Course Outline

Transportation **REVISED: August/2017**

Job Title:
Automotive Body Technician

Career Pathway:
Structural Repair and Refinishing

Industry Sector:
Transportation

O*NET-SOC CODE:
49-3021.00

CBEDS Title:
Structural Repair

CBEDS No.:
5663

79-80-55

Auto Body Repair/3: Mechanical and Electrical

Credits: 30 **Hours:** 360

Course Description:
This competency-based course is the third in a sequence of five designed for the National Automotive Technicians Education Foundation (NATEF) certification in Auto Body Repair. It provides students with technical instruction and practical experience in mechanical and electrical repair of automobiles using sustainable and green vehicle technologies. Instruction includes the inspection, removal, replacement, and/or adjustment of the following: suspension and steering, electrical, brakes, heating and air conditioning, cooling, drive train, fuel, intake, exhaust, and restraint systems. It covers a review of trade mathematics, employability skills, and entrepreneurial skills. 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 the ability to lift and carry heavy items as required by the industry and successful completion of the course Auto Body Repair/2: Structural (79-80-53). CFC (dichlorodifluoromethane) certification is mandatory for anyone working on air conditioning systems.

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

Meets NATEF Standards and identifies high priority tasks in collision repair and refinish. Check the NATEF Manual for explanation of high priority I or G 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 Couseling 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. 7-18

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	p. 20
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. 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.	pp. 7-18
EVALUATION PROCEDURES	pp. 20-21
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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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.

B. Structural Repair and Refinishing Pathway
The Structural Repair and Refinishing pathway prepares students for postsecondary education and employment in the transportation industry, including but not limited to body and frame straightening, estimating, painting, and refinishing (included but not limited to airplanes, trains, vehicles, and equipment).

Sample occupations associated with this pathway:

- Estimator
- Claims Adjuster
- Technician
- Insurance Company/Manufacturer's Representative
- Investigator/Inspector

B1.0 Students practice personal and occupational safety and understand the environmental effects of collision repair and refinishing practices.

B2.0 Practice the safe and appropriate use of tools, equipment, and work processes.

B3.0 Apply measurement systems and the mathematical functions necessary to perform required fabrication, maintenance, and operation procedures.

B4.0 Apply scientific principles in relation to chemical, mechanical, and physical functions and in relation to industry and manufacturer standards.

B5.0 Perform and document repair procedures in accordance with manufacturer recommendations and industry standards.

B6.0 Demonstrate basic business practices.

B7.0 Understand structural and nonstructural analysis and damage repair.

B8.0 Demonstrate an understanding of mechanical and electrical components in relation to industry and manufacturer standards.

B9.0 Demonstrate the concepts, principles, and practices of painting and refinishing.

COMPETENCY-BASED COMPONENTS
for the Auto Body Repair/3: Mechanical and Electrical Course

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
A. INTRODUCTION AND SAFETY Review, apply, and evaluate classroom and workplace policies and procedures used in accordance with federal, state, and local safety and environmental regulations. (5 hours)	1. Review the scope and purpose of the course. 2. Review classroom policies and procedures. 3. Review classroom and workplace first aid and emergency procedures. 4. Review the different occupations in the Transportation Industry Sector which have an impact on the role of the auto technician. 5. Review the importance of the "safety first" attitude. 6. Review the California Occupational Safety and Health Administration (Cal/OSHA) workplace requirements for auto body repair technicians. 7. Review the impact of Environmental Protection Agency (EPA) legislation on Transportation Industry Sector practices in protecting and preserving the environment. 8. Review the impact of California Air Resources Board (ARB) legislation on Transportation Industry Sector practices in protecting and preserving the environment. 9. Review and demonstrate the use of the Material Safety Data Sheet (MSDS) as it applies to the automotive industry. 10. Review the safety items required by federal, state, and local regulations. 11. Review the role of the National Automotive Technicians Education Foundation (NATEF) in auto technician training. 12. Review and demonstrate the NATEF standards regarding proper use of protective clothing and gloves in an auto shop. 13. Review and demonstrate the NATEF standards regarding proper use of protective respiratory gear in an auto shop. 14. Review and demonstrate the NATEF standards regarding proper use of protective eye gear in an auto shop. 15. Review and demonstrate the NATEF standards regarding proper ventilation in an auto shop. 16. Review and demonstrate NATEF standards regarding proper handling, storage, and disposal of chemicals and materials used in an auto shop. 17. Pass the safety exam with 100% accuracy.	**Career Ready Practice:** 1, 3, 6, 8, 12 **CTE Anchor:** Communications: 2.1, 2.2, 2.3, 2.4 Career Planning and Management: 3.2, 3.3, 3.4, 3.5, 3.6, 3.9 Technology: 4.1 Health and Safety: 6.1, 6.2, 6.3, 6.4, 6.5, 6.6 Ethics and Legal Responsibilities: 8.2 Leadership and Teamwork: 9.4 Technical Knowledge and Skills: 10.1, 10.2 **CTE Pathway:** B1.1, B1.2, B1.3, B1.6, B6.1, B6.4

