



## Auto Body Repair Course Outline

### Course Description

This 519 hour NATEF approved one year course is designed to inform and instruct students in the basics of auto body repair. Instruction includes theory and techniques related to the process of welding, metal straightening and panel/body alignment on a variety of auto body industry materials including metal, glass and plastic. Students will learn effective customer relations and sales in multiple settings. Estimating damage repair costs and procedures are key components in this course. Students will be prepared for entry-level employment in the auto body repair industry as an auto body repair technician.

### Course Details

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

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

30 total credits (15/semester):

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

**Pre-Requisites:**

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

**CTE Classification:**

- **Industry Sector:** Transportation
- **Industry Pathway:** Structural Repair and Refinishing
- **CA Basic Education Data System (CBEDS) Code:** 5663

**Work-Based Learning:**

Job shadowing and internships may be available for students in good standing in class

**Certifications & State Tests:**

- SVCTE Certificate of Completion awarded with “C” or better average for both semesters.
- Online certifications optional (3M, I-CAR, S/P2)

## Possible Education & Career Pathways

For more career information: [www.onetonline.org](http://www.onetonline.org)

College & Career Pathways:	Career Opportunities	O*NET Codes
<u>Post-Secondary:</u> Students with a high school diploma and having successfully completed this course have a number of entry-level career opportunities, as well as continuing their education.	<ul style="list-style-type: none"> <li>Automotive Body and Related Repairer</li> </ul>	49-3021.00
<u>Continuing Education: Including Community College, Training Programs, Certifications, etc:</u> <ul style="list-style-type: none"> <li>No specific majors/degrees related to Auto Body Repair identified at this time</li> </ul>	<ul style="list-style-type: none"> <li>Insurance Appraiser, Auto Damage</li> </ul>	13-1032.00

## Ongoing Unit: Career Readiness & Professionalism

32 hours

Students will develop personal and professional skills in the classroom that will transfer to the workplace.

- Time management and organization
- Interpersonal skills
- Work with a variety of technology
- Creative thinking and problem solving
- Job search skills including: resume, job applications and effective interview skills

### Standards Alignments:

CCSS: LS 11-12.1; RLST 11-12.3, 11-12.10; WS 11-12.4, 11-12. 6

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

Key Assignments	CTE Anchor Standards	CTE Pathway Standards
✓ <b>Key Assignment:</b> Student will participate in mock interviews with industry professionals, peers and instructors to increase their communication, interpersonal and employability skill-sets. <b>Assessment:</b> instructor, peer and public feedback, self reflection, observation, oral defense	2.1, 2.2, 2.3, 2.4, 2.5	B 1.0
✓ <b>Key Assignment:</b> Students will prepare a portfolio including a cover letter and resume through workshop, self and peer editing, and teacher instruction and demonstration. <b>Assessment:</b> written documentation, instructor, peer and public feedback, self reflection	2.4, 11.5	

<p>✓ <b>Key Assignment:</b> Students will have the opportunity to participate in a SkillsUSA Competition. In preparation for competition, students will fund raise, attend meetings, meet all requirements and dates and prepare for competition. At competition, students will have the opportunity to compete in categories related to Auto Body Repair and Professionalism.</p> <p><b>Assessment:</b> instructor, peer and public feedback, self reflection, observation</p>	<p>1.0, 2.1, 2.2, 2.3, 2.4, 2.5, 3.0, 4.1, 5.0, 6.3, 6.4, 9.0, 10.0, 11.5</p>	<p>B 1.0</p>
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<b>Ongoing Unit: Safety and Environmental Inspection</b>	<b>40 hours</b>
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Students will learn how to identify safety hazards in the lab and learn how to maintain a safe work environment.

