and storage techniques for the general shop equipment.</li> <li>3. Identify and demonstrate the proper use, maintenance, and storage techniques for the following specialty tools and equipment for diesel engines: <ol style="list-style-type: none"> <li>a. connector pick tool set</li> <li>b. ball/small hole gauges</li> <li>c. cooling system vacuum fill machine (optional)</li> <li>d. dial bore gauge or telescoping gauges</li> <li>e. engine stands</li> <li>f. fan hub wrenches</li> </ol> </li> </ol>	<p><b>Career Ready Practice:</b> 1, 3, 10</p> <p><b>CTE Anchor:</b> Health and Safety: 6.3</p> <p><b>CTE Pathway:</b> C2.2, C2.3</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(10 hours)	<ul style="list-style-type: none"> <li>g. injector removal tool(s)</li> <li>h. liner installer (universal)</li> <li>i. liner puller (universal)</li> <li>j. manometer - (water) or magnehelic gauge</li> <li>k. precision straight edge</li> <li>l. protrusion gauge (cylinder liner height)</li> <li>m. ring compressor</li> <li>n. ring expander(s)</li> <li>o. rod bolt protectors</li> <li>p. soft jaw vise or adapters</li> <li>q. valve spring compressor</li> <li>r. vibration damper puller</li> </ul> <p>4. Identify and demonstrate the proper use, maintenance, and storage techniques for the following specialty tools and equipment for diesel preventive maintenance:</p> <ul style="list-style-type: none"> <li>a. fifth wheel test pin</li> <li>b. stop watch</li> <li>c. tire square</li> <li>d. trailer cord tester</li> </ul> <p>5. Identify and demonstrate the proper use, maintenance, and storage techniques for the following engine diagnostic-testing instruments:</p> <ul style="list-style-type: none"> <li>a. tachometer</li> <li>b. compression tester</li> <li>c. cylinder leakage tester</li> <li>d. engine vacuum gauge</li> </ul>	
<p>F. LUBRICATION SYSTEM</p> <p>Understand, apply, and evaluate the diagnostic, maintenance, and repair techniques for the lubrication system of a diesel engine according to the manufacturer's specifications</p>	<ul style="list-style-type: none"> <li>1. Test engine oil pressure and check operation of pressure sensor, gauge, and/or sending unit; test engine oil temperature and check operation of temperature sensor; determine needed action. P-1</li> <li>2. Check engine oil level, condition, and consumption; determine needed action. P-1</li> <li>3. Inspect and measure oil pump, drives, inlet pipes, and pick-up screens; check drive gear clearances; determine needed action. P-3</li> <li>4. Inspect oil pressure regulator valve(s), by-pass and pressure relief valve(s), oil thermostat, and filters; determine needed action. P-3</li> <li>5. Inspect, clean, and test oil cooler and components; determine needed action. P-3</li> <li>6. Inspect turbocharger lubrication and cooling systems; determine needed action. P-2</li> <li>7. Determine proper lubricant and perform oil and filter change. P-1</li> </ul>	<p><b>Career Ready Practice:</b> 1, 4, 11</p> <p><b>CTE Anchor:</b> Technology: 4.1, 4.2, 4.3 Problem Solving and Critical Thinking: 5.1, 5.2, 5.3, 5.4 Responsibility and Flexibility: 7.4 Ethics and Legal Responsibilities: 8.1 Demonstration and Application: 11.2</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(20 hours)		<b>CTE Pathway:</b> C2.1, C2.2, C2.3, C2.4, C2.5, C2.6, C3.1, C3.7, C4.1, C4.3, C5.6, C6.1, C6.2