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
B. TOOLS AND EQUIPMENT Understand, apply, and evaluate the policies and procedures for using tools and equipment on the mechanical and electrical components of an auto in accordance with federal, state, and local safety and environment regulations. (5 hours)	1. Review the common hand tools used in an auto body shop. 2. Identify and demonstrate the proper use, maintenance, and storage techniques for the following tools and equipment used on the mechanical and electrical components of an automobile or other vehicles: a. battery charger - with boost capability b. battery post cleaner c. battery terminal pliers d. battery terminal puller e. brake bleeder - vacuum assisted f. brake spoon g. butane soldering gun/iron h. chassis lubricator i. connector pick tool set j. cooling system pressure tester k. DMM (Digital Multimeter) l. feeler gauge (blade type): i. .002" - .040" ii. .006mm - .070mm m. flexible dial indicator gauge n. headlamp aiming equipment o. jumper wire set (with various adapters) p. oil filter wrenches q. wheel alignment system (4-wheel) r. wire and terminal repair Kit	**Career Ready Practice:** 1 **CTE Anchor:** Communications: 2.1, 2.2, 2.3 Health and Safety: 6.1, 6.3, 6.5, 6.6 Ethics and Legal Responsibilities: 8.5 Technical Knowledge and Skills: 10.1, 10.2 **CTE Pathway:** B1.6, B2.1, B3.2, B4.4
C. TRADE MATHEMATICS REVIEW Review, apply, and evaluate the mathematical requirements in the workplace.	1. Review the practical applications of math in auto body repair. 2. Review and demonstrate problem-solving techniques involving whole number problems, using addition, subtraction, multiplication, and division. 3. Review and demonstrate problem-solving techniques involving various fraction problems, using arithmetic operations (addition, subtraction, multiplication, and division). 4. Review and demonstrate problem-solving techniques involving various decimal problems, using arithmetic operations. 5. Review and demonstrate techniques for changing fractions to decimals. 6. Review and demonstrate techniques for changing decimals to fractions. 7. Review the English system of measuring length. 8. Review the English system of measuring weight. 9. Review the English system of measuring volume or capacity. 10. Review the relationships between various English system linear units of measurement, such as inches, feet, yards, and miles. 11. Review the relationships between various English system units of volume or capacity, such as cups, pints, quarts, and gallons. 12. Review and demonstrate problem-solving techniques for various English system measuring problems, using arithmetic operations.	**Career Ready Practice:** 1 **CTE Anchor:** Communications; 2.1, 2.2, 2.3, 2.4 Problem Solving and Critical Thinking: 5.1, 5.4 Technical Knowledge and Skills: 10.1 **CTE Pathway:** B3.1, B 3.4

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(5 hours)	13. Review and demonstrate measuring techniques of various objects by using the English system measuring tools common to the trade. 14. Describe the metric system of measuring length. 15. Describe the metric system of measuring weight. 16. Describe the metric system of measuring volume or capacity. 17. Describe the relationships between various metric system linear units of measurement, such as millimeters, centimeters, and meters. 18. Describe the relationships between various metric system units of weight such as milligrams, grams, and kilograms. 19. Describe and demonstrate problem-solving techniques for various metric system measuring problems involving addition, subtraction, multiplication, and division. 20. Describe and demonstrate measuring techniques of objects using metric system measuring tools common to the trade. 21. Describe and demonstrate problem-solving techniques for geometric problems that apply to auto body repair. 22. Describe and demonstrate problem-solving techniques for algebraic problems that apply to auto body repair. 23. Describe and demonstrate problem-solving techniques using percentages. 24. Describe and demonstrate techniques for reading and interpreting graphs. 25. Describe and demonstrate techniques for using a calculator.	
D. SUSPENSION AND STEERING Understand, apply, and evaluate the inspection, removal, replacement, and/or adjustment techniques for the components of auto suspension and steering systems.	1. Identify one–time use fasteners. HP-I 2. Remove, replace, inspect, or adjust the power steering pump, pulleys, belts, hoses, fittings and pump mounts. HP-G 3. Remove and replace the power steering gear (non-rack and pinion type). HP-G 4. Remove and replace the power rack and pinion steering gear; inspect and replace the mounting bushings, tie rod ends, bellow boots, and brackets; ensure proper mounting location. HP-G 5. Inspect and adjust (where applicable) the steering linkage geometry (attitude/parallelism). HP-G 6. Inspect and replace the pitman arm. HP-G 7. Inspect and replace the relay (center link/intermediate) rod. HP-G 8. Inspect, remove, and replace the idler arm and mountings. HP-G 9. Inspect, remove, and replace the tie rod sleeves, clamps, and tie rod ends. HP-G 10. Inspect, remove, and replace the steering linkage damper. HP-G 11. Inspect, remove, and replace the upper and lower control arms. HP-G 12. Inspect, remove, and replace the upper and lower control arm bushings, shafts, and rebound bumpers. HP-G 13. Inspect, remove, and replace the upper and lower ball joints. HP-G 14. Inspect, remove, and replace the steering knuckle/spindle/hub assemblies (including bearings, races, seals, etc.). HP-G 15. Inspect, remove, and replace the front suspension system coil	**Career Ready Practice:** 1, 4, 5 **CTE Anchor:** Communication: 2.1, 2.2, 2.3, 2.4 Technology: 4.1, 4.2, 4.3 Problem Solving and Critical Thinking: 5.1, 5.2, 5.3, 5.4 Health and Safety: 6.1, 6.3, 6.4, 6.6 Responsibility and Flexibility: 7.4, 7.5, 7.7 Ethics and Legal Responsibilities: 8.1, 8.5 Technical Knowledge and Skills: 10.1, 10.2, 10.3

