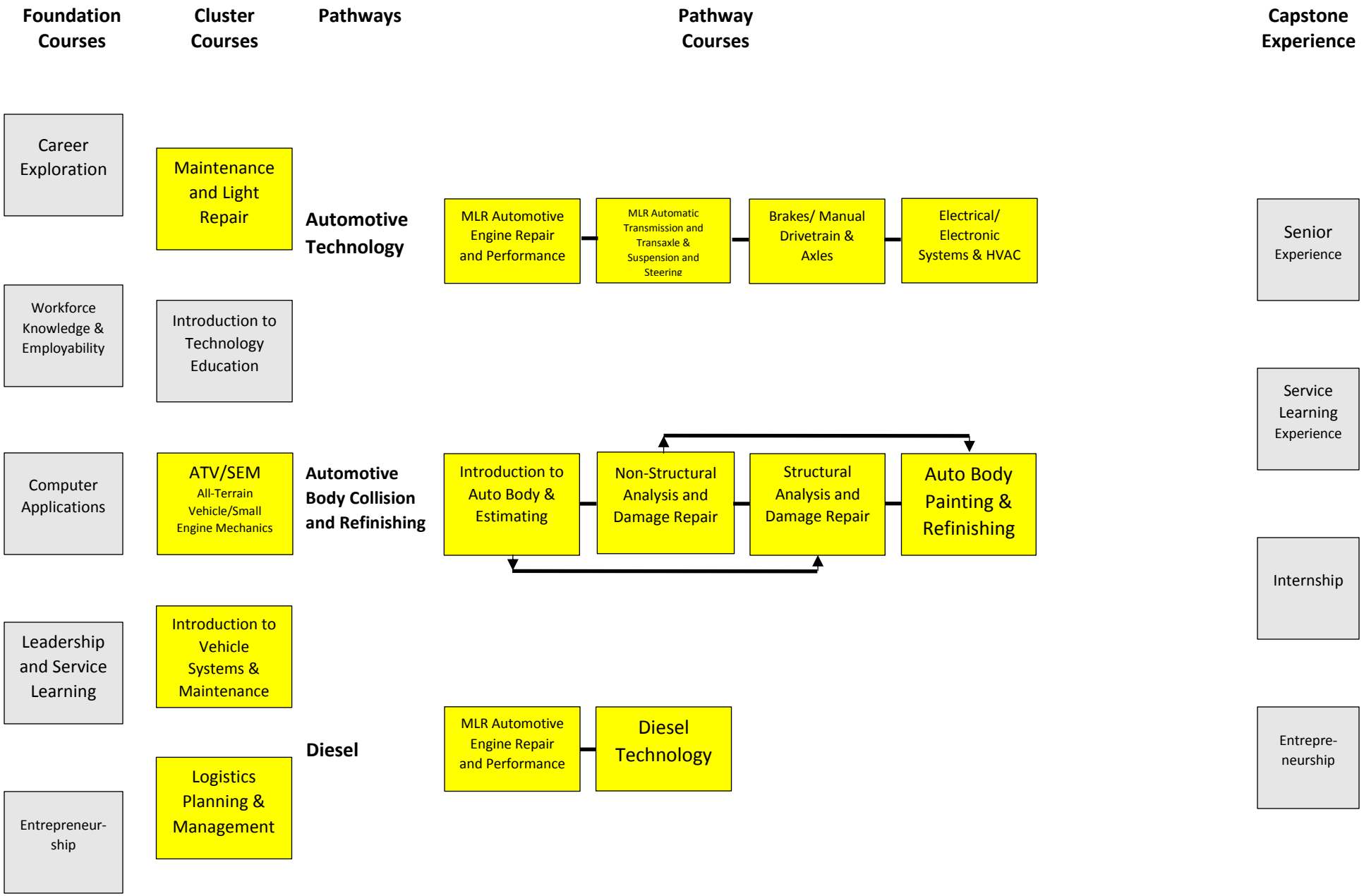
Transportation, Distribution & Logistics Programs of Study



ATV/SEM (All-Terrain Vehicle/Small Engine Mechanics)

Career Cluster	Transportation, Distribution & Logistics
Course Code	20109
Prerequisite(s)	None
Credit	.5
Program of Study and Sequence	Any Foundation course – ATV/SEM – Any pathway course - Capstone
Student Organization	SkillsUSA
Coordinating Work-Based Learning	Job Shadow
Industry Certifications	NA
Dual Credit or Dual Enrollment	NA
Teacher Certification	Transportation, Distribution & Logistics Cluster Endorsement; Automotive Technology Pathway Endorsement *Automotive Technology ; *7-12 Technology Education
Resources	

Course Description:

ATV/SEM is an introductory course on the small gas engine. The student will study the various small engine types, parts identification, and engine operation. Students will tear down a small gas engine. In order to have a properly running engine, students will inspect, reassemble and trouble shoot. Student evaluation is performance based.

Program of Study Application

ATV/SEM is a cluster course within the Transportation, Distribution and Logistics career cluster.

Course Standards

SEM 1 Students will demonstrate shop and tool safety.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 1 Recall & Reproduction	SEM 1.1 Examine basic shop safety using Occupational Safety Health Administration (OSHA) standards Examples: • Locate Fire extinguisher/ Fire Blankets/Exits • Never have an open flame near flammable liquids • Do not refuel engine while in operation • Demonstrate proper start up and shutoff procedures (be aware of surroundings when pull-starting small gas engine (SGE)) • Eye and hearing protection • Clothing and shoe protection	OSHA 10 Briggs & Stratton http://www.instructorscorner.org
Level2 Skill\Concept	SEM 1.2 Demonstrate proper use of hand and power tools Examples: • General tool test (Name and function of tool being used, proper use of each tool, care and storage) • Review Torque wrench settings and usage • Spark test tools (Use appropriate spark tester to check spark)	Briggs & Stratton
Level2 Skill\Concept	SEM 1.3 Summarize the proper use of Safety Data Sheets (SDS) Examples: • Handling and storage of related liquids to SGE (Small Gas Engine) • Firefighting measures • Hazards identification	SDS SHEET OSHA
Level 3 Strategic Thinking	SEM 1.4 Create safety portfolio Examples: • Maintain records of written safety examinations • Maintain records of equipment examinations for which the student has passed an operational checkout • OSHA 10 certification • Review SDS	

Notes

SEM 2 Students will demonstrate independent and teamwork skills as well as explore career opportunities within the industry.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 3 Strategic Thinking	SEM 2.1 Participate in leadership activities Example: • CTSO's (Career and Technical Student Organizations)	SkillsUSA
Level 4 Extended Thinking	SEM 2.2 Utilize guidance software to research and report on career opportunities	SDMyLife
Level 3 Strategic Thinking	SEM 2.3 Develop a teamwork project Example: • Tear down/Rebuild procedures	

Notes

SEM 3 Students will properly prepare customer documentation.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 3 Strategic Thinking	SEM 2.1 Complete work order form Examples: • Utilize appropriate parts identification media • Communicate with customer and/or supervisor to determine service requested • Maintain work order records to account for parts and labor	http://parts.sepw.com/?gclid=CKT_qt75q9QCFUVWDQodYpEIaw
Level 3 Strategic Thinking	SEM 2.2 Prepare customer bill/receipt Examples: • Write a service order • Identify work performed on work orders • Calculate labor cost using a flat rate manual	http://parts.sepw.com/?gclid=CKT_qt75q9QCFUVWDQodYpEIaw

Notes

SEM 4 Students will apply communication, mathematics and science knowledge and skills to ATV/SEM.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 3 Strategic Thinking	SEM 4.1 Examine how physics concepts apply to small engine technology Example: • Student will determine horsepower of any small engine using HP=W/(T*33,000). HP = Horse power, W = Work, T = Time	Briggs & Stratton
Level 3 Strategic Thinking	SEM 4.2 Explore the application of fundamental laws of hydraulics Examples: • Student will demonstrate the principle that fluids cannot be compressed by building a basic hydraulic cylinder/motor device on a test bench.	
Level 3 Strategic Thinking	SEM 4.3 Perform mathematical calculations and measurements commonly used in small engines Examples: • Student will calculate displacement of any given engine based on the equation d=c*b2s c-constant 0.7584, b-bore, s-stroke, d-displacement • The amount of work can be found with the equation w=f*d where w=work in lb/ft (ftlb), f=force in pounds, d=distance	
Level 3 Strategic Thinking	SEM 4.4 Communicate findings as related to mathematics and science knowledge and skills to diagnosis problems in small engines Examples: • Students will complete a written report given the findings of any lab activity (e.g. low horse power due to poor air exchange).	