- Environmental laws
- Introduction to tools
- MSDS (materials safety data sheet)
- Proper waste disposal and recycling
- Vehicle safety
- Safety glasses and other protection equipment

**Standards Alignments:**  
**CCSS:** LS 11-12.1; RLST 11-12.3, 11-12.10; **WS** 11-12.4, 11-12.6  
**NGSS:** SEP 1, 2, 3, 4, 5, 6, 7, 8; **ETS** 1, 2

Key Assignments	CTE Anchor Standards	CTE Pathway Standards
<p>✓ <b>Key Assignment:</b> Using a checklist aligned with EPA standards provided by instructor, students will individually explore the lab looking for safety violations in electrical, fire, chemical, as well as solid waste material and suggest improvements and corrective actions in written form.</p> <p><b>Assessment:</b> teacher observation, sign-off sheet</p>	<p>6.1, 6.2, 6.3, 6.4, 6.5, 6.6</p>	<p>B 1.2, B 1.3, B 1.4, B 1.5, B 2.1</p>
<p>✓ <b>Key Assignment:</b> Students will participate in an online safety course (S/P2) which consists of a series of online training, videos and quizzes related to safety in the auto body field. After successful completion of the online course, students will receive a certificate acknowledging their achievement.</p> <p><b>Assessment:</b> online multiple choice quiz</p>	<p>10.1, 11.2, 10.2</p>	<p>B 1.2, B 1.3, B 1.4, B 1.5, B 2.1</p>

**Unit 1: Vehicle Construction and Parts Identification** **35 hours**

Students will explore the basic construction of automobiles and learn to identify the body parts through classroom and hand-on lab work.

- Types of vehicles (unibody, body-over-frame, SUV, truck, car, hybrid)
- Body parts (fenders, doors, hood, trunk lid, bumpers, crush zones)
- Identify aluminum, steel, plastic and magnesium components
- Glass types (laminated, tempered)
- Aftermarket add-on accessories

**Standards Alignments:**  
**CCSS: LS 11-12.1; RLST 11-12.3**  
**NGSS: SEP 1, 2, 3, 4, 5, 6, 7, 8; ETS 1, 2**

Key Assignments	CTE Anchor Standards	CTE Pathway Standards
<p>✓ <b>Key Assignment:</b> Students will identify and label auto body panels to include: bumper, grill, hood, fenders, cowl, windshield, doors, roof, sail panel, quarter panel, trunk lid, rear panel, rear bumper, head and tail lights using a class vehicle. Students will demonstrate to the instructor knowledge of panels and names.</p> <p><b>Assessment:</b> oral questioning, observation</p>	4.1	B 3.2
<p>✓ <b>Key Assignment:</b> Instructor will provide three hoods made from different components. Students will analyze each hood, inspect the materials, feel/judge the weight in order to differentiate between and identify the material used to manufacture the hood.</p> <p><b>Assessment:</b> oral questioning, observation</p>	6.4	B 3.2

**Unit 2: Metal Finishing and Body Filling** **80 hours**

In the shop lab, student will develop the skills necessary to return metal to its original shape and apply plastic fillers for finishing.

- Paint removal
- Locate and identify damaged area
- Dent straightening
- Filler preparation
- Rough and finish sand
- Proper application to steel and aluminum.

**CCSS: RLST 11-12.10**  
**NGSS: SEP 1-8; ETS 1, 2**

Key Assignments	CTE Anchor Standards	CTE Pathway Standards
<p>✓ <b>Key Assignment:</b> Using a hammer and dolly, students will remove small dents from a practice panel using proper hammer on and hammer off dolly techniques and demonstrate their skill to peers and instructor for feedback and inspection.</p> <p><b>Assessment:</b> instructor visual inspection, ASE-style quiz</p>	5.0, 6.3, 6.4, 6.6, 7.4	B 1.4, B 2.0
<p>✓ <b>Key Assignment:</b> Students will remove the paint from the damaged area of a body panel using a hand-held air grinder implementing the cross-cut grinding method while keeping the metal cool and within industry standard. Students demonstrate these skills to peers and instructor for feedback and inspection.</p> <p><b>Assessment:</b> instructor visual inspection, ASE-style quiz</p>	5.0, 6.3, 6.4, 6.6, 7.4	B 1.4
<p>✓ <b>Key Assignment:</b> After cross-cut grinding and metal is clear of any imperfections on the damaged area of their body panel, students will follow manufacturer guidelines to mix plastic filler with catalyst and apply to damaged area using a plastic spreader. Students must achieve a smooth finish ready for rough sanding.</p> <p><b>Assessment:</b> self-evaluation, instructor observation, and inspection, ASE-style quiz</p>	5.0, 6.3, 6.4, 6.6, 7.4, 8.3, 8.4	B 1.4
<p>✓ <b>Key Assignment:</b> Students will block sand plastic filler on the repaired body panel using 36 and 80 grit sandpaper multiple times feeling for imperfections (high or low spots, pinholes, sand scratches) until achieving desired industry standards.</p> <p><b>Assessment:</b> self-evaluation, instructor observation and inspection, quiz, visual and touch inspection, ASE-style quiz</p>	5.0, 6.3, 6.4, 6.6, 7.4, 8.3, 8.4	B 1.4