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
	springs and spring insulators (silencers). HP-G 16. Inspect, remove, replace, and adjust suspension system torsion bars, and inspect mounts. HP-G 17. Inspect, remove, and replace the stabilizer bar bushings, brackets, and links. HP-G 18. Inspect, remove, and replace the MacPherson strut cartridge or assembly, upper bearing, and mount. HP-G 19. Inspect, remove, and replace the rear suspension system transverse links, control arms, stabilizer bars, bushings, and mounts. HP-G 20. Inspect, remove, and replace the suspension system leaf spring(s), leaf spring insulators (silencers), shackles, brackets, bushings, and mounts. HP-G 21. Inspect the axle assembly for damage and misalignment. HP-G 22. Inspect, remove, and replace the shock absorbers. HP-G 23. Diagnose, inspect, adjust, repair, or replace the active suspension systems and associated lines and fittings. HP-G 24. Measure the vehicle ride height and determine the needed repairs. HP-I 25. Inspect, remove, replace, and align the front and rear frames (cradles/sub). HP-G 26. Diagnose the steering column damage, looseness, and binding problems (including tilt mechanisms); determine needed repairs. HP-G 27. Inspect, remove, and replace the steering shaft U-joint(s), flexible coupling(s), collapsible columns, and steering wheels. HP-G 28. Diagnose the manual and power steering gear (non-rack and pinion type) noises, binding, uneven turning effort, looseness, hard steering, and fluid leakage problems; determine needed repairs. HP-G 29. Diagnose the power rack and pinion steering gear noises, vibration, looseness, hard steering, and fluid leakage problems, ensure proper mounting location; determine needed repairs. HP-G 30. Diagnose the non-MacPherson front and rear suspension system noises and body sway problems; determine needed repairs. HP-G 31. Diagnose the MacPherson strut suspension system noises and body sway problems; determine needed repairs. HP-G 32. Diagnose vehicle wandering, pulling, hard steering, bump steer, memory steering, torque steering, and steering return problems; determine needed repairs. HP-G 33. Adjust the front and rear wheel camber on suspension systems with camber adjustments. HP-I 34. Check the front and rear wheel camber on adjustable and non-adjustable suspension systems; determine needed repairs. HP-I 35. Adjust the caster on suspension systems with caster adjustments. HP-I 36. Check the caster on adjustable and non-adjustable suspension systems; determine needed repairs. HP-I 37. Check and adjust the wheel toe including centering steering wheel; determine needed adjustment or repair. HP-I 38. Identify toe-out-on-turns (turning radius) related problems;	**CTE Pathway:** B1.2, B1.3, B1.4, B2.1, B2.2, B3.1, B3.2, B3.4, B4.5, B4.6, B5.1, B5.2, B5.3, B6.2, B6.4, B7.4, B8.2