Notes

SEM 5 Students will troubleshoot a small engine.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 4 Extended Thinking	SEM 5.1 Implement strategic diagnostic procedures Examples: • Apply small engine trouble shooting procedures • Diagnose and determine needed repair on small engine components • Determine wear on internal engine parts using specialized tools	Briggs & Stratton
Leve l2 Skill\Concept	SEM 5.2 Conduct preventative maintenance on a small engine Examples: • Change oil and filter on small engine • Inspect and change air filter • Disassemble, clean, and inspect fuel pump • Disassemble, clean, and inspect carburetor	

Notes

SEM 6 Students will properly test, diagnose, service, and repair charging and electrical systems related to small engines.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 3 Strategic Thinking	SEM 6.1 Illustrate the application of Ohm's law to charging and electrical systems related to small engines Examples: • Complete the start amp draw test on a small engine with an electric start system. • Compute amperage use of any circuit by using the equation amps=volts/ohms	Briggs & Stratton
Level2 Skill\Concept	SEM 6.2 Interpret schematics, diagrams, and reference information used in small engine electrical systems Examples: • Troubleshoot the charging circuit using a manufacturer's guide • Read a multimeter	
Level 3 Strategic Thinking	SEM 6.3 Use strategy-based diagnostics for determining the cause of a fault in an electrical circuit Examples: • Test, diagnose, and service batteries and charging systems • Test, diagnose, and service light systems • Demonstrate the use of equipment and tools for electrical testing and diagnosis • Troubleshoot and repair starting circuit	

Notes

SEM 7 Students will properly test, diagnose, service and repair fuel delivery systems as related to small engine technology.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 3 Strategic Thinking	SEM 7.1 Analyze the functions and operations of a fuel system related to small engine technology Examples: • Complete fuel pressure test of system utilizing a fuel pump. • Set carburetor float height. • Adjust both low and high idle circuits on carburetor engines • Complete fuel injector function test on fuel injected engines.	Briggs & Stratton
Level 3 Strategic Thinking	SEM 7.2 Diagnose fuel system problem Examples: • Test and determine needed repair on fuel system • Inspect and determine needed repair on air cleaner system	
Level 3 Strategic Thinking	SEM 7.3 Perform fuel system service Examples: • Remove and replace the fuel tank, fuel lines and fuel filter system • Service oil-bath or foam type air cleaner • Reassemble and adjust a carburetor • Reassemble and install fuel pump	

Notes

SEM 8 Students will properly test, diagnose, service and repair emission systems related to small engine technology.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 4 Extended Thinking	SEM 8.1 Analyze the function and operation of emission systems related to small engines Examples: • Research EPA emissions standards and requirements, and write a report on how those laws affect the small engine service industry.	Briggs & Stratton
Level 4 Extended Thinking	SEM 8.2 Diagnose emission systems relating to small engine technology Examples: • Use an exhaust gas analyzer to determine the amount of HC and NOx emissions contained in the exhaust from a small engine and determine repair strategies. • Complete electrical/electronic testing of manifold absolute pressure (MAP) sensor, O_2 (Oxygen) or throttle position sensor and determine whether repair or replacement of parts is needed.	
Level 3 Strategic Thinking	SEM 8.3 Perform emission system service on small engine Examples: • Replace a MAP sensor. • Replace a fuel pressure sensor. • Demonstrate or observe a fuel map in electronic format	

Notes

Brakes/Manual Drivetrain & Axles

Career Cluster	Transportation, Distribution & Logistics
Course Code	20122
Prerequisite(s)	Introduction to Vehicle Systems and Maintenance or Maintenance and Light Repair - Recommended
Credit	1
Program of Study and Sequence	Foundational courses – Introduction to Vehicle Systems and Maintenance or Maintenance and Light Repair – **Brakes/Manual Drivetrain & Axles** – Capstone Experience
Student Organization	Skills USA
Coordinating Work-Based Learning	NA
Industry Certifications	Automotive Service Excellence (ASE) Student Certification
Dual Credit or Dual Enrollment	NA
Teacher Certification	Transportation, Distribution & Logistics Cluster Endorsement; Autobody Technology Pathway Endorsement; *Autobody Technology
Resources	

Course Description: Students in this course will learn theory and operation as well as diagnosis and repair of brake systems and manual drive trains. Completion of this course will aid students as they continue their education at the post-secondary level or in the workforce and in the preparation for their ASE certification test. (The examples are NATEF (National Automobile Technician Education Foundation) tasks that the student may complete for ASE (Automotive Service Excellence) certification.)

Program of Study Application

Brakes/Manual Drivetrain & Axles is an advanced pathway course in the transportation, distribution and logistics career cluster, automotive technology pathway.

Course Standards

AB 1 Students will demonstrate automotive technology safety practices, including Occupational Safety and Health Administration (OSHA) and Environmental Protection Agency (EPA) requirements, for an automotive repair facility.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skills/ Concepts	AB 1.1 Demonstrate automotive technician safety practices. • Use protective clothing and safety equipment according to OSHA and EPA requirements. • Summarize the proper use of Safety Data Sheet (SDS) • Demonstrate the proper use of hand and power tools • Examine basic shop safety using OSHA standards. • Maintain a portfolio of successfully completed safety and equipment exams	• NATEF tasks that apply to sub-indicators • OSHA 10 • "Right to Know" Federal Law • EPA

Notes

AB 2 Students will demonstrate knowledge of brake system theory and procedure.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	AB 2.1 Analyze and diagnose automotive brake hydraulic and friction systems. Examples: • Identify and interpret brake system concerns; determine needed action. P-1 • Research vehicle service information including fluid type, vehicle service history, service precautions, and technical service bulletins. P-1 • Describe procedure for performing a road test to check brake system operation including an anti-lock brake system (ABS). P-1 • Identify brake system components and configuration. P-1	• NATEF tasks that apply to sub-indicators

Notes: P-1, P-2, P-3 refers to levels of difficulty under NATEF tasks (P-1 lowest)

AB 3 Students will demonstrate knowledge and procedure of the hydraulic brake system.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 3: Strategic Thinking	AB 3.1 Analyze and draw conclusions concerning malfunctions of brake hydraulic systems. Examples: • Diagnose pressure concerns in the brake system using hydraulic principles (Pascal's Law). P-1 • Check master cylinder for internal/external leaks and proper operation; determine needed action. P-1 • Identify components of hydraulic brake warning light system. P-2 • Diagnose poor stopping, pulling or dragging concerns caused by malfunctions in the hydraulic system; determine needed action. P-3	• NATEF tasks that apply to sub-indicators
Level 2: Skills/ Concepts	AB 3.2 Apply repair skills to correct malfunctions of brake hydraulic systems. Examples: • Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging, wear, and loose fittings/supports; determine needed action. P-1 • Remove, bench bleed, and reinstall master cylinder. P-1 • Replace brake lines, hoses, fittings, and supports. P-2 • Fabricate brake lines using proper material and flaring procedures (double flare and ISO types). P-2 • Select, handle, store, and fill brake fluids to proper level; use proper fluid type per manufacturer specification. P-1 • Inspect, test, and/or replace components of brake warning light system. P-3 • Bleed and/or flush brake system. P-1 • Test brake fluid for contamination. P-1 • Measure brake pedal height, travel, and free play (as applicable); determine needed action. P-1	• NATEF tasks that apply to sub-indicators

Notes

AB 4 Students will demonstrate knowledge of theory and repair procedures for drum brake systems.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 3: Strategic Thinking	AB 4.1 Assess and evaluate operation of drum brake systems. Examples: • Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging or pedal pulsation concerns; determine needed action. P-1	• NATEF tasks that apply to sub-indicators
Level 2: Skills/ Concepts	AB 4.2 Repair drum brake systems. Examples: • Remove, clean, and inspect brake drum; measure brake drum diameter; determine serviceability. P-1 • Refinish brake drum and measure final drum diameter; compare with manufacturer's specification. P-1 • Remove, clean, inspect, and/or replace brake shoes, springs, pins, clips, levers, adjusters/self-adjusters, other related brake hardware, and backing support plates; lubricate and reassemble. P-1 • Inspect wheel cylinders for leaks and proper operation; remove and replace as needed. P-2 • Pre-adjust brake shoes and parking brake; install brake drums or drum/hub assemblies and wheel bearings; perform final checks and adjustments. P-1	• NATEF tasks that apply to sub-indicators

Notes

AB 5 Students will demonstrate knowledge of theory and repair procedures for disc brake systems.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 3: Strategic Thinking	AB 5.1 Assess and evaluate operation of disc brake systems. Examples: • Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging, or pulsation concerns; determine needed action. P-1 • Inspect caliper mounting and slides/pins for proper operation, wear, and damage; determine needed action. P-1 • Describe importance of operating vehicle to burnish/break-in replacement brake pads according to manufacturer's recommendations. P-1	• NATEF tasks that apply to sub-indicators
Level 2: Skills/ Concepts	AB 5.2 Repair disc brake systems. • Remove, inspect, and/or replace brake pads and retaining hardware; determine needed action. P-1 • Lubricate and reinstall caliper, brake pads, and related hardware; seat brake pads; inspect for leaks. P-1 • Clean and inspect rotor and mounting surface; measure rotor thickness, thickness variation, and lateral runout; determine needed action. P-1 • Remove and reinstall/replace rotor. P-1 • Refinish rotor on vehicle; measure final rotor thickness and compare with specification. P-1 • Refinish rotor off vehicle; measure final rotor thickness and compare with specification. P-1 • Retract and re-adjust caliper piston on an integrated parking brake system. P-2 • Check brake pad wear indicator; determine needed action. P-1 • Remove and clean caliper assembly; inspect for leaks, damage, and wear; determine needed action. P-1	• NATEF tasks that apply to sub-indicators

Notes

AB 6 Students will demonstrate knowledge of theory and repair procedures for power assist units.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	AB 6.1 Analyze power-assist units. Examples: • Check brake pedal travel with and without engine running to verify proper power booster operation. P-2 • Identify components of the brake power assist system (vacuum and hydraulic); check vacuum supply (manifold or auxiliary pump) to vacuum-type power booster. P-1	• NATEF tasks that apply to sub-indicators

Notes

AB 7 Students will demonstrate knowledge of theory and repair procedures for related systems – Wheel Bearings, Parking Brakes, Electrical

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skills/ Concepts	AB 7.1 Diagnose related systems (i.e., wheel bearings, parking brakes, electrical). Examples: • Diagnose wheel bearing noises, wheel shimmy, and vibration concerns; determine needed action. P-2 • Check parking brake system components for wear, binding, and corrosion; clean, lubricate, adjust and/or replace as needed. P-1 • Check parking brake operation and parking brake indicator light system operation; determine needed action. P-1 • Check operation of brake stop light system. P-1	• NATEF tasks that apply to sub-indicators
Level 2: Skills/ Concepts	AB 7.2 Repair related systems Examples: • Replace wheel bearing and race. P-3 • Inspect and replace wheel studs. P-1 • Remove, reinstall, and/or replace sealed wheel bearing assembly. P-1 • Remove, clean, inspect, repack, and install wheel bearings; replace seals; install hub and adjust bearings. P-2	• NATEF tasks that apply to sub-indicators

Notes

AB 8 Students will demonstrate knowledge of theory and repair procedures for related systems – Antilock Brake Systems (ABS), Traction Control Systems (TCS), Electronic Stability Control (ESC).