Unit 3: Outer Body Panel Replacement and Adjustment		65 hours
<p>Students will work on cars in the lab to learn the proper procedures to remove outer body panels and replace for proper fit using industry standard tools and equipment.</p> <ul style="list-style-type: none"> <li>● Remove and replace bolt, clip and glued on body panels</li> <li>● Adjust panels for fit and proper operation</li> <li>● Bumper alignment</li> <li>● Door skin removal</li> <li>● Panel and weld bonding</li> </ul> <p><b>Standards Alignments:</b>            CCSS: LS 11-12.1; RLST 11-12.10            NGSS: SEP 1, 2, 3, 4, 5, 6, 7, 8; ETS 1, 2</p>		
Key Assignments	CTE Anchor	CTE Pathway

	Standards	Standards
<p>✓ <b>Key Assignment:</b> Using instructor-provided damaged vehicle door, students will work in teams to remove the outer door skin using various methods (grinding, cutting) and tools such as: grinder, cut-off wheel, oxy acetylene torches, vice grips, wire wheel and hammer and dolly. Students will correctly demonstrate their technique to instructor.</p> <p><b>Assessment:</b> self-evaluation, instructor observation and inspection, quiz, visual and touch inspection, peer feedback, ASE-style quiz</p>	5.0, 6.3, 6.4, 6.6, 7.4	B 2.0, B 3.0, B 4.5, B 7.0
<p>✓ <b>Key Assignment:</b> Working in pairs and using the NATEF check-off list, students will remove and install outer body panels and bumpers on a shop vehicle. Students will demonstrate their ability to adjust to proper fit and alignment, restoring vehicle to factory specifications.</p> <p><b>Assessment:</b> self-evaluation, instructor observation and inspection, quiz, visual and touch inspection, peer feedback, ASE-style quiz</p>	5.0, 6.3, 6.4, 6.6, 7.4	B 3.0, B 4.5, B 7.0

<b>Unit 4: Welding and Cutting</b>		<b>85 hours</b>
<p>Welding skills are essential for any student who wishes to enter the auto body field. Students will work in the lab on practice panels and on a variety of vehicles to perfect their welding skills.</p> <ul style="list-style-type: none"> <li>• MIG welding (continuous, stitch, plug, butt, spot)</li> <li>• Auto body panel cutting procedures</li> <li>• Various cutting operations</li> <li>• Metal preparation</li> <li>• Vertical, horizontal and upside-down welding</li> </ul> <p><b>Standards Alignments:</b>            CCSS: RLST 11-12.10            NGSS: SEP 1, 2, 3, 4, 5, 6, 7, 8; ETS 1, 2</p>		
Key Assignments	CTE Anchor Standards	CTE Pathway Standards
<p>✓ <b>Key Assignment:</b> Students will identify different types of metals and determine if they are weldable or non-welding body parts. They will demonstrate their knowledge to the instructor by accurately identifying: metal, aluminum, mild and high-strength steel.</p> <p><b>Assessment:</b> teacher observation, verbal testing, ASE-style quiz</p>	2.0, 7.0	B 2.0, B 3.0, B 7.0
<p>✓ <b>Key Assignment:</b> Students will accurately measure and cut a piece of metal from a used hood and grind the metal prepping for welding using: safety equipment, air chisel, cut-off wheel, grinder, mig welder, welding pliers, vice grips and other industry standard tools.</p> <p><b>Assessment:</b> visual inspection, teacher/student consultation, rubric, ASE-style quiz</p>	5.0, 6.3, 6.4, 7.0	B 1.4, B 2.0