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(60 hour)	determine needed repairs. HP-I 39. Identify the steering axis inclination- (SAI), including the angle- and king pin inclination (KPI)-related problems; determine needed repairs. HP-I 40. Identify the thrust angle related problems; determine needed repairs. HP-I 41. Check for the front wheel setback; determine needed repairs. HP-I 42. Diagnose the tire wear patterns; determine needed repairs. HP-I 43. Inspect the tires, identify the direction of rotation and location; check and adjust air pressure. HP-I 44. Diagnose the wheel/tire vibration, shimmy, and tramp (wheel hop) problems; determine needed repairs. HP-G 45. Measure the wheel, tire, axle, and hub runout; determine needed repairs. HP-I 46. Diagnose the tire pull (lead) problems; determine corrective actions. HP-G 47. Reinstall the wheels and torque.	
E. ELECTRICAL Understand, apply, and evaluate the inspection, removal, replacement, and/or adjustment techniques for the components of an auto electrical system.	1. Check the voltages in the electrical wiring circuits with a DMM (digital multimeter). HP-I 2. Check for voltage drop and/or current flow in electrical wiring circuits and components with a DMM (digital multimeter). HP-I 3. Repair the electrical circuits, wiring, and connectors. HP-I 4. Inspect, test, and replace the fusible links, circuit breakers, and fuses. HP-I 5. Perform battery state-of-charge test and determine needed service. HP-I 6. Inspect, clean, and replace the battery. HP-I 7. Dispose of batteries and battery acid according to federal, state, and local requirements. HP-G 8. Perform slow/fast battery charge. HP-I 9. Identify programmable electrical/electronic components; record data for reprogramming before disconnecting battery. HP-I 10. Inspect, clean, and repair or replace battery cables, connectors, and clamps. HP-I 11. Inspect alignment, adjust, remove, and replace the alternator (generator), drive belts, pulleys, and fans. HP-I 12. Check the operation of exterior lighting; determine needed repairs. HP-I 13. Aim headlamp assemblies and fog/driving lamps; determine needed repairs. HP-I 14. Inspect, test, repair or replace switches, relays, bulbs, sockets, connectors, and wires of interior and exterior light circuits. HP-I 15. Remove and replace the horn(s); check operation. HP-I 16. Check the operation of the wiper/washer systems; determine needed repairs. HP1 17. Check the operation of the power side and tailgate windows; determine needed repairs. HP-I 18. Inspect, remove, and replace the power seat, motors, linkages,	**Career Ready Practice:** 1, 4, 5 **CTE Anchor:** Communications: 2.1, 2.2, 2.3 Technology: 4.1, 4.2, 4.3 Problem Solving and Critical Thinking: 5.1, 5.2, 5.3, 5.4 Health and Safety: 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7 Responsibility and Flexibility: 7.4, 7.5, 7.7 Ethics and Legal Responsibilities: 8.1, 8.3 Technical Knowledge and Skills: 10.1, 10.2 **CTE Pathway:** B1.2, B1.3, B1.4, B1.6, B2.1, B2.2, B3.2, B4.4, B5.1, B5.2, B7.4, B8.3

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(70 hours)	cables, etc. HP-G 19. Inspect, remove, and replace the components of the electric door and hatch/trunk lock. HP-G 20. Inspect, remove, and replace the components of the keyless lock/unlock devices and alarm systems. HP-G 21. Inspect, remove, and replace the components of the electrical sunroof and convertible top. HP-G 22. Check the operation of the electrically heated mirrors, windshields, back lights, panels, etc.; repair as necessary. HP-I 23. Inspect, remove, and replace the components of the power antenna circuits. HP-I 24. Demonstrate the proper self-grounding procedures for handling electronic components. HP-I 25. Check for module communication errors using a scan tool. HP-G 26. Use wiring diagrams and diagnostic flow charts during diagnosis of electrical circuit problems. HP-G 27. Demonstrate safe disarming techniques of high voltage systems on hybrid vehicles. HP-G	
F. BRAKES Understand, apply, and evaluate the inspection, removal, replacement, and/or adjustment techniques for the components of an auto brake system.	1. Inspect brake lines and fittings for leaks, dents, kinks, rust, cracks or wear; tighten loose fittings and supports; replace brake lines (double flare and ISO types), fittings, and supports. HP-I 2. Inspect flexible brake hoses for leaks, kinks, cracks, bulging or wear; remove and replace hoses; tighten loose fittings and supports. HP-I 3. Identify, handle, store, and install appropriate brake fluids; dispose of in accordance with federal, state, and local regulations. HP-G 4. Bleed (manual, pressure, vacuum or surge) hydraulic brake system. HP-I 5. Pressure test brake hydraulic system; determine needed repair. HP-G 6. Adjust brake shoes; remove and reinstall brake drums or drum/hub assemblies and wheel bearings. HP-I 7. Reinstall wheel and torque lug nuts. HP- I 8. Remove and reinstall caliper assembly. HP-I 9. Clean and inspect caliper mountings for wear and damage. HP-I 10. Check parking brake system operation. HP-I 11. Identify and replace ABS wheel speed sensor components. HP-G 12. Depressurize ABS hydraulic or electronic system. HP-G 13. Identify the proper procedures for handling brake dust. HP-G 14. Check for bent or damaged brake system components. HP-G	**Career Ready Practice:** 1, 4, 5 **CTE Anchor:** Communications: 2.1, 2.2, 2.3 Technology: 4.1, 4.2 Problem Solving and Critical Thinking: 5.2, 5.3 Health and Safety: 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7, Responsibility and Flexibility: 7.4, 7.7 Ethics and Legal Responsibilities: 8.1, 8.2, 8.3, 8.4 Technical Knowledge and Skills: 10.1, 10.2, 10.3