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skills/ Concepts	AB 8.1 Diagnose Electronic Brake Control Systems: ABS, TCS and ESC Systems Examples: • Identify and inspect electronic brake control system components (ABS, TCS, ESC); determine needed action. P-1 • 2. Describe the operation of a regenerative braking system. P-3	• NATEF tasks that apply to sub-indicators

Notes

AB 9 Students will demonstrate knowledge of theory and repair procedures for manual drive train and axles.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 1: Recall and Reproduction	AB 9.1 Identify manual transmission information Examples: • Research vehicle service information including fluid type, vehicle service history, service precautions, and technical service bulletins. P-1 • Identify manual drive train and axle components and configuration. P-1	• NATEF tasks that apply to sub-indicators
Level 2: Skills/ Concepts	AB 9.2 Perform general maintenance procedures Examples: • Drain and refill manual transmission/transaxle and final drive unit; use proper fluid type per manufacturer's specification. P-1 • Check fluid condition; check for leaks. P-2	• NATEF tasks that apply to sub-indicators

Notes

AB 10 Students will perform maintenance procedures for hydraulic clutches.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skills/ Concepts	AB 10.1 Check clutch hydraulic system. Examples: • Check and adjust clutch master cylinder fluid level; use proper fluid type per manufacturer specification. P-1 • Check for hydraulic system leaks. P-1	• NATEF tasks that apply to sub-indicators

Notes

AB 11 Students will define the operation of electronic manual transmission/transaxle.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 1: Recall and Reproduction	AB 11.1 Research Manual Transmission/Transaxle. Example: • Describe the operational characteristics of an electronically-controlled manual transmission/transaxle. P-2	• NATEF tasks that apply to sub-indicators

Notes

AB 12 Students will inspect, diagnose, and perform repair procedures for drive train components.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skills/ Concepts	AB 12.1 Inspect, diagnose, and repair drive shaft, half shafts, universal joints and constant-velocity (CV) joints Examples: • Inspect, remove, and/or replace bearings, hubs, and seals. P-2 • Inspect, service, and/or replace shafts, yokes, boots, and universal/CV joints. P-2 • Inspect locking hubs. P-3 • Check for leaks at drive assembly and transfer case seals; check vents; check fluid level; use proper fluid type per manufacturer specification. P-2	• NATEF tasks that apply to sub-indicators

Notes

AB 13 Students will inspect, diagnose, and perform repair procedures for the differential assembly.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skills/ Concepts	AB 13.1 Perform maintenance on differential case assembly Examples: • Clean and inspect differential case; check for leaks; inspect housing vent. P-1 • Check and adjust differential case fluid level; use proper fluid type per manufacturer's specification. P-1 • Drain and refill differential housing. P-1 • Inspect and replace drive axle wheel studs. P-1	• NATEF tasks that apply to sub-indicators

Notes:

MLR Automotive Engine Repair and Performance

Career Cluster	Transportation, Distribution & Logistics
Course Code	20121
Prerequisite(s)	Introduction to Vehicle Systems and Maintenance or Maintenance and Light Repair - Recommended
Credit	1
Program of Study and Sequence	Foundational courses – Introduction to Vehicle Systems and Maintenance or Maintenance and Light Repair – **Automotive Engine Repair and Performance** – Capstone Experience
Student Organization	SkillsUSA
Coordinating Work-Based Learning	NA
Industry Certifications	NA
Dual Credit or Dual Enrollment	NA
Teacher Certification	Transportation, Distribution & Logistics Cluster Endorsement; Autobody Technology Pathway Endorsement; *Autobody Technology
Resources	

Course Description:
Completion of Automotive Engine Repair and Performance will help students prepare for post-secondary education and training. This course will further the students' technical education experience and help prepare them for the workforce.
Students will learn:

- How to work safely on the vehicle in a workshop situation.
- Engine operation based on the six operating systems: lubrication, cooling, fuel, ignition, air induction and exhaust systems.
- General engine maintenance to include valve train, lubrication and cooling system.
- General engine performance to include computerized controls, fuel, air induction, exhaust systems and emissions control systems.

Course Standards

EPER 1: Students will demonstrate automotive technology safety practices, as identified in Occupational Safety and Health Administration (OSHA) and Environmental Protection Agency (EPA) requirements for an automotive repair facility.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 1: Recall and Reproduction	EPER 1.1 Demonstrate automotive technology safety practices. Examples: • Identify general shop safety rules and procedures. • Identify and use proper procedures for safe jack and lift operations. • Utilize proper ventilation procedures for working within the lab/shop area. • Identify the location and the types of fire extinguishers and other fire safety equipment. • Identify the location and use of eye wash stations. • Identify the location of posted evacuation routes. • Locate and demonstrate knowledge of Safety Data Sheets (SDS).	• NATEF tasks that apply to sub-indicators • OSHA 10 • "Right to Know" Federal Law • EPA

Notes

EPER 2: **Students will demonstrate proper tool selection and usage.**

Webb Level	*Sub-indicator*	*Integrated Content*
Level 1: Recall and Reproduction	EPER 2.1. Demonstrate proper tool selection and usage. Examples: • Identify tools and their usage in automotive applications. • Identify standard and metric designation. • Demonstrate safe handling and use of appropriate tools. • Demonstrate proper cleaning, storage, and maintenance of tools and equipment. • Demonstrate proper use of precision measuring tools (e.g. micrometer, dial-indicator, dial-caliper).	

Notes

EPER 3: Students will prepare the vehicle for service.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	EPER 3.1 Perform preparatory procedures for vehicle service. Examples: • Identify information needed and the service requested on a repair order. P-1 • Identify purpose and demonstrate proper use of fender covers, mats. • Demonstrate use of the three C's: concern, cause, and correction. • Review vehicle service history. P-1 • Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. P-1	• NATEF tasks that apply to sub-indicators

Notes: P-1, P-2, P-3 refers to levels of difficulty under NATEF tasks (P-1 lowest)

EPER 4. Students will perform engine repair.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2 Skill/Concept	EPER 4.1 Perform engine maintenance operations. Examples: • Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins. P-1 • Verify operation of the instrument panel engine warning indicators. P-1 • Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action. P-1 • Install engine covers using gaskets, seals, and sealers as required. P-1 • Verify engine mechanical timing. P-2 • Perform common fastener and thread repair, to include: remove broken bolt, restore internal and external threads, and repair internal threads with thread insert. P-1 • Identify service precautions related to service of the internal combustion engine of a hybrid vehicle. P-1	• NATEF tasks that apply to sub-indicators
Level 2: Skill/Concept	EPER 4.2 Understand component operation and perform maintenance on cylinder head and valve train. Examples: • Adjust valves (mechanical or hydraulic lifters). P-2 • Identify components of the cylinder head and valve train. P-1	• NATEF tasks that apply to sub-indicators

Level 2: Skill/Concept	EPER 4.3 Test, inspect and perform maintenance on the lubrication and cooling system. Examples: • Perform cooling system pressure and dye tests to identify leaks; check coolant condition and level; inspect and test radiator, pressure cap, coolant recovery tank, heater core, and galley plugs; determine necessary action. P-1 • Inspect, replace, and/or adjust drive belts, tensioners, and pulleys; check pulley and belt alignment. P-1 • Remove, inspect, and replace thermostat and gasket/seal. P-1 • Inspect and test coolant; drain and recover coolant; flush and refill cooling system; use proper fluid type per manufacturer specification; bleed air as required. P-1 • Perform engine oil and filter change; use proper fluid type per manufacturer specification; reset maintenance reminder as required. P-1 • Identify components of the lubrication and cooling systems. P-1	• NATEF tasks that apply to sub-indicators

Notes

EPER 5. Students will test, diagnose, and repair engine performance issues.