<b>G. COOLING SYSTEM</b>  Understand, apply, and evaluate the diagnostic, maintenance, and repair techniques for the cooling system of a diesel engine according to the manufacturer's specifications.	<ol style="list-style-type: none"> <li>1. Check engine coolant type, level, condition, and consumption; test coolant for freeze protection and additive package concentration; determine needed action. P-1</li> <li>2. Test coolant temperature and check operation of temperature and level sensors, gauge, and/or sending unit; determine needed action. P-1</li> <li>3. Inspect and reinstall/replace pulleys, tensioners and drive belts; adjust drive belts and check alignment. P-1</li> <li>4. Inspect thermostat(s), by-passes, housing(s), and seals; replace as needed. P-2</li> <li>5. Recover, flush, and refill with recommended coolant/additive package; bleed cooling system. P-1</li> <li>6. Inspect coolant conditioner/filter assembly for leaks; inspect valves, lines, and fittings; replace as needed. P-1</li> <li>7. Inspect water pump and hoses; replace as needed. P-1</li> <li>8. Inspect, clean, and pressure test radiator, pressure cap, tank(s), and recovery systems; determine needed action. P-1</li> <li>9. Inspect thermostatic cooling fan system (hydraulic, pneumatic, and electronic) and fan shroud; replace as needed. P-1</li> </ol>	<b>Career Ready Practice:</b> 1, 4, 11  <b>CTE Anchor:</b> Technology: 4.1, 4.2, 4.3 Problem Solving and Critical Thinking: 5.1, 5.2, 5.3, 5.4 Responsibility and Flexibility: 7.4 Ethics and Legal Responsibilities: 8.1 Demonstration and Application: 11.2  <b>CTE Pathway:</b> C2.1, C2.2, C2.3, C2.4, C2.5, C2.6, C3.1, C3.7, C4.1, C4.3, C5.6, C6.1, C6.2
<b>H. AIR INDUCTION AND EXHAUST SYSTEMS</b>  Understand, apply, and evaluate the diagnostic, maintenance, and repair techniques for the air induction and exhaust systems of a diesel engine according to the manufacturer's specifications.	<ol style="list-style-type: none"> <li>1. Perform air intake system restriction and leakage tests; determine needed action. P-1</li> <li>2. Perform intake manifold pressure (boost) test; determine needed action. P-1</li> <li>3. Perform exhaust back pressure test; determine needed action. P-2</li> <li>4. Inspect turbocharger(s), wastegate, and piping systems; determine needed action. P-2</li> <li>5. Inspect and test turbocharger(s) (variable ratio/geometry VGT), pneumatic, hydraulic, electronic controls, and actuators. P-3</li> <li>6. Check air induction system: piping, hoses, clamps, and mounting; service or replace air filter as needed. P-1</li> <li>7. Remove and reinstall turbocharger/wastegate assembly. P-3</li> <li>8. Inspect intake manifold, gaskets, and connections; replace as needed. P-3</li> </ol>	<b>Career Ready Practice:</b> 1, 4, 11  <b>CTE Anchor:</b> Technology: 4.1, 4.2, 4.3 Problem Solving and Critical Thinking: 5.1, 5.2, 5.3, 5.4 Responsibility and Flexibility: 7.4