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(50 hours)		**CTE Pathway:** B1.2, B1.3, B1.4, B2.1, B2.2, B3.1, B3.2, B4.1, B4.6, B5.1, B5.2, B5.3, B6.1, B6.2, B6.3, B6.4, B6.5, B8.4
G. HEATING AND AIR CONDITIONING Understand, apply, and evaluate the inspection, removal, replacement, and/or adjustment techniques for the components of auto heating and air conditioning systems. (25 hours)	1. Identify and comply with environmental concerns relating to refrigerants and coolants. HP-G 2. Maintain and verify correct operation of certified refrigerant recovery and recharging equipment. HP-G 3. Locate and identify A/C system service ports. HP-I 4. Identify and recover refrigerant from A/C system. HP-G 5. Recycle refrigerant in accordance with EPA regulations. HP-G 6. Identify, label, and store refrigerant. HP-G 7. Test recycled refrigerant for non-condensable gases. HP-G 8. Evacuate A/C system; check for leaks. HP-G 9. Recharge A/C system with refrigerant; perform leak test. HP-G 10. Identify oil type and maintain correct amount in A/C system. HP-G 11. Inspect, adjust, and replace A/C compressor drive belts; check pulley alignment. HP-G 12. Remove and replace A/C compressor; inspect, repair or replace A/C compressor mount. HP-G 13. Inspect, repair or replace A/C system mufflers, hoses, lines, fittings, orifice tube, expansion valve, and seals. HP-G 14. Inspect, test, and replace A/C system condenser and mounts. HP-G 15. Inspect and replace receiver/drier or accumulator/drier. HP-G 16. Inspect and repair A/C component wiring. HP-G	**Career Ready Practice:** 1, 4, 5 **CTE Anchor:** Communications: 2.1, 2.2, 2.3 Technology: 4.1 Health and Safety: 6.1, 6.2, 6.3, 6.5, 6.6 Responsibility and Flexibility: 7.4, 7.5 Ethics and Legal Responsibilities: 8.1 Technical Knowledge and Skills: 10.1 **CTE Pathway:** B1.2, B1.3, B1.4, B1.5, B2.1, B2.2, B3.2, B5.1, B6.1, B6.3, B8.5
H. COOLING SYSTEMS Understand, apply, and evaluate the inspection, removal, replacement, and/or adjustment techniques for the components of auto cooling systems.	1. Check engine cooling and heater system hoses and belts; determine needed repairs. HP-I 2. Inspect, test, remove, and replace radiator, pressure cap, coolant recovery system, and water pump. HP-G 3. Recover, refill, and bleed system with proper coolant and check level of protection; leak test system and dispose of materials in accordance with EPA specifications. HP-I 4. Remove and replace fan (both electrical and mechanical), fan pulley, fan clutch, and fan shroud. HP-G	**Career Ready Practice:** 1, 4, 5 **CTE Anchor:** Communications: 2.1, 2.2, 2.3 Technology: 4.1

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(25 hours)	5. Inspect, remove, and replace auxiliary oil/fluid coolers; check oil levels. HP-G 6. Inspect, remove, and replace electric fan sensors; check operation. HP-G	Problem Solving and Critical Thinking: 5.1, 5.3, 5.4 Health and Safety: 6.1, 6.2, 6.3, 6.5, 6.6 Responsibility and Flexibility: 7.4, 7.7 Ethics and Legal Responsibilities: 8.1 Technical Knowledge and Skills: 10.1 **CTE Pathway:** B1.2, B1.3, B1.4, B1.5, B2.1, B2.2, B3.2, B5.1, B6.1, B6.3, B8.5
I. DRIVE TRAIN Understand, apply, and evaluate the inspection, removal, replacement, and/or adjustment techniques for the components of an auto drive train.	1. Remove, replace, and adjust shift or clutch linkage as required. HP-G 2. Remove, replace, and adjust cables or linkages for throttle valve (TV), kickdown, and accelerator pedal. HP-G 3. Remove and replace electronic sensors, wires, and connectors. HP-G 4. Remove and replace powertrain assembly; inspect, replace, and align powertrain mounts. HP-G 5. Remove and replace drive axle assembly. HP-G 6. Inspect, remove and replace half shafts and axle constant velocity (CV) joints. HP-G 7. Inspect, remove and replace drive shafts and universal joints.	**Career Ready Practice:** 1, 4, 5 **CTE Anchor:** Communications: 2.1, 2.2, 2.3 Technology: 4.1 Problem Solving and Critical Thinking: 5.1, 5.3 Health and Safety: 6.1, 6.2, 6.3, 6.4, 6.5, 6.6 Responsibility and Flexibility: 7.4, 7.7 Ethics and Legal Responsibilities: 8.1 Technical Knowledge and Skills: 10.1