Webb level	Sub-indicator	Integrated Content
Level 3: Strategic Thinking	EPER 5.1. Perform engine diagnostics and analyze retrieved data. Examples: • Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins. P-1 • Perform engine absolute manifold pressure tests (vacuum/boost); document results. P-2 • Perform cylinder power balance test; document results. P-2 • Perform cylinder cranking and running compression tests; document results. P-2 • Perform cylinder leakage test; document results. P-2 • Verify engine operating temperature. P-1 • Remove and replace spark plugs; inspect secondary ignition components for wear and damage. P-1	• NATEF tasks that apply to sub-indicators
Level 3: Strategic Thinking	EPER 5.2. Test the computerized controls and analyze retrieved data. Examples: • Retrieve and record diagnostic trouble codes (DTC), On-board Diagnostic (OBD) monitor status, and freeze frame data; clear codes when applicable. P-1 • Describe the use of the OBD monitors for repair verification. P-1	• NATEF tasks that apply to sub-indicators
Level 2: Skill/Concept	EPER 5.3. Perform maintenance on the fuel, air Induction, and exhaust systems Examples: • Replace fuel filter(s) where applicable. P-2 • Inspect, service, or replace air filters, filter housings, and intake duct work. P-1 • Inspect integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shields; determine necessary action. P-1 • Inspect condition of exhaust system hangers, brackets, clamps, and heat shields; determine necessary action. P-1 • Check and refill diesel exhaust fluid (DEF). P-2	• NATEF tasks that apply to sub-indicators

Level 2: Skill/Concept	EPER 5.4. Perform maintenance operations on emissions control system. Examples: • Inspect, test, and service Positive Crankcase Ventilation (PCV) filter/breather, valve, tubes, orifices, and hoses; perform necessary action. P-2	• NATEF tasks that apply to sub-indicators

Notes

Auto Body Painting and Refinishing

Career Cluster	Transportation, Distribution & Logistics
Course Code	20116
Prerequisite(s)	Intro to Auto body and Estimating
Credit	1
Program of Study and Sequence	Auto Body Structural Analysis – **Auto Body Painting and Refinishing** – Senior Capstone
Student Organization	SkillsUSA
Coordinating Work-Based Learning	Youth Internships, Industry Guest Speakers and Industry Tours
Industry Certifications	Automotive Service Excellence-ASE
Dual Credit or Dual Enrollment	NA
Teacher Certification	Transportation, Distribution & Logistics Cluster Endorsement; Autobody Technology Pathway Endorsement; *Autobody Technology
Resources	

Course Description: Students will perform basic paint applications and final inspections. Students will comply with personal and environmental safety practices associated with clothing and the use of gloves; respiratory protection; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemical/material in accordance with local, state, and federal safety and environmental regulations.

Program of Study Application

Auto Body Painting and Refinishing is an advanced pathway course in the transportation, distribution and logistics career cluster, automotive body collision and refinishing pathway.

Course Standards

PFR 1 Auto body students understand painting and refinishing safety precautions.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	PFR 1.1 Demonstrate auto body painting and refinishing safety practices Examples: • Select and use proper personal safety equipment; take necessary precautions with hazardous operations and materials according to federal, state, and local regulations. HP-I • Identify safety and personal health hazards according to Occupational Safety and Health Administration (OSHA) guidelines and the "Right to Know Law." HP-I • Inspect spray environment and equipment to ensure compliance with federal, state and local regulations, and for safety and cleanliness hazards. HP-I • Select and use a National Institute of Occupational Safety and Health (NIOSH) approved air purifying respirator. Inspect condition and ensure fit and operation. Perform proper maintenance in accordance with OSHA Regulation 1910.134 and applicable state and local regulation. HP-I • Select and use the proper personal safety equipment for surface preparation, spray gun and related equipment operation, paint mixing, matching and application paint defects, and detailing (gloves, suits, hoods, eye and ear protection, etc.). HP-I	• NATEF tasks that pertain to safety. • OSHA 10 • "Right to Know" Federal Law • OSHA 1910.134 addresses respiratory safety and maintenance

Notes: HP-I – High Priority Individual and HP-G – High Priority Group

PFR 2 Students will understand surface preparation procedures.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	PFR 2.1 Analyze areas for surface preparation Examples: • Inspect and identify type of finish, surface condition and film thickness; develop and document a plan for refinishing using a total product system. HP-G • Identify a complimentary color or shade of undercoat to improve coverage. HP-G • Identify types of rigid, semi-rigid or flexible plastic parts to be refinished; determine the materials needed, preparation and refinishing procedures. HP-I • Identify metal parts to be refinished; determine material needed, preparation, and refinishing procedures. HP-I	• NATEF tasks that apply to sub-indicator.
Level 2: Skill/Concept	PFR 2.2 Prepare automotive surface to be refinished Examples: • Soap and water wash entire vehicle; use appropriate cleaner to remove contaminants. HP-I • Inspect and identify type of finish, surface condition, and film thickness; develop and document a plan for refinishing using a total product system. HP-G • Remove paint finish as needed. HP-I • Dry- or wet-sand areas to be refinished. HP-I • Featheredge areas to be refinished. HP-I • Apply suitable metal treatment or primer in accordance with total paint product systems. HP-I • Mask and protect areas that will not be refinished. HP-I • Demonstrate different masking techniques (recess/back masking, foam door type, etc.). HP-G • Mix primer, primer-surfacer and primer-sealer. HP-I • Identify a complimentary color or shade of undercoat to improve coverage. HP-G • Apply primer onto surface of repaired area. HP-I • Apply two-component finishing filler to minor surface imperfections.	• NATEF tasks that apply to sub-indicator

	HP-I • Block sand area to which primer-surfacer has been applied. HP-I • Dry-sand area to which finishing filler has been applied. HP-I • Remove dust from area to be refinished, including cracks or moldings on adjacent areas. HP-I • Clean area to be refinished using a final cleaning solution. HP-I • Remove, with a tack rag, any dust or lint particles from the area to be refinished. HP-I • Apply suitable primer sealer to the area being refinished. HP-I • Scuff sand to remove nibs or imperfections from a sealer. HP-I • Apply stone chip resistant coating. HP-G • Restore caulking and seam sealers to repaired areas. HP-G • Prepare adjacent panels for blending. HP-I	

Notes

PFR 3 Students will understand spray gun and related equipment operation.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	PFR 3.1 Inspect, prepare and demonstrate usage of spray gun and related equipment Examples: • Inspect, clean, and determine condition of spray guns and related equipment (air hoses, regulators, air lines, air source, and spray environment). HP-I • Select spray gun setup (fluid needle, nozzle, and cap) for product being applied. HP-I • Test and adjust spray gun using fluid, air and pattern control valves. HP-I • Demonstrate an understanding of the operation of pressure spray equipment. HP-G	• NATEF tasks that apply to sub-indicator

Notes

PFR 4 Students will understand and perform paint mixing, matching, and applying automotive refinishing materials.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 1: Recall	PFR 4.1 Understand the process for mixing and matching automotive paint Examples: • Identify color code by manufacturer's vehicle information label. HP-I • Shake, stir, reduce, catalyze/activate, and strain refinish materials. HP-I • Identify product expiration dates as applicable. HP-G • Identify and mix paint using a formula. HP-I • Identify poor hiding colors; determine necessary action. HP-G • Identify alternative color formula to achieve a blendable match. HP-I • Identify the material's equipment and preparation differences between solvent and waterborne technologies. HP-G	• NATEF tasks that apply to sub-indicator
Level 2: Skill/Concept	PFR 4.2 Correctly apply automotive paint to prepared surfaces Examples: • Apply finish using appropriate spray techniques (gun arc, angle, distance, travel speed, and spray pattern overlap) for the finish being applied. HP-I • Apply selected product on test or let-down panel; check for color match. HP-I • Apply single stage topcoat. HP-G • Apply basecoat/clearcoat for panel blending and panel refinishing. HP-I • Apply basecoat/clearcoat for overall refinishing. HP-G • Remove nibs or imperfections from basecoat. HP-I • Refinish plastic parts. HP-I • Apply multi-stage coats for panel blending and overall refinishing. HP-G • Tint color using formula to achieve a blendable match. HP-I	• NATEF tasks that apply to sub-indicator

Notes:

PFR 5 Students will identify causes and correction procedures for paint defects.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	PFR 5.1 Identify paint defects, understand the causes, and correct paint defects Examples: • Identify blistering (raising of the paint surface, air entrapment); correct the cause(s) and the condition. HP-G • Identify a dry spray appearance in the paint surface; correct the cause(s) and the condition. HP-I • Identify the presence of fish-eyes (crater-like openings) in the finish; correct the cause(s) and the condition. HP-I • Identify lifting; correct the cause(s) and the condition. HP-G • Identify clouding (mottling and streaking in metallic finishes); correct the cause(s) and the condition. HP-I • Identify orange peel; correct the cause(s) and the condition. HP-I • Identify overspray; correct the cause(s) and the condition. HP-I • Identify solvent popping in freshly painted surface; correct the cause(s) and the condition. HP-G • Identify sags and runs in paint surface; correct the cause(s) and the condition. HP-I • Identify sanding marks or sand scratch swelling; correct the cause(s) and the condition. HP-I • Identify contour mapping/edge mapping; correct the cause(s) and the condition. HP-G • Identify color difference (off-shade); correct the cause(s) and the condition. HP-G • Identify tape tracking; correct the cause(s) and the condition. HP-G • Identify low gloss condition; correct the cause(s) and the condition. HP-G • Identify poor adhesion; correct the cause(s) and the condition. HP-G • Identify paint cracking (shrinking, splitting, crowsfeet or line-checking, micro-checking, etc.); correct the cause(s) and the condition. HP-G • Identify corrosion; correct the cause(s) and the condition. HP-G • Identify dirt or dust in the paint surface; correct the cause(s) and the	• NATEF tasks that apply to sub-indicator

	condition. HP-I • Identify water spotting; correct the cause(s) and the condition. HP-G • Identify finish damage caused by bird droppings, tree sap, and other natural causes; correct the condition. HP-G • Identify finish damage caused by airborne contaminants (acids, soot, rail dust, and other industrial-related causes); correct the condition. HP-G • Identify die-back conditions (dulling of the paint film showing haziness); correct the cause(s) and the condition. HP-G • Identify chalking (oxidation); correct the cause(s) and the condition. HP-G • Identify bleed-through (staining); correct the cause(s) and the condition. HP-G • Identify pin-holing; correct the cause(s) and the condition. HP-G • Identify buffing-related imperfections (swirl marks, wheel burns); correct the condition. HP-I • Identify pigment flotation (color change through film build); correct the cause(s) and the condition. HP-G	