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(20 hours)	<ol style="list-style-type: none"> <li>9. Inspect, clean, and test charge air cooler assemblies; inspect aftercooler assemblies; replace as needed. P-2</li> <li>10. Inspect exhaust manifold, piping, mufflers, and mounting hardware; repair or replace as needed. P-2</li> <li>11. Inspect exhaust after treatment devices; determine necessary action. P-3</li> <li>12. Inspect and test preheater/inlet air heater, or glow plug system and controls; perform needed action. P-2</li> <li>13. Inspect and test exhaust gas recirculation (EGR) system including EGR valve, cooler, piping, filter, electronic sensors, controls, and wiring; determine needed action. P-3</li> </ol>	<p>Ethics and Legal Responsibilities: 8.1 Demonstration and Application: 11.2</p> <p><b>CTE Pathway:</b> C2.1, C2.2, C2.3, C2.4, C2.5, C2.6, C3.1, C3.3, C3.7, C4.1, C4.3, C5.6, C6.1, C6.3, C7.1, C8.1</p>
<p>I. FUEL SYSTEM: FUEL SUPPLY SYSTEM</p> <p>Understand, apply, and evaluate the diagnostic, maintenance, and repair techniques for the fuel supply system of a diesel engine according to the manufacturer's specifications.</p> <p>(20 hours)</p>	<ol style="list-style-type: none"> <li>1. Check fuel level, and condition; determine needed action. P-1</li> <li>2. Perform fuel supply and return system tests; determine needed action. P-1</li> <li>3. Inspect fuel tanks, vents, caps, mounts, valves, screens, crossover system, supply and return lines and fittings; determine needed action. P-1</li> <li>4. Inspect, clean, and test fuel transfer (lift) pump, pump drives, screens, fuel/water separators/indicators, filters, heaters, coolers, ECM cooling plates, and mounting hardware; determine needed action. P-1</li> <li>5. Inspect and test low pressure regulator systems (check valves, pressure regulator valves, and restrictive fittings); determine needed action. P-1</li> <li>6. Check fuel system for air; determine needed action; prime and bleed fuel system; check primer pump. P-1</li> </ol>	<p><b>Career Ready Practice:</b> 1, 4, 11</p> <p><b>CTE Anchor:</b> Technology: 4.1, 4.2, 4.3 Problem Solving and Critical Thinking: 5.1, 5.2, 5.3, 5.4 Responsibility and Flexibility: 7.4 Ethics and Legal Responsibilities: 8.1 Technical Knowledge and Skills: 10.1 Demonstration and Application: 11.2</p> <p><b>CTE Pathway:</b> C1.5, C2.1, C2.2, C2.3, C2.4, C2.5, C2.6, C3.1, C3.6, C3.7, C4.1, C4.3, C5.6, C6.1, C6.3, C6.4</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>J. FUEL SYSTEM: ELECTRONIC FUEL MANAGEMENT SYSTEM</p> <p>Understand, apply, and evaluate the diagnostic, maintenance, and repair techniques for the fuel supply system of a diesel engine according to the manufacturer's specifications</p> <p>(35 hours)</p>	<ol style="list-style-type: none"> <li>1. Inspect and test power and ground circuits and connections; measure and interpret voltage, voltage drop, amperage, and resistance readings using a digital multimeter (DMM); determine needed action. P-1</li> <li>2. Interface with vehicle's on-board computer; perform diagnostic procedures using recommended electronic diagnostic equipment and tools (to include PC based software and/or data scan tools); determine needed action. P-1</li> <li>3. Check and record electronic diagnostic codes and trip/operational data; monitor electronic data; clear codes; determine further diagnosis. P-1</li> <li>4. Locate and use relevant service information (to include diagnostic procedures, flow charts, and wiring diagrams). P-1</li> <li>5. Inspect and replace electrical connector terminals, seals, and locks. P-1</li> <li>6. Inspect and test switches, sensors, controls, actuator components, and circuits; adjust or replace as needed. P-1</li> <li>7. Using recommended electronic diagnostic tools (to include PC based software and/or data scan tools), access and interpret customer programmable parameters. P-2</li> <li>8. Inspect, test, and adjust electronic unit injectors (EUI); determine needed action. P-2</li> <li>9. Remove and install electronic unit injectors (EUI) and related components; recalibrate ECM (if applicable). P-2</li> <li>10. Perform cylinder contribution test utilizing recommended electronic diagnostic tool. P-1</li> <li>11. Perform on-engine inspections and tests on hydraulic electronic unit injectors and system electronic controls; determine needed action. P-2</li> <li>12. Perform on-engine inspections and tests on hydraulic electronic unit injector high pressure oil supply and control systems; determine needed action. P-2</li> <li>13. Perform on-engine inspections and tests on common rail type injection systems; determine needed action. P-3</li> <li>14. Inspect high pressure injection lines, hold downs, fittings and seals; determine needed action. P-3</li> </ol>	<p><b>Career Ready Practice:</b> 1, 4, 5, 10</p> <p><b>CTE Anchor:</b> Technology: 4.1, 4.2, 4.3 Problem Solving and Critical Thinking: 5.1, 5.2, 5.3, 5.4 Responsibility and Flexibility: 7.4 Ethics and Legal Responsibilities: 8.1 Technical Knowledge and Skills: 10.1 Demonstration and Application: 11.2</p> <p><b>CTE Pathway:</b> C1.5, C2.1, C2.2, C2.3, C2.4, C2.5, C2.6, C3.1, C3.6, C3.7, C4.1, C4.3, C5.6, C6.1, C6.3, C6.4, C7.7</p>
<p>K. ENGINE BRAKES</p> <p>Understand, apply, and evaluate the diagnostic, maintenance, and repair techniques for the engine brake system of a diesel engine according to the manufacturer's specifications.</p>	<ol style="list-style-type: none"> <li>1. Inspect and adjust engine compression/exhaust brakes; determine needed action. P-3</li> <li>2. Inspect, test, and adjust engine compression/exhaust brake control circuits, switches, and solenoids; repair or replace as needed. P-3</li> <li>3. Inspect engine compression/exhaust brake housing, valves, seals, lines, and fittings; repair or replace as needed. P-3</li> </ol>	<p><b>Career Ready Practice:</b> 1, 5, 10</p> <p><b>CTE Anchor:</b> Technology: 4.1, 4.2, 4.3 Problem Solving and Critical Thinking: 5.1, 5.2, 5.3, 5.4</p>



COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>M. DIESEL ELECTRIC VEHICLE REVIEW</p> <p>Review and evaluate the basics of diesel electric vehicles.</p> <p>(1 hour)</p>	<ol style="list-style-type: none"> <li>1. Review the definition of diesel electric vehicles.</li> <li>2. Review the difference between a diesel electric vehicle and a vehicle powered by a diesel engine on the bases of:               <ol style="list-style-type: none"> <li>a. engine size</li> <li>b. fuel economy</li> <li>c. emissions</li> </ol> </li> </ol>	<p><b>Career Ready Practice:</b> 1, 4, 5, 10, 11</p> <p><b>CTE Anchor:</b> Problem Solving and Critical Thinking: 5.3 Technical Knowledge and Skills: 10.1</p> <p><b>CTE Pathway:</b> C1.5, C3.1, C3.6</p>
<p>N. EMPLOYABILITY SKILLS REVIEW</p> <p>Review, apply, and evaluate the employability skills required in diesel repair and maintenance.</p> <p>(3 hours)</p>	<ol style="list-style-type: none"> <li>1. Review employer requirements for the following:               <ol style="list-style-type: none"> <li>a. punctuality</li> <li>b. attendance</li> <li>c. attitude toward work</li> <li>d. quality of work</li> <li>e. teamwork</li> <li>f. responsibility</li> <li>g. timeliness</li> <li>h. communication skills</li> </ol> </li> <li>2. Update potential employers through traditional and internet sources.</li> <li>3. Update sample résumés.</li> <li>4. Review the importance of filling out a job application legibly, with accurate and complete information.</li> <li>5. Complete sample job application forms correctly.</li> <li>6. Review the importance of enthusiasm on a job.</li> <li>7. Review the importance of appropriate appearance on a job.</li> <li>8. Review the importance of the continuous upgrading of job skills.</li> <li>9. Review the importance of customer service as a method of building permanent relationships between the organization and the customer.</li> </ol>	<p><b>Career Ready Practice:</b> 1, 2, 3, 5, 10, 11</p> <p><b>CTE Anchor:</b> Communications: 2.1, 2.2, 2.3, 2.4 Career Planning and Management: 3.1, 3.2, 3.4, 3.9 Responsibility and Flexibility: 7.2, 7.4, 7.5, 7.7 Leadership and Teamwork: 9.2 Demonstration and Application: 11.5</p> <p><b>CTE Pathway:</b> C5.3, C5.4, C5.5</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>O. ENTREPRENEURIAL SKILLS</p> <p>Understand, apply, and evaluate the process involved in becoming an entrepreneur in the diesel repair and maintenance industry.</p> <p>(2 hours)</p>	<ol style="list-style-type: none"> <li>1. Define entrepreneurship.</li> <li>2. Identify the necessary characteristics of successful entrepreneurs.</li> <li>3. Describe the contributions of entrepreneurs to the diesel repair and maintenance industry.</li> <li>4. Explain the purpose and components of a business plan.</li> <li>5. Examine personal goals prior to starting a business.</li> <li>6. Evaluate sources of monetary investment in a business opportunity.</li> <li>7. State various licensing requirements in the diesel repair and maintenance business.</li> <li>8. Develop a scenario depicting the student as the diesel repair and maintenance owner</li> <li>9. Differentiate between sustainable and green business practices and standard business practices.</li> </ol>	<p><b>Career Ready Practice:</b> 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12</p> <p><b>CTE Anchor:</b> Communications: 2.3, 2.4 Career Planning and Management: 3.4, 3.5, 3.7, 3.9 Responsibility and Flexibility: 7.1, 7.6 Technical Knowledge and Skills: 10.3 Demonstration and Application: 11.5</p> <p><b>CTE Pathway:</b> C1.1, C5.3, C5.4, C5.5</p>