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(40 hours)		**CTE Pathway:** B1.2, B1.3, B1.4, B1.6, B2.1, B3.2, B4.4, B6.3, B8.1
J. FUEL, INTAKE, AND EXHAUST SYSTEMS Understand, apply, and evaluate the inspection, removal, replacement, and/or adjustment techniques for the components of auto fuel, intake, and exhaust systems. (40 hours)	1. Inspect, remove and replace exhaust pipes, mufflers, converters, resonators, tail pipes, and heat shields. HP-G 2. Inspect, remove and replace fuel tank, fuel tank filter, fuel cap, fuel filler hose, and inertia switch; inspect and replace fuel lines and hoses; check fuel for contaminants. HP-G 3. Inspect, remove and replace engine components of air intake systems. HP-G 4. Inspect, remove and replace canister, filter, vent, and purge lines of fuel vapor (EVAP) control systems. HP-G	**Career Ready Practice:** 1, 4, 5 **CTE Anchor:** Communications: 2.1, 2.2, 2.3 Technology: 4.1 Problem Solving and Critical Thinking: 5.1, 5.3 Health and Safety: 6.1, 6.2, 6.3, 6.4, 6.5, 6.6 Responsibility and Flexibility: 7.4, 7.7 Ethics and Legal Responsibilities: 8.1 Technical Knowledge and Skills: 10.1 **CTE Pathway:** B1.2, B1.3, B1.4, B1.6, B2.1, B2.2, B3.2, B4.4, B6.3, B8.1
K. RESTRAINT SYSTEMS Understand, apply, and evaluate the inspection, removal, replacement, and/or adjustment techniques for the components of auto restraint systems.	1. Identify and perform vehicle manufacturer's recommended procedures for inspecting or replacing restraint systems and components. HP-I 2. Inspect, remove, and replace seatbelt and shoulder harness assembly and components. HP-G 3. Inspect restraint system mounting areas for damage; repair as needed. HP-G 4. Verify proper operation of seatbelt. HP-G 5. Deactivate and reactivate Supplemental Restraint System (SRS). HP-G	**Career Ready Practice:** 1, 4, 5 **CTE Anchor:** Communications: 2.1, 2.2, 2.3 Technology: 4.1

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(20 hours)	6. Inspect, remove and replace Supplemental Restraint System (SRS) sensors and wiring; ensure sensor orientation. HP-G 7. Verify that Supplemental Restraint System (SRS) is operational. HP-I 8. Inspect, remove, replace and dispose of deployed and non-deployed airbag(s) and pretensions. HP-G 9. Use Diagnostic Trouble Codes (DTC) to diagnose and repair the Supplemental Restraint System (SRS). HP-G	Problem Solving and Critical Thinking: 5.1, 5.2, 5.3, 5.4 Health and Safety: 6.6 Responsibility and Flexibility: 7.4, 7.5, 7.7 Ethics and Legal Responsibilities: 8.1, 8.3, 8.4 Technical Knowledge and Skills: 10.1 **CTE Pathway:** B2.1, B2.2, B3.2, B4.6, B5.1, B5.3, B6.2, B6.3, B6.4, B8.6
L. RESOURCE MANAGEMENT REVIEW Understand, apply, and evaluate the resource management principles and techniques in the auto repair and maintenance business.	1. Review the following: a. resources b. management c. sustainability 2. Review the management of the following resources in the auto repair and maintenance business: a. time b. materials c. personnel 3. Review specific examples of effective management of the following in the auto repair and maintenance business: a. time b. materials c. personnel 4. Review the benefits of effective resource management in the auto repair and maintenance business: a. profitability b. sustainability c. company growth 5. Review the economic benefits and liabilities of managing resources in an environmentally responsible way.	**Career Ready Practice:** 1, 3, 6, 8, 9, 12 **CTE Anchor:** Communications: 2.1, 2.2, 2.3, 2.4 Career Planning and Management: 3.1, 3.2 Technology: 4.1, 4.2 Problem Solving and Critical Thinking: 5.1, 5.3 Responsibility and Flexibility: 7.1, 7.2. 7.3, 7.4, 7.5, 7.6, 7.7 Ethics and Legal Responsibilities: 8.1, 8.3, 8.4, 8.5