Notes

PRF6-Students will understand and perform detailing of paint refinishing.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	PRF 6.1 Perform final vehicle inspection Examples: • Perform vehicle clean-up; complete quality control using a checklist. HP-I • Apply decals, transfers, tapes, woodgrains, pinstripes (painted and taped), etc. HP-G • Sand, buff and polish fresh or existing finish to remove defects as required. HP-I • Clean interior, exterior, and glass. HP-I • Clean body openings (door jambs and edges, etc.). HP-I • Remove overspray. HP-I	• NATEF tasks that apply to sub-indicator

Notes

MLR Automatic Transmission/Transaxle and Suspension/Steering

Career Cluster	Transportation and Logistics
Course Code	20123
Prerequisite(s)	Introduction to Vehicle Systems and Maintenance or Maintenance and Light Repair - Recommended
Credit	1
Program of Study and Sequence	Foundational courses – Introduction to Vehicle Systems and Maintenance or Maintenance and Light Repair – **Automotive Transmission/Transaxle and Suspension/Steering** – Capstone Experience
Student Organization	SkillsUSA
Coordinating Work-Based Learning	NA
Industry Certifications	ASE
Dual Credit or Dual Enrollment	NA
Teacher Certification	Transportation, Distribution & Logistics Cluster Endorsement; Autobody Technology Pathway Endorsement *Autobody Technology
Resources	

Course Description:

Students will learn how to inspect, analyze, and service the vehicles automatic transmission/transaxle and suspension/steering systems. They will learn how to evaluate problems and determine the correct solution for the task at hand. Students will comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

Program of Study Application

MLR (Maintenance Light Repair) Automatic Transmission/Transaxle and Suspension/Steering is an advanced pathway course in the transportation, distribution and logistics career cluster, automotive technology career pathway.

Course Standards

ATSS 1 Students will demonstrate automotive technology safety practices, as identified in Occupational Safety and Health Administration (OSHA) and Environmental Protection Agency (EPA) requirements for an automotive repair facility.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 1: Recall and Reproduction	ATSS 1.1 Demonstrate automotive technology safety practices Examples: • Identify general shop safety rules and procedures. • Identify and use proper procedures for safe jack and lift operations. • Utilize proper ventilation procedures for working within the lab/shop area. • Identify the location and the types of fire extinguishers and other fire safety equipment. • Identify the location and use of eye wash stations. • Identify the location of posted evacuation routes. • Locate and demonstrate knowledge of Safety Data Sheets (SDS). • Properly dispose chemicals in accordance to state law.	• NATEF tasks that pertain to safety. • OSHA 10 • "Right to Know" Federal Law • EPA

Notes

ATSS 2 Students will demonstrate proper tool selection and usage.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 1: Recall and Reproduction	ATSS 2.1 Demonstrate proper tool selection and usage Examples: • Identify tools and their usage in automotive applications. • Identify standard and metric designation. • Demonstrate safe handling and use of appropriate tools. • Demonstrate proper cleaning, storage, and maintenance of tools and equipment. • Demonstrate proper use of precision measuring tools (e.g. micrometer, dial-indicator, dial-caliper).	

Notes

ATSS 3 Students will perform diagnostics and repair on the vehicle's automatic transmission and transaxle.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/ Concept	ATSS 3.1 Inspect and identify drivetrain components Examples: • Research vehicle service information including fluid type, vehicle service history, service precautions, and technical service bulletins. P-1 • Check fluid level in a transmission or transaxle equipped with a dip-stick. P-1 • Check fluid level in a transmission or transaxle not equipped with a dipstick. P-1 • Check transmission fluid condition; check for leaks. P-2 • Identify drive train components and configuration. P-1	• NATEF tasks that apply to sub-indicator.
Level 2: Skill/ Concept	ATSS 3.2 Perform maintenance on vehicle automatic transmission and transaxle while on the vehicle Examples: • Inspect, adjust, and/or replace external manual valve shift linkage, transmission range sensor/switch, and/or park/neutral position switch. P-2 • Inspect for leakage at external seals, gaskets, and bushings. P-1 • Inspect, replace and/or align power train mounts. P-2 • Drain and replace fluid and filter(s); use proper fluid type per manufacturer specification. P-1	• NATEF tasks that apply to sub-indicator.
Level 4: Extended Thinking	ATSS 3.3 Analyze the vehicle's automatic transmission and transaxle while off the vehicle Examples: • Describe the operational characteristics of a continuously variable transmission (CVT). P-3 • Describe the operational characteristics of a hybrid vehicle drive train. P-3	• NATEF tasks that apply to sub-indicator.

Notes: P-1, P-2, P-3 refers to levels of difficulty under NATEF tasks (p-1 lowest)

ATSS 4 Students will perform maintenance on vehicle suspension and steering systems.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 4: Extended Thinking	ATSS 4.1 Analyze and evaluate the suspension and steering system components Examples: • Research vehicle service information including fluid type, vehicle service history, service precautions, and technical service bulletins. P-1 • Disable and enable supplemental restraint system (SRS); verify indicator lamp operation. P-1 • Identify suspension and steering system components and configurations. P-1	• NATEF tasks that apply to sub-indicator.
Level 3: Strategic Thinking	ATSS 4.2 Inspect and assess the suspension and steering system Examples: • Inspect rack and pinion steering gear inner tie rod ends (sockets) and bellows boots. P-1 • Inspect power steering fluid level and condition. P-1 • Flush, fill, and bleed power steering system; use proper fluid type per manufacturer specification. P-2 • Inspect for power steering fluid leakage. P-1 • Remove, inspect, replace, and/or adjust power steering pump drive belt. P-1 • Inspect and replace power steering hoses and fittings. P-2 • Inspect pitman arm, relay (centerlink/intermediate) rod, idler arm, mountings, and steering linkage damper. P-1 • Inspect tie rod ends (sockets), tie rod sleeves, and clamps. P-1 • Inspect upper and lower control arms, bushings, and shafts. P-1 • Inspect and replace rebound bumpers. P-1 • Inspect track bar, strut rods/radius arms, and related mounts and bushings. P-1 • Inspect upper and lower ball joints (with or without wear indicators). P-1 • Inspect suspension system coil springs and spring insulators (silencers). P-1 • Inspect suspension system torsion bars and mounts. P-1	• NATEF tasks that apply to sub-indicator.

	• Inspect and/or replace front/rear stabilizer bar (sway bar) bushings, brackets, and links. P-1 • Inspect, remove, and/or replace strut cartridge or assembly; inspect mounts and bushings. P-2 • Inspect front strut bearing and mount. P-1 • Inspect rear suspension system lateral links/arms (track bars), control (trailing) arms. P-1 • Inspect rear suspension system leaf spring(s), spring insulators (silencers), shackles, brackets, bushings, center pins/bolts, and mounts. P-1 • Inspect, remove, and/or replace shock absorbers; inspect mounts and bushings. P-1 • Inspect electric power steering assist system. P-2 • Identify hybrid vehicle power steering system electrical circuits and safety precautions. P-2 • Describe the function of suspension and steering control systems and components, (i.e. active suspension, and stability control). P-3	
Level 2: Skill/ Concept	ATSS 4.3 Inspect and measure vehicle wheel alignment Examples: • Perform pre-alignment inspection; measure vehicle ride height. P-1 • Describe alignment angles (camber, caster and toe) P-1	• NATEF tasks that apply to sub-indicator
Level 2: Skill/ Concept	ATSS 4.4 Inspect, Identify, and repair wheels and tires Examples: • Inspect tire condition; identify tire wear patterns; check for correct tire size, application (load and speed ratings), and air pressure as listed on the tire information placard/label. P-1 • Rotate tires according to manufacturer's recommendations including vehicles equipped with tire pressure monitoring systems (TPMS). P-1 • Dismount, inspect, and remount tire on wheel; balance wheel and tire assembly. P-1 • Dismount, inspect, and remount tire on wheel equipped with tire pressure monitoring system sensor. P-1 • Inspect tire and wheel assembly for air loss; determine necessary action. P-1	• NATEF tasks that apply to sub-indicator.

	• Repair tire following vehicle manufacturer approved procedure. P-1 • Identify indirect and direct tire pressure monitoring systems (TPMS); calibrate system; verify operation of instrument panel lamps. P-1 • Demonstrate knowledge of steps required to remove and replace sensors in a tire pressure monitoring system (TPMS) including relearn procedure.P-1	

Notes

Diesel Technology

Career Cluster	Transportation, Distribution & Logistics
Course Code	20107
Prerequisite(s)	Automotive Engine Repair and Performance
Credit	1
Program of Study and Sequence	Automotive Engine Repair and Performance – **Diesel Technology** – Capstone Experience
Student Organization	SkillsUSA
Coordinating Work-Based Learning	NA
Industry Certifications	NA
Dual Credit or Dual Enrollment	Lake Area Technical Institute - C or better (class grade) for dual enrollment
Teacher Certification	Transportation, Distribution & Logistics Cluster Endorsement; Autobody Technology Pathway Endorsement; *Autobody Technology
Resources	

Course Description:

Students will develop an understanding of the Automotive Diesel service and repair pathway including Over the Road Transportation, Construction Equipment and Agricultural Equipment. The desire for students to receive industry training at the basic level and then be able to step up to the higher level of competency in this field is the ultimate goal of this course. Completion of this course will help students with post-secondary education and training and prepare them for the workforce and further technical education, qualifications and experience.