<p>✓ <b>Key Assignment:</b> Students will perform the following welds: continuous, stitch, plug and butt weld. Students will also demonstrate correct technique and industry standard welds to instructor for feedback and have the opportunity to adjust as necessary until industry standards are met.</p> <p><b>Assessment:</b> visual inspection, teacher/student consultation, rubric, ASE-style quiz</p>	5.0, 6.3, 6.4, 7.0	B 1.4, B 2.0
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<b>Unit 5: Frame Inspection and Repair</b>	<b>50 hours</b>
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Students work on various vehicles in the lab to learn the basic skills necessary for frame repair. They will learn how to properly attach a car to frame rack and set up for pull.

- Diagnosis of structural damage (extent, direction, impact, indirect damage)
- Identify and inspect various types of frame damage (collapse, sag, sideway, twist, diamond)
- Identify and use proper technique to attach vehicle to frame rack
- Measurement (tram gauge, tape measure, laser measurement system)

**Standards Alignments:**  
**CCSS: RLST 11-12.10**  
**NGSS: SEP 1, 2, 3, 4, 5, 6, 7, 8; ETS 1,2**

Key Assignments	CTE Anchor Standards	CTE Pathway Standards
<p>✓ <b>Key Assignment:</b> On a damaged vehicle, students working in groups will perform visual inspections to determine the direction, point(s) of impact, and extent of direct and indirect damage. Using a diagram of an automobile, students will identify all areas of impact, and analyze and describe in writing the types of impact such as: collapse, sag, sideway, twist, and diamond.</p> <p><b>Assessment:</b> written documentation, student/teacher conference &amp; feedback, peer feedback &amp; inspection, ASE-style quiz</p>	5.0, 6.3, 6.4, 6.6, 7.4	B 2.0, B 3.0, B 4.0, B 7.0
<p>✓ <b>Key Assignment:</b> In teams of two, students will properly follow all shop procedures to safely set up a shop car on the frame rack and securely anchor the vehicle to the rack, making the vehicle ready for structural pulling of the damaged area of the vehicle.</p> <p><b>Assessment:</b> ASE style quiz, visual inspection</p>	5.0, 6.3, 6.4, 6.6, 7.4	B 2.0, B 3.0, B 7.0
<p>✓ <b>Key Assignment:</b> Using a diagram of an automobile, students will work in pairs to measure the damaged area of a shop vehicle using tram gauge, tape measure, laser measurement system</p>	5.0, 6.3, 6.4, 6.6, 7.4	B 2.0, B 3.0, B 7.0

and demonstrate their knowledge of impact to formulate, document, propose corrective action and defend their solution. <b>Assessment:</b> ASE-style quiz, written documentation, teacher observation, instructor & peer feedback		
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<b>Unit 6: Estimating</b>	<b>40 hours</b>
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Students will estimate parts, labor and cost necessary to return vehicle to pre-accident condition.

- Vehicle identification (VIN)
- Determine extent of damage
- Estimate labor, operations and appropriate estimating sequence
- Mitchell estimating system
- Electronic estimate writing
- Differences between OEM, aftermarket, used parts

**Standards Alignments:**  
**CCSS:** LS 11-12.1; **RLST** 11-12.3, 11-12.10; **WS** 11-12.4, 11-12. 6  
**NGSS:** SEP 1, 2, 3, 4, 5, 6, 7, 8; **ETS** 1, 2