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(5 hours)		Leadership and Teamwork: 9.1, 9.2, 9.3 Technical Knowledge and Skills: 10.1, 10.2 Demonstration and Application: 11.2 **CTE Pathway:** B6.2, B6.3, B6.4
M. EMPLOYABILITY SKILLS REVIEW Understand, apply, and evaluate the employability skills required in auto body repair. (5 hours)	1. Review employer requirements for the following: a. punctuality b. attendance c. attitude toward work d. quality of work e. teamwork f. responsibility g. timeliness h. communication skills 2. Update researched data on potential employers. 3. Update sample résumés. 4. Review the importance of filling out a job application legibly, with accurate and complete information. 5. Complete sample job application forms correctly. 6. Review the importance of enthusiasm on a job. 7. Review the importance of appropriate appearance on a job. 8. Review the importance of the continuous upgrading of job skills. 9. Review customer service as a method of building permanent relationships between the organization and the customer.	**Career Ready Practice:** 1, 2, 3, 7, 8 **CTE Anchor:** Communications: 2.1, 2.2, 2.3, 2.4 Career Planning and Management: 3.1, 3.2, 3.3, 3.4, 3.5, 3.8, 3.9 Technology: 4.1 Responsibility and Flexibility: 7.2, 7.3, 7.4, 7.5, 7.6, 7.7 Ethics and Legal Responsibilities: 8.3, 8.4, 8.5 Leadership and Teamwork: 9.1, 9.2, 9.3 Technical Knowledge and Skills: 10.1, 10.2 Demonstration and Application: 11.1, 11.2, 11.5 **CTE Pathway:** B1.1, B1.4, B2.1, B4.5, B5.1, B6.2, B6.5

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
N. ENTREPRENEURIAL SKILLS REVIEW Review, apply, and evaluate the process involved in becoming an entrepreneur in the auto body repair industry. (5 hours)	1. Review the definition of entrepreneurship. 2. Review the necessary characteristics of successful entrepreneurs. 3. Review the contributions of entrepreneurs to the auto body repair industry. 4. Review the purpose and components of a business plan. 5. Review personal goals prior to starting a business. 6. Review the sources of monetary investment in a business opportunity. 7. Review the various licensing requirements in the auto body repair business. 8. Develop a scenario depicting the student as the auto body repair business owner.	**Career Ready Practice:** 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 **CTE Anchor:** Communications: 2.1, 2.2, 2.3, 2.4, 2.5 Career Planning and Management: 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7 Technology: 4.1, 4.2 Responsibility and Flexibility: 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7, 7.8 Ethics and Legal Responsibilities: 8.1, 8.2, 8.3, 8.4, 8.5 Leadership and Teamwork: 9.1, 9.2, 9.3, 9.6 Technical Knowledge and Skills: 10.1, 10.2, 10.3, 10.4 Demonstration and Application: 11.1, 11.2, 11.3, 11.4, 11.5 **CTE Pathway:** B1.1, B1.5, B2.1, B3.2, B4.5, B5.1, B5.2, B6.2, B6.3, B6.4, B6.5

SUGGESTED INSTRUCTIONAL MATERIALS and OTHER RESOURCES

TEXTBOOKS

Duffy, James E. Auto Body Repair Technology. Cengage Learning, 2008

Duffy, James E. Collision Repair Fundamentals. Delmar Cengage Learning, 2007.

Finch Richard. Performance Welding Handbook, 2nd Edition. Motorbooks, 2005.

LaVielle, Tom. Crash Estimating Training Guide (Where to Go When You Need to Know Motor). Hearst Business Publishing, 1999.

Parks, Dennis W. The Complete Guide to Auto Body Repair. Motorbooks, 2008.

Richardson, Jim. Pro Paint & Body. HP Trade, 2002.

Alan Livesey and Alan Robinson. Repair of Vehicle Bodies, 5th Edition. Taylor & Francis, Inc, 2006.

Sformo, Larry, Todd Sformo and George Moore. Practical Problems in Math for Automotive Technicians, 6th Edition. Cengage Learning, 2004.

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.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

COMPETENCY CHECKLIST

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

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

SECTION D – Suspension and Steering – Pass all assignments and exams on suspension and steering with a minimum score of 80% or higher.

SECTION E – Electrical – Pass all assignments and exams on electrical with a minimum score of 80% or higher.

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

SECTION G – Heating and Air Conditioning – Pass all assignments and exams on heating and air conditioning with a minimum score of 80% or higher.

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

SECTION I – Drive Train – Pass all assignments and exams on drive train with a minimum score of 80% or higher.