Program of Study Application

Diesel Technology is a second pathway course in the Transportation, Distribution & Logistics career cluster, Diesel pathway.

Course Standards

DT 1 Students will adhere to health and safety standards in the work place, including systems and procedures.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 1: Recall	DT 1.1 Apply skills and knowledge of health and safety practices and expectations to ensure a safe working environment for the individual and co-workers (fellow students) Examples: • Identify and describe personal safety equipment, including eye, hair and hearing protection, clothing and footwear. • Know and understand how to work safely around vehicles in the workplace. • Identify, isolate and remove potential work place hazards, that is, fix the risks. • Know and understand how to work safely with hoists and lifting equipment. • Understand how to identify and manage potential and actual fires and fire hazards in the workplace. • Know and understand evacuation procedures in the workplace, including personal and collective responsibilities. • Know and understand how to work safely using hand and shop tools and equipment. • Know and understand how to work safely with hazardous materials, including disposal and storage.	Occupational Safety Health Administration (OSHA) Environmental Protection Agency (EPA)

Notes

DT 2 Students will learn and understand basic electricity and electronics principles.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	DT 2.1 Understand and implement basic electricity and electronic principles that apply to diesel powered equipment, including starting, charging, lighting and accessories Examples: • Understand basic electricity theory. • Explain the basic fundamentals of electricity. • Calculate values of resistance, current and voltage using Ohms Law. • Explore series circuits. • Investigate parallel circuits. • Examine series-parallel circuits. • Explore common electrical components. • Investigate the starter, its related components and circuits. • Explore the principles and components relating to the charging circuit.	
Level 2: Skill/Concept	DT 2.2 Perform basic electrical repair techniques Examples: • Make solder connections. • Demonstrate the proper use of a digital multi-meter. • Diagnose the condition of starter circuits, performing the necessary steps using a load tester and multi-meter. • Analyze the function and condition of a lead-acid battery.	

Notes

DT 3 Students will demonstrate their understanding of basic aspects of diesel engines.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	DT 3.1 Understand the technical and nontechnical aspects of diesel engines Examples: • Know and understand different types of hand, shop and measurement tools. • Distinguish between different types of fasteners. • Understand the role of the technician in the diesel industry. • Identify, define and demonstrate basic diesel engine principles. • Identify and define power formulas in diesel industry. • Disassemble a diesel engine. • Assemble a diesel engine per engine manual. • Demonstrate the ability to rebuild a cylinder head. • Start a diesel engine.	

Notes This information will give them the basic understanding needed to continue in the Diesel Mechanic program.

DT 4 Students will apply principles of basic hydraulic systems.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	DT 4.1 Research and inspect basic mobile hydraulics Examples: • Report how basic hydraulic systems have evolved and developed. • Calculate the force of a given cylinder under given pressures. • Inspect a hydraulic jack. • Evaluate a gear pump for possible repairs. • Evaluate a vane pump for possible repairs. • Examine a piston pump for possible repairs. • Examine a hydraulic cylinder. • Flow rate a pump on the test stand (Megatech). • Analyze the principles of circuits on the test stand (Amatrol). • Explore the fundamentals of hydraulic ISO symbols. • Explore the fundamentals of a small backhoe.	

Notes: Students will be introduced to the principles, components, fluid systems and circuits of hydraulic systems.

DT 5. Students will demonstrate how basic braking systems operate.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	DT 5.1 Identify and understand basic vehicle braking systems, including hydraulic and air brake systems Examples: • Explore the principles of brakes. • Demonstrate the hydraulic drum brake rebuild procedure. • Demonstrate the hydraulic disc brake rebuild procedure. • Understand different types of power brakes. • Explain the operation of brake valves. • Examine the fundamentals of the air system.	

Notes

DT 6. Students will apply principles of fuel systems on diesel engines.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	DT 6.1 Differentiate between, and identify components of, fuel delivery systems • Identify principles, components, systems and circuits for fuel delivery systems • Analyze fuel injection components and principle • Demonstrate how to time an in-line fuel pump • Demonstrate how to time a rotary fuel pump • Analyze non-starting situations related to fuel and engine phasing	

Notes

Electrical/Electronic Systems and Heating Ventilation Air Conditioning (HVAC)

Career Cluster	Transportation Distribution and Logistics
Course Code	20105
Prerequisite(s)	Introduction to Vehicle Systems and Maintenance or Maintenance and Light Repair - Recommended
Credit	1
Program of Study and Sequence	Foundational courses – Introduction to Vehicle Systems and Maintenance or Maintenance and Light Repair – **Electrical/Electronic Systems and HVAC** – Capstone Experience
Student Organization	SkillsUSA
Coordinating Work-Based Learning	NA
Industry Certifications	NA
Dual Credit or Dual Enrollment	NA
Teacher Certification	Transportation, Distribution & Logistics Cluster Endorsement; Automotive Technology Pathway Endorsement; *Automotive Technology
Resources	

Course Description:

Students in Electrical/Electronic Systems and Heating Ventilation Air Conditioning (HVAC) will learn theory and operation as well as diagnosis and repair of Electrical/Electronic and HVAC systems. Completion of this course will aid students as they continue their education at the post-secondary level or in the workforce and in the preparation for their ASE certification test. (The examples are NATEF (National Automobile Technician Education Foundation) tasks that the student may complete for ASE (Automotive Service Excellence) certification.)

Program of Study Application

Electrical/Electronic Systems and Heating Ventilation Air Conditioning (HVAC) is an advanced pathway course in the transportation, distribution and logistics career cluster, automotive technology pathway.

Course Standards

EEHVAC 1 Students will demonstrate automotive technology safety practices, including Occupational Safety and Health Administration (OSHA) and Environmental Protection Agency (EPA) requirements, for an automotive repair facility.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	EEHVAC 1.1 Demonstrate automotive technician safety practices Examples: • Use protective clothing and safety equipment according to OSHA and EPA requirements. • Summarize the proper use of safety data sheet (SDS) • Demonstrate the proper use of hand and power tools • Examine basic shop safety using OSHA standards • Maintain a portfolio of successfully completed safety and equipment exams	• NATEF tasks that apply to sub-indicators

Notes

EEHVAC 2 Students will perform maintenance, diagnostic and repair procedures of electrical/electronic systems.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 3: Strategic Thinking	EEHVAC 2.1 Demonstrate knowledge of the vehicle electrical system Examples: • Research vehicle service information including vehicle service history, service precautions, and technical service bulletins. P-1 • Demonstrate knowledge of electrical/electronic series, parallel, and series and parallel circuits using principles of electricity (Ohm's Law). P-1 • Demonstrate proper use of a digital multimeter (DMM) when measuring source voltage, voltage drop (including grounds), current flow, and resistance. P-1 • Demonstrate knowledge of the causes and effects from shorts, grounds, opens, and resistance problems in electrical/electronic circuits. P-1 • Identify electrical/electronic system components and configuration. P-1	• NATEF tasks that apply to sub-indicators
Level 2: Skill/Concept	EEHVAC 2.2 Test and repair electrical problems Examples: • Use a test light to check operation of electrical circuits. P-2 • Use fused jumper wires to check operation of electrical circuits. P-2 • Measure key-off battery drain (parasitic draw). P-1 • Inspect and test fusible links, circuit breakers, and fuses; determine necessary action. P-1 • Repair and/or replace connectors, terminal ends, and wiring of electrical/electronic systems (including solder repair) P-1 • Use wiring diagrams to trace electrical/electronic circuits. P-1	• NATEF tasks that apply to sub-indicators

Notes: P-1, P-2, P-3 refers to levels of difficulty under NATEF tasks (P-1 lowest)

EEHVAC 3 Students will perform maintenance, diagnostic and repair procedures of the battery systems.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 1: Recall	EEHVAC 3.1 Identify battery requirements Examples: • Identify safety precautions for high voltage systems on electric, hybrid electric, and diesel vehicles. P-2 • Identify electrical/electronic modules, security systems, radios, and other accessories that require reinitialization or code entry after reconnecting vehicle battery. P-1 • Identify hybrid vehicle auxiliary (12v) battery service, repair, and test procedures. P-2	• NATEF tasks that apply to sub-indicators
Level 2: Skill/Concept	EEHVAC 3.2 Service battery Examples: • Perform battery state-of-charge test; determine necessary action. P-1 • Confirm proper battery capacity for vehicle application; perform battery capacity and load test; determine necessary action. P-1 • Maintain or restore electronic memory functions. P-1 • Inspect and clean battery; fill battery cells; check battery cables, connectors, clamps, and hold-downs. P-1 • Perform slow/fast battery charge according to manufacturer's recommendations. P-1 • Jump-start vehicle using jumper cables and a booster battery or an auxiliary power supply. P-1	• NATEF tasks that apply to sub-indicators

Notes

EEHVAC 4 Students will perform maintenance, diagnostic and repair procedures of starting systems.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 1: Recall	EEHVAC 4.1 Explain starting system operation Examples: • Demonstrate knowledge of an automatic idle-stop/start-stop system. P-3	• NATEF tasks that apply to sub-indicators
Level 2: Skill/Concept	EEHVAC 4.2 Inspect and repair starting system Examples: • Perform starter current draw test; determine necessary action. P-1 • Perform starter circuit voltage drop tests; determine necessary action. P-1 • Inspect and test starter relays and solenoids; determine necessary action. P-2 • Remove and install starter in a vehicle. P-1 • Inspect and test switches, connectors, and wires of starter control circuits; determine necessary action. P-2	• NATEF tasks that apply to sub-indicators