Key Assignments	CTE Anchor Standards	CTE Pathway Standards
<p>✓ <b>Key Assignment:</b> Instructor will provide a damaged vehicle for students to analyze the extent and direction of damage. Students will write the customer and vehicle information including: customer name, address contact information, VIN number, manufacturer, type of vehicle, and any options to determine parts necessary to repair the damage.</p> <p><b>Assessment:</b> instructor inspection, written documentation, peer feedback, observation</p>	2.0, 4.1, 4.3, 5.0, 7.4	B 3.0, B 4.0, B 5.0, B 6.0, B 7.0
<p>✓ <b>Key Assignment:</b> Throughout the second semester, students will build upon prior knowledge and prepare multiple damage reports based on damaged shop vehicles and will utilize the Mitchell computerized estimating system to generate an estimated cost for damage repair including labor hours, parts and sales tax.</p> <p><b>Assessment:</b> instructor inspection, written documentation, peer feedback, observation</p>	2.0, 4.1, 4.3, 5.0, 7.4	B 3.0, B 4.0, B 5.0, B 6.0, B 7.0



**Unit 7: Plastic Repair** **25 hours**

Working hands-on in the lab, students will learn to repair a flexible plastic bumper using a plastic welder.

- Types of plastics
- Determine repairability
- Clean and prep surfaces
- Panel repair (rigid, semi-rigid, flexible)
- Various adhesives types and techniques

**Standards Alignments:**

CCSS: RLST 11-12.10

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

Key Assignments	CTE Anchor Standards	CTE Pathway Standards
<p>✓ <b>Key Assignment:</b> Using a float test, students will distinguish between different types of plastics and determine the proper method to undergo repair procedures. Students will defend their choices and prove their findings based on evidence.</p> <p><b>Assessment:</b> ASE-style quiz, observation</p>	6.3, 6.4, 6.6, 7.4, 10.4	B 1.4, B 2.0, B 9.1
<p>✓ <b>Key Assignment:</b> After determination of type of plastic on their section of bumper, students will use a process consisting of soap &amp; water cleansing, wax and grease removal and surface grinding (V out) to prep the surface for plastic welding repair. They will perform a visual inspection and rework the area if needed.</p> <p><b>Assessment:</b> ASE-style quiz, observation, visual inspection, self-reflection</p>	6.3, 6.4, 6.6, 7.4	B 1.4
<p>✓ <b>Key Assignment:</b> Building upon their knowledge of plastic and plastic preparation skills, students will correctly engage the plastic welder, adjust the settings, and perform plastic welds on gouges, tears and punctures to their section of a bumper in order to restore the damaged bumper to manufacturer specifications.</p> <p><b>Assessment:</b> ASE style quiz, self-reflection, peer and instructor inspection, observation</p>	6.3, 6.4, 6.6, 7.4	B 1.4

## Unit 8: Glass Repair/Replacement and Water Leak Diagnosis and Repair 25 hours

Students learn the procedures to identify a variety of water leaks in an automobile and comprehend the proper repair procedures.

- Types of glass (laminated, tempered)
- Glass removal and installation (stationary, removable)
- Identify various types of water leaks (glass, seam sealer, grommit, burn through, misalignment, loose parts)
- Water leak repair
- weather stripping
- Sunroof operation and drainage
- Cowl panel operation and drainage

### Standards Alignments:

CCSS: RLST 11-12.10

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

Key Assignments	CTE Anchor Standards	CTE Pathway Standards
<p>✓ <b>Key Assignment:</b> Students will be provided with a shop or customer door glass. Students will work in teams of 2 to remove the glass from both power and manual window regulators using hand tools, jumper battery, wire leads and various industry standard tools and then properly reinstall to manufacturer specifications using reverse procedures.</p> <p><b>Assessment:</b> ASE-style quiz, instructor inspection and observation, student demonstration</p>	6.3, 6.4, 6.6, 7.4	B 1.4, B 2.0
<p>✓ <b>Key Assignment:</b> As a class, students will assist in breaking different types of auto glass (laminated, tempered) to witness the different properties of each type of glass, interpret the safety factors involved with structural integrity and assess repair procedures for both types.</p> <p><b>Assessment:</b> ASE-style quiz, instructor inspection and observation</p>	6.3, 6.4, 6.6, 7.4	B 1.4, B 2.0
<p>✓ <b>Key Assignment:</b> On a shop or student car, while working in groups, students will check for and identify various types of water leaks (glass, seam sealer, grommit, burn through, misalignment, loose parts) using water as a visual aid, and use the process of elimination to diagnose the leak(s) and propose corrective action in written form.</p> <p><b>Assessment:</b> ASE-style quiz, instructor inspection, written documentation, peer feedback, observation</p>	6.3, 6.4, 6.6, 7.4, 9.7	B 1.4, B 2.0