SECTION J – Fuel, Intake, and Exhaust Systems – Pass all assignments and exams on fuel, intake, and exhaust systems with a minimum score of 80% or higher.

SECTION K – Restraint Systems – Pass all assignments and exams on restraint systems with a minimum score of 80% or higher.

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

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

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

DEFINITIONS OF TECHNICAL TERMS

ACTIVE SUSPENSION SYSTEM – Electronically controlled continuously self-adjusting suspension system.

ADJUST – To bring components or equipment to specified operational settings.

ALIGN (REALIGN) – To adjust components to a line or predetermined relative position.

ANALYZE – To examine the relationship of components of an operation.

ANCHOR – To hold in place.

APPLY – To put on, attach, or affix chemicals, components or parts by spraying, brushing, spreading or using hardware.

BLEED – To remove air from a closed system.

BUFF – To remove fine scratches, usually from a painted surface, using a fine abrasive in a neutral medium.

CHECK – To verify condition by performing an operational or comparative examination.

CLEAN – To rid component of extraneous matter for the purpose of reconditioning, repairing, measuring, or reassembling.

COLD SHRINK – To restore original contour, shape, and dimensions to stretched sheet metal areas utilizing appropriate hammer and dolly techniques.

COMPOUND – To smooth and bring out the gloss of a topcoat using an abrasive material.

CONDITION – To prepare for future action.

DENIB – To remove paint runs, sags or imperfections by sanding or filing.

DETERMINE – To establish the type and extent of damage to a component or the procedure to be used to affect the necessary repair.

DEVELOP (PLAN) – To identify, arrange or organize the steps or procedural components into a logical sequence of actions.

DIAGNOSE – To locate the root cause or nature of a problem by using the specified procedure.

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

FEATHEREDGE – To taper and smooth the edges of a damaged area using abrasives.

FILL (REFILL) – To bring fluid level to specified point or volume.

FLUSH – To use a fluid to clean an internal system.

GRIND – To remove base metal using a motor-driven abrasive wheel, disk or pad.

HEAT SHRINK – To restore original contour, shape and dimensions to stretched sheet metal areas by applying heat and utilizing appropriate hammer and dolly techniques.

IDENTIFY – To establish the identity of a vehicle or component prior to service; to determine the nature or degree of a problem.

INSPECT – (SEE CHECK)

INSTALL (REINSTALL) – To place a component in its proper position in a system.

LEAK TEST – To locate the source of leaks in a component or system.

LOCATE – To find by using tools, measuring instruments, equipment or the senses.

MASK – To protect a component or area from incidental damage from the application of refinishing materials or processes using tape, paper, or other appropriate materials.

MEASURE – To compare existing dimensions to specified dimensions by the use of calibrated instruments and gauges.

MIX – To combine or blend into one mass or mixture so that the constituent parts are indistinguishable.

PERFORM – To accomplish a procedure in accordance with established methods and standards.

PROTECT – To take actions to prevent damage to areas of the vehicles adjacent to the repair area.

REDUCE – To mitigate or eliminate the effects of damage to a repair area using tools, equipment, and procedures.

REFINISH – To apply cleaners, paint, and other finishing materials to the repair areas.

REMOVE – To disconnect and separate a component from a system.

REPAIR – To restore a malfunctioning component or system to operating condition.

REPLACE – To exchange an unserviceable component with a new or rebuilt component; to reinstall a component.

RESTORE – To return the repair areas to the original size, dimensions, shape, performance characteristics, and condition.

ROUGH SAND – To remove body filler, primer/substrate, or finish materials using coarse abrasives.

SAND – To abrade with sandpaper mounted either on an orbital/rotary sander or a rubber blocking tool.

SCUFF – To abrade or otherwise apply a rough surface to a body panel or finish area using abrasives to improve adhesion.

SELECT – To choose the correct part, tool, equipment or setting during an assembly, adjustment or procedure.

SETUP – To select and assemble components, assemblies or parts in order or combination to produce desired results.

SRS – Supplemental Restraint System.

STORE – To organize and put away parts, hardware, and components for future retrieval and use.

STRAIGHTEN – To remove bends, creases, and other damage while returning a component to its original size, shape, and condition.

STRUCTURAL COMPONENTS – Any part of a vehicle's structure that bears loads, provides strength, and when removed would compromise the integrity of the vehicle.

TINT – To adjust the shade, color or hiding ability of paint, primer, or refinishing materials.

VERIFY – To confirm a condition, adjustment or setting.

WASH – To clean by spraying, dipping, rinsing, rubbing or scrubbing.

WELD – To join two metals or plastic pieces together by bringing them to their melting points, often adding filler material to the joint.

Statement for Civil Rights

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