Notes

EEHVAC 5 Students will perform maintenance, diagnostic and repair procedures of the charging system.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	EEHVAC 5.1 Remove, inspect, and replace charging system components Examples: • Perform charging system output test; determine necessary action. P-1 • Inspect, adjust, and/or replace generator (alternator) drive belts; check pulleys and tensioners for wear; check pulley and belt alignment. P-1 • Remove, inspect, and/or replace generator (alternator). P-2 • Perform charging circuit voltage drop tests; determine necessary action. P-2	• NATEF tasks that apply to sub-indicators

Notes

EEHVAC 6 Students will identify and perform repair procedures of electrical systems.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	EEHVAC 6.1 Identify and inspect lighting, instrument cluster, driver information, and body electrical systems and verify operation Examples: • Identify system voltage and safety precautions associated with high-intensity discharge headlights. P-2 • Inspect interior and exterior lamps and sockets including headlights and auxiliary lights (fog lights/driving lights); replace as needed. P-1 • Verify operation of instrument panel gauges and warning/indicator lights; reset maintenance indicators. P-1 • Verify windshield wiper and washer operation; replace wiper blades. P-1 • Describe the operation of keyless entry/remote-start systems. P-3	• NATEF tasks that apply to sub-indicators
Level 2: Skill/Concept	EEHVAC 6.2 Perform the following repair operations • Aim headlights. P-2 • Disable and enable supplemental restraint system (SRS) and verify indicator lamp operation. P-1 • Remove and reinstall door panel. P-1	• NATEF tasks that apply to sub-indicators

Notes

EEHVAC 7 Students will research and identify heating, ventilation, and air conditioning components.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 1: Recall	EEHVAC 7.1 Obtain vehicle service information on heating and air conditioning components Examples: • Research vehicle service information, including refrigerant/oil type, vehicle service history, service precautions, and technical service bulletins. P-1 • Identify heating, ventilation and air conditioning (HVAC) components and configuration. P-1	• NATEF tasks that apply to sub-indicators

Notes

EEHVAC 8 Students will perform repair procedures for the refrigeration system.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	EEHVAC 8.1 Inspect and repair refrigeration system components Examples: • Inspect and replace A/C compressor drive belts, pulleys, and tensioners; visually inspect A/C components for signs of leaks; determine necessary action. P-1 • Identify hybrid vehicle A/C system electrical circuits and the service/safety precautions. P-2 • Inspect A/C condenser for airflow restrictions; determine necessary action. P-1	• NATEF tasks that apply to sub-indicators

Notes

EEHVAC 9 Students will perform repair procedures for the heating and cooling system.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	EEHVAC 9.1 Analyze heating and engine cooling systems problem Example: • Inspect engine cooling and heater systems hoses and pipes; determine necessary action. P-1	• NATEF tasks that apply to sub-indicators

Notes

EEHVAC 10 Students will perform inspection and identification procedures for the heating, ventilation and air conditioning (HVAC) system.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	EEHVAC 10.1 Inspect and identify operating systems and related controls Examples: • Inspect A/C-heater ducts, doors, hoses, cabin filters, and outlets; determine necessary action. P-1 • Identify the source of A/C system odors. P-2	• NATEF tasks that apply to sub-indicators

Notes

MLR Automotive Engine Repair and Performance

Career Cluster	Transportation, Distribution & Logistics
Course Code	20121
Prerequisite(s)	Introduction to Vehicle Systems and Maintenance or Maintenance and Light Repair - Recommended
Credit	1
Program of Study and Sequence	Foundational courses – Introduction to Vehicle Systems and Maintenance or Maintenance and Light Repair – **Automotive Engine Repair and Performance** – Capstone Experience
Student Organization	SkillsUSA
Coordinating Work-Based Learning	NA
Industry Certifications	NA
Dual Credit or Dual Enrollment	NA
Teacher Certification	Transportation, Distribution & Logistics Cluster Endorsement; Autobody Technology Pathway Endorsement; *Autobody Technology
Resources	

Course Description:
Completion of Automotive Engine Repair and Performance will help students prepare for post-secondary education and training. This course will further the students' technical education experience and help prepare them for the workforce.
Students will learn:

- How to work safely on the vehicle in a workshop situation.
- Engine operation based on the six operating systems: lubrication, cooling, fuel, ignition, air induction and exhaust systems.
- General engine maintenance to include valve train, lubrication and cooling system.
- General engine performance to include computerized controls, fuel, air induction, exhaust systems and emissions control systems.

Course Standards

EPER 1: Students will demonstrate automotive technology safety practices, as identified in Occupational Safety and Health Administration (OSHA) and Environmental Protection Agency (EPA) requirements for an automotive repair facility.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 1: Recall and Reproduction	EPER 1.1 Demonstrate automotive technology safety practices. Examples: • Identify general shop safety rules and procedures. • Identify and use proper procedures for safe jack and lift operations. • Utilize proper ventilation procedures for working within the lab/shop area. • Identify the location and the types of fire extinguishers and other fire safety equipment. • Identify the location and use of eye wash stations. • Identify the location of posted evacuation routes. • Locate and demonstrate knowledge of Safety Data Sheets (SDS).	• NATEF tasks that apply to sub-indicators • OSHA 10 • "Right to Know" Federal Law • EPA

Notes

EPER 2: **Students will demonstrate proper tool selection and usage.**

Webb Level	*Sub-indicator*	*Integrated Content*
Level 1: Recall and Reproduction	EPER 2.1. Demonstrate proper tool selection and usage. Examples: • Identify tools and their usage in automotive applications. • Identify standard and metric designation. • Demonstrate safe handling and use of appropriate tools. • Demonstrate proper cleaning, storage, and maintenance of tools and equipment. • Demonstrate proper use of precision measuring tools (e.g. micrometer, dial-indicator, dial-caliper).	

Notes

EPER 3: Students will prepare the vehicle for service.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	EPER 3.1 Perform preparatory procedures for vehicle service. Examples: • Identify information needed and the service requested on a repair order. P-1 • Identify purpose and demonstrate proper use of fender covers, mats. • Demonstrate use of the three C's: concern, cause, and correction. • Review vehicle service history. P-1 • Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. P-1	• NATEF tasks that apply to sub-indicators

Notes: P-1, P-2, P-3 refers to levels of difficulty under NATEF tasks (P-1 lowest)

EPER 4. Students will perform engine repair.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2 Skill/Concept	EPER 4.1 Perform engine maintenance operations. Examples: • Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins. P-1 • Verify operation of the instrument panel engine warning indicators. P-1 • Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action. P-1 • Install engine covers using gaskets, seals, and sealers as required. P-1 • Verify engine mechanical timing. P-2 • Perform common fastener and thread repair, to include: remove broken bolt, restore internal and external threads, and repair internal threads with thread insert. P-1 • Identify service precautions related to service of the internal combustion engine of a hybrid vehicle. P-1	• NATEF tasks that apply to sub-indicators
Level 2: Skill/Concept	EPER 4.2 Understand component operation and perform maintenance on cylinder head and valve train. Examples: • Adjust valves (mechanical or hydraulic lifters). P-2 • Identify components of the cylinder head and valve train. P-1	• NATEF tasks that apply to sub-indicators

Level 2: Skill/Concept	EPER 4.3 Test, inspect and perform maintenance on the lubrication and cooling system. Examples: • Perform cooling system pressure and dye tests to identify leaks; check coolant condition and level; inspect and test radiator, pressure cap, coolant recovery tank, heater core, and galley plugs; determine necessary action. P-1 • Inspect, replace, and/or adjust drive belts, tensioners, and pulleys; check pulley and belt alignment. P-1 • Remove, inspect, and replace thermostat and gasket/seal. P-1 • Inspect and test coolant; drain and recover coolant; flush and refill cooling system; use proper fluid type per manufacturer specification; bleed air as required. P-1 • Perform engine oil and filter change; use proper fluid type per manufacturer specification; reset maintenance reminder as required. P-1 • Identify components of the lubrication and cooling systems. P-1	• NATEF tasks that apply to sub-indicators

Notes

EPER 5. Students will test, diagnose, and repair engine performance issues.