**Unit 9: Customer Relations and Sales Skills** **42 hours**

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

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

**Standards Alignments:**  
**CCSS: LS 11-12.1; RLST 11-12.3, 11-12. 10; WS 11-12.4, 11-12.6**  
**NGSS: SEP 1, 2, 3, 4, 5, 6, 7, 8; ETS 1, 2**

Key Assignments	CTE Anchor Standards	CTE Pathway Standards
<p>✓ <b>Key Assignment:</b> Students will role play a customer/service provider interaction. One student will take the role of client, the other will take the role of estimator. They will demonstrate to class the proper customer relations including greeting, appearance, attitude and addressing client concerns, needs and expectations. Students will provide an explanation of repair procedures and timelines, acquire customer consent for vehicle repair and demonstrate proper sales strategies.</p> <p><b>Assessment:</b> peer and instructor feedback, observation</p>	2.2, 2.4, 5.4, 7.7	B 6.0
<p>✓ <b>Key Assignment:</b> Students will role play a customer/service provider interaction where the customer becomes upset. One student will take the role of client, the other will take the role of estimator. They will demonstrate to the class the proper way to handle the situation in a mature and professional manner. Peers will critique and offer suggestions.</p> <p><b>Assessment:</b> peer and instructor feedback, observation, critique, oral questioning</p>	2.2, 2.4, 5.4, 7.7, 9.6, 9.7	B 6.0

**Instructional Materials**

<b>Textbooks</b>	<b>Electronic Media/Supplemental Print Materials/Online Resources</b>
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**Autobody Repair Technology** 6<sup>th</sup> edition  
James E Duffy – Delmar Learning© 2016  
ISBN: 978-1133702856

- 3Mcollision.com
- Online Safety Training S/P2
- Mitchell Estimating System

## Standards Assessed in this Course

### CTE Anchor Standards

- 1.0 Academics: Academics standards are aligned to pathways; see below.
- 2.0 Communications: Acquire and use accurately sector terminology and protocols at the career and college readiness level for communicating effectively in oral, written, and multimedia formats.
- 3.0 Career Planning and Management: Integrate multiple sources of career information from diverse formats to make informed career decisions, solve problems, and manage personal career plans.
- 4.0 Technology: Use existing and emerging technology, to investigate, research, and produce products and services, including new information, as required in the sector workplace environment.
- 5.0 Problem Solving and Critical Thinking: Conduct short, as well as more sustained, research to create alternative solutions to answer a question or solve a problem unique to the sector using critical and creative thinking, logical reasoning, analysis, inquiry, and problem-solving techniques.
- 6.0 Health and Safety: Demonstrate health and safety procedures, regulations, and personal health practices and determine the meaning of symbols, key terms, and domain-specific words and phrases as related to the sector workplace environment.
- 7.0 Responsibility and Flexibility: Initiate, and participate in, a range of collaborations demonstrating behaviors that reflect personal and professional responsibility, flexibility, and respect in the sector workplace environment and community settings.
- 8.0 Ethics and Legal Responsibilities: Practice professional, ethical, and legal behavior, responding thoughtfully to diverse perspectives and resolving contradictions when possible, consistent with applicable laws, regulations, and organizational norms.
- 9.0 Leadership and Teamwork: Work with peers to promote divergent and creative perspectives, effective leadership, group dynamics, team and individual decision making, benefits of workforce diversity, and conflict resolution.
- 10.0 Technical Knowledge and Skills: Apply essential technical knowledge and skills common to all pathways in the sector following procedures when carrying out experiments or performing technical tasks.
- 11.0 Demonstration and Application: Demonstrate and apply the knowledge and skills contained in the Information and Communication Technologies anchor standards, pathway standards, and performance indicators in classroom, laboratory, and workplace settings, and through career technical student organizations such as Future Business Leaders of America and SkillsUSA.