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

### **TEXTS AND SUPPLEMENTAL BOOKS**

Bell, Joseph. Modern Diesel Technology: Electricity and Electronics. Cengage Learning, 2006.

Bennett, Sean. Medium/Heavy Duty Truck Engines, Fuel and Computerized Management Systems. Cengage Learning, 2008.

Bosch, Robert GmbH. Diesel-Engine Management. Wiley, John and Sons, Incorporated, 2006.

Bosch, Robert GmbH. Electronic Diesel Control EDC. Bentley Publishers, 2001.

Dagel, John F., Robert N. Brady and John Dagel. Diesel Engine and Fuel System Repair, 5<sup>th</sup> Edition. (Hardcover). Prentice Hall, 2001.

Dempsey, Paul K. Troubleshooting and Repairing Diesel Engines. MacGraw-Hill Companies, 2007.

Dixon, John and Frank Dixon. Modern Diesel Technology: Heating, Ventilation, Air Conditioning and Refrigeration. Cengage Learning, 2006.

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

Norman, Andrew. Heavy Duty Truck Systems. 3<sup>rd</sup> Edition. Thomson Delmar Learning, 2000.

Norman, Andrew and John A. Corinchock. Diesel Technology: Fundamentals, Service, Repair. Goodheart-Willcox Publisher, 2006.

Norman, Andrew, John A. Corinchock and Robert Scharff. Diesel Technology. Goodheart-Willcox Publisher, 2000.

Song, Chunshan. Chemistry of Diesel Fuel. CRC Press, 2000.

## **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)

[http://www.ed-foundation.org/html\\_pages/products\\_programs\\_services/natef\\_tools/non-structural\\_analysis/non-structural\\_analysis.shtml](http://www.ed-foundation.org/html_pages/products_programs_services/natef_tools/non-structural_analysis/non-structural_analysis.shtml)

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)

## **COMPETENCY CHECKLIST**

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

### **METHODS AND PROCEDURES**

- A. Lecture and discussion
- B. Demonstration
- C. Multi-sensory presentations
- D. Lab and live shop work

### **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 – Trade Mathematics Review – Pass all assignments and exams on trade mathematics review with a minimum score of 80% or higher.

SECTION D – Service Manuals and Computer-Based Information Systems Review – Pass all assignments and exams on service manuals and computer-based information systems review with a minimum score of 80% or higher.

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

SECTION F – Lubrication System – Pass all assignments and exams on lubrication system with a minimum score of 80% or higher.

SECTION G – Cooling System – Pass all assignments and exams on cooling system with a minimum score of 80% or higher.

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

SECTION I – Fuel System: Fuel Supply System – Pass all assignments and exams on fuel system: fuel supply system with a minimum score of 80% or higher.

SECTION J – Fuel System: Electronic Fuel Management System – Pass all assignments and exams on fuel system: electronic fuel management system with a minimum score of 80% or higher.

SECTION K – Engine Brakes – Pass all assignments and exams on engine brakes with a minimum score of 80% or higher.

SECTION L – Preventative Maintenance – Pass all assignments and exams on preventative maintenance with a minimum score of 80% or higher.

SECTION M – Diesel Electric Vehicle Review – Pass all assignments and exams on diesel electric vehicle review with a minimum score of 80% or higher.

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

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

**NATEF Task List Priority Item Totals (by area)**

I. Diesel Engines

P-1 = 39

P-2 = 27

P-3 = 24

II. Drive Train

P-1 = 23

P-2 = 17

P-3 = 17

III. Brakes

P-1 = 30

P-2 = 14

P-3 = 10

IV. Suspension & Steering

P-1 = 23

P-2 = 11

P-3 = 11

V. Electrical/Electronic Systems

P-1 = 31

P-2 = 21

P-3 = 12

VI. Heating, Ventilation, & Air Conditioning

P-1 = 29

P-2 = 16

P-3 = 12

VII. Preventative Maintenance Inspection

P-1 = 145

P-2 = 0

P-3 = 0

VIII. Hydraulics

P-1 = 12

P-2 = 20

P-3 = 0

## 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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