### Transportation Sector — Structural Repair and Refinishing Pathway Standards

**B 1.0** **Students understand the value and necessity of practicing personal and occupational safety and the environmental effects of collision repair and refinishing practices:**

- B 1.1 Understand industry environmental conservation practices and their applications.
- B 1.2 Practice the safe handling and storage of chemicals and hazardous wastes as required by the Occupational Safety and Health Administration, Air Resources Board, Air Quality Management Districts, and other regulatory agencies.
- B 1.3 Understand the generation of waste products and other environmentally destructive substances.
- B 1.4 Use appropriate materials and repair technologies.
- B 1.5 Understand the environmental implications of using new and emerging materials, resources, and technologies.
- B 1.6 Understand the safety practices applied when servicing vehicle-body electronics and other vehicle systems.

**B 2.0** **Students understand the safe and appropriate use of tools, equipment, and work processes:**

- B 2.1 Understand how certain tools and equipment are used to perform maintenance and repair operations.
- B 2.2 Use tools, equipment, and machines to safely measure, test, diagnose, and analyze components and systems (e.g., electrical and electronic circuits, alternating and direct-current applications, fluid/hydraulic and air/pneumatic systems).

**B 3.0** **Students understand and apply measurement systems and the mathematical functions necessary to perform required fabrication, maintenance, and operation procedures:**

- B 3.1 Understand industry-standard measurement scales, devices, and systems used to perform design, fabrication, diagnostic, maintenance, and repair procedures.
- B 3.2 Use technical vocabulary, technical reports and manuals, electronic systems, and related technical data resources, as appropriate, to determine repairs and estimates.
- B 3.3 Understand the different types of welding and heat processes used in repair processes and procedures.
- B 3.4 Understand the mathematical functions associated with collision repair and refinishing.

**B 4.0** **Students understand scientific principles in relation to chemical, mechanical, and physical functions and in relation to industry and manufacturer standards:**

- B 4.1 Understand the principles of mechanical, electrical, hydraulic, and pneumatic power in relation to collision repair and refinishing.
- B 4.2 Understand the physical and chemical characteristics of metals, plastics, and other materials.
- B 4.3 Understand the principles of electricity and electronics.
- B 4.4 Know the basic terms, characteristics, and concepts of physical and chemical processes.
- B 4.5 Understand body and frame construction.

**Transportation Sector — Structural Repair and Refinishing Pathway Standards:**

**B 9.0** **Students understand and demonstrate concepts, principles and practices of painting and finishing:**

- B 9.3 Understand the operation of spray guns and related equipment.
- B 9.4 Know how to mix, match, and apply paint.
- B 9.5 Understand the causes and cures of paint defects.
- B 9.6 Understand how to prepare vehicles for final detail.

**Common Core State Standards**

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

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

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

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

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

**Next Generation Science Standards**

**Scientific and Engineering Practices – SEP**

- SEP 1 Asking questions (for science) and defining problems (for engineering)
- SEP 2 Developing and using models
- SEP 3 Planning and carrying out investigations
- SEP 4 Analyzing and interpreting data
- SEP 5 Using mathematics and computational thinking
- SEP 6 Constructing explanations (for science) and designing solutions (for engineering)
- SEP 7 Engaging in argument from evidence
- SEP 8 Obtaining, evaluating, and communicating information

**Engineering, Technology, and the Applications of Science – ETS**

- ETS 1: Engineering Design
- ETS 1.A: Defining and Delimiting an Engineering Problem
- ETS 1.B: Developing Possible Solutions
- ETS 1.E: Optimizing the Design Solution
- ETS 2: Links Among Engineering, Technology, Science, and Society
- ETS 2.A: Interdependence of Science, Engineering, and Technology
- ETS 2.B: Influence of Engineering, Technology, and Science on Society and the Natural World