Webb level	Sub-indicator	Integrated Content
Level 3: Strategic Thinking	EPER 5.1. Perform engine diagnostics and analyze retrieved data. Examples: • Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins. P-1 • Perform engine absolute manifold pressure tests (vacuum/boost); document results. P-2 • Perform cylinder power balance test; document results. P-2 • Perform cylinder cranking and running compression tests; document results. P-2 • Perform cylinder leakage test; document results. P-2 • Verify engine operating temperature. P-1 • Remove and replace spark plugs; inspect secondary ignition components for wear and damage. P-1	• NATEF tasks that apply to sub-indicators
Level 3: Strategic Thinking	EPER 5.2. Test the computerized controls and analyze retrieved data. Examples: • Retrieve and record diagnostic trouble codes (DTC), On-board Diagnostic (OBD) monitor status, and freeze frame data; clear codes when applicable. P-1 • Describe the use of the OBD monitors for repair verification. P-1	• NATEF tasks that apply to sub-indicators
Level 2: Skill/Concept	EPER 5.3. Perform maintenance on the fuel, air Induction, and exhaust systems Examples: • Replace fuel filter(s) where applicable. P-2 • Inspect, service, or replace air filters, filter housings, and intake duct work. P-1 • Inspect integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shields; determine necessary action. P-1 • Inspect condition of exhaust system hangers, brackets, clamps, and heat shields; determine necessary action. P-1 • Check and refill diesel exhaust fluid (DEF). P-2	• NATEF tasks that apply to sub-indicators

Level 2: Skill/Concept	EPER 5.4. Perform maintenance operations on emissions control system. Examples: • Inspect, test, and service Positive Crankcase Ventilation (PCV) filter/breather, valve, tubes, orifices, and hoses; perform necessary action. P-2	• NATEF tasks that apply to sub-indicators

Notes

Introduction to Auto Body and Estimating

Career Cluster	Transportation, Distribution & Logistics
Course Code	20117
Prerequisite(s)	None
Credit	0.5 to 1
Program of Study and Sequence	Foundation Course – Cluster Course **– Introduction to Auto Body and Estimating** – Auto Body Non-Structural Analysis and Damage Repair or Auto Body Structural Analysis and Damage Repair
Student Organization	SkillsUSA
Coordinating Work-Based Learning	Field Trips, Youth Internships, Industry Speakers
Industry Certifications	ASE (Automotive Service Excellence) OSHA (Occupational Safety and Health Administration) 10
Dual Credit or Dual Enrollment	NA
Teacher Certification	Transportation, Distribution & Logistics Cluster Endorsement; Autobody Technology Pathway Endorsement; *Autobody Technology
Resources	

Course Description:

This course is designed to expose the students to different industry terminology, safety practices, auto body estimating and basic auto body repairs. This course is for the students to receive basic industry based training before stepping up to higher level courses in this field.

Program of Study Application

Introduction to Auto Body and Estimating is a first pathway course in the Transportation, Distribution and Logistics career cluster, Automotive Body Collision and Refinishing pathway.

Course Standards

IAB 1 Students will demonstrate understanding of auto body safety practices and careers.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	IAB 1.1 Demonstrate auto body safety practices Examples: • Select and use proper personal safety equipment; take the necessary precautions with hazardous operations and materials in accordance with federal, state, and local regulations. HP-I • Locate procedures and precautions that may apply to the vehicle being repaired. HP-I • Identify vehicle system hazard types, locations and recommended procedures (supplemental restraint system (SRS), hybrid/electric/alternative fuel vehicles) before inspecting or replacing components. HP-I	• National Automotive Technicians Education Foundation (NATEF) Tasks that pertain to safety • OSHA 10
Level 2: Skill/Concept	IAB 1.2 Analyze career opportunities in the Transportation, Distribution, & Logistics career cluster Examples: • Create resume • Contact industry leaders • Identify related careers of auto body	• SDMylife • Industry speakers

Notes: HP-I – High Priority Individual and HP-G – High Priority Group

IAB 2 Demonstrate uses of auto body tools and equipment.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	IAB 2.1 Demonstrate hand and power tools and their uses Examples: • Names of tools and their uses • Difference between pneumatic and electric • Safety procedures when using tools • Show how to maintain tools	
Level 3: Strategic Thinking	IAB 2.2 Analyze uses of a compressed air system Examples: • Components of a compressed air system • Compressed air system maintenance • Uses of compressed air • Safety issues when using compressed air • Operations of a compressed air system • Demonstrate use of compressed air in different operations.	• NATEF Tasks that pertain to compressed air systems

Notes

IAB 3 Employ collision repair estimating processes.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 3: Strategic Thinking	IAB 3.1 Demonstrate the process involved in obtaining important information Examples: • Determine and record customer/vehicle owner information. HP-I • Identify and record vehicle identification number (VIN) information, including nation of origin, make, model, restraint system, body type, productions date, engine type and assembly plant. HP-I • Identify and record vehicle mileage and options, including trim level, paint code, transmission, accessories and modifications HP-I	• NATEF Tasks that pertain to this sub-indicator.
Level 2: Skill/Concept	IAB 3.2 Demonstrate the process of writing a repair estimate Examples: • Position the vehicle for inspection. HP-G • Prepare vehicle for inspection by providing access to damaged areas. HP-G • Analyze damage to determine appropriate methods for overall repairs. HP-I • Identify and record pre-existing damage. HP-I • Apply appropriate estimating and parts nomenclature (terminology). HP-I • Determine and apply appropriate estimating sequence. HP-I • Utilize estimating guide procedure pages. HP-I • Identify operations requiring labor value judgment. HP-G • Select appropriate labor value for each operation (structural, non-structural, mechanical, and refinish). HP-I • Apply math skills to establish charges and totals. HP-I • Identify procedural differences between computer generated and manually written estimates. HP-G • Recognize the differences in estimation procedures when using different information provider systems. HP-G	• NATEF Tasks that pertain to this sub-indicator.

Notes

IAB 4 Apply auto body repair and finishing techniques.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	IAB 4.1 Demonstrate basic auto body repair techniques Examples: • Know proper corrosion protection methods and why you apply them. • Welding processes • Metal straightening techniques • Filler options • Plastic repair techniques • Purpose of block sanding • Hammer and Dolly procedures • Block sanding techniques • Uses of different body fillers • Proper uses of sandpaper grits	• NATEF Tasks that pertain to this sub-indicator.
Level 2: Skill/Concept	IAB 4.2 Demonstrate processes in automotive finishing Examples: • Know and understand proper overspray protection • Proper refinishing procedures • Proper surface preparation • Uses of refinishing equipment • Apply overspray protection • Prepare different surfaces properly • Demonstrate how to use refinishing equipment (including maintenance) • Perform a spray gun test	• NATEF Tasks that pertain to this sub-indicator.

Notes

Intro to Vehicle Systems & Maintenance

Career Cluster	Transportation, Distribution & Logistics
Course Code	20106
Prerequisite(s)	None
Credit	.5 or 1
Program of Study and Sequence	Any Foundation course – **Intro to Vehicle Systems & Maintenance** – pathway course in the automotive technology; automotive body, collision & refinishing; or diesel pathway
Student Organization	SKillsUSA
Coordinating Work-Based Learning	NA
Industry Certifications	NA
Dual Credit or Dual Enrollment	NA
Teacher Certification	Transportation, Distribution & Logistics Cluster Endorsement; Automotive Technology Pathway Endorsement; *Automotive Technology *7-12 Technology Education
Resources	

Course Description:

Intro to Vehicle Systems & Maintenance is an introductory automobile course. Students will study the basic principles of electrical and mechanical systems used in motor vehicle technology while developing core hand skills. This course is designed to give learners an insight into careers in the automotive service and repair industry and encourages learners to undertake many maintenance and repair tasks.

Program of Study Application

Intro to Vehicle Systems and Maintenance is a cluster course in the transportation, distribution and logistics cluster. Intro to Vehicle Systems and Maintenance will prepare a student to enter any of the pathways in the cluster.

Course Standards

IVSM 1 Students will demonstrate automotive technology safety practices, including Occupational Safety and Health Administration (OSHA) and Environmental Protection Agency (EPA) requirements, for an automotive repair facility.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2 Skill/Concept	IVSM 1.1 Demonstrate automotive technician safety practices Examples: • Use protective clothing and safety equipment according to OSHA and EPA requirements. • Summarize the proper use of safety data sheet (SDS) • Demonstrate the proper use of hand and power tools • Examine basic shop safety using OSHA standards • Maintain a portfolio of successfully completed safety and equipment exams	• OSHA 10
Level 2 Skill/Concept	IVSM 1.2 Understand the way in which waste gasses, emissions, and other environmentally destructive substances are generated and their effects on the environment Examples: • Understand the formation of carbon monoxide in internal combustion engines and the effects on the environment • Study the effects of vehicle emissions on the eco-system • Compare the emissions of hydro-fuel cell, electric, and gasoline powered vehicles	

Notes

IVSM2 Students explore career opportunities in the transportation, distribution and logistics career cluster and develop leadership skills.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2 Skill/Concept	IVSM 2.1 Demonstrate independent and teamwork skills Examples: • Participate in Career and Technical Student Organizations (CTSO's) • Develop a teamwork project (change oil, tire rotation)	• SKillsUSA
Level 2 Skill/Concept	IVSM 2.2 Explore career opportunities within the industry Examples: • Utilize guidance software to research and report on career opportunities • Update student portfolios and personal learning plans	• SDMyLife • Classroom speakers

Notes

IVSM3 Students will demonstrate an understanding of the safe and appropriate use of tools, equipment and work processes.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2 Skill/Concept	ITVSM 3.1. Understand and use the appropriate tools and equipment Examples: • Demonstrate proper usage of tools and equipment • Inspect and perform preventative and required maintenance of tools and equipment	
Level 2 Skill/Concept	IVSM 3.2. Diagnose and analyze components and systems Examples: • Use DMM (digital multi-meter) to measure electrical voltage, amps and resistance • Demonstrate use of a load tester on a battery, charging, and starting systems	
Level 2 Skill/Concept	IVSM 3.3. Select and demonstrate proper use of measuring devices and mathematical formulas Examples: • Identify the measuring instruments needed to assure proper tolerance ranges can be achieved (micrometer, caliper) • Identify, apply, and calculate mathematical formulas that apply to the automotive industry (Ohm's Law, cubic displacement, horse power)	
Level 2 Skill/Concept	IVSM 3.4. Use and understand standard and metric units of measurements Examples: • Measure brake rotor with caliper and compare to specifications • Measure tread width and mathematically calculate the sidewall height of the tire using the aspect ratio of the tire • Convert standard units and metric units	
Level 2 Skill/Concept	IVSM 3.5. Use measurement devices to diagnose and repair vehicles and components following industry standards Examples: • Identify tools and equipment used to measure caster, camber and toe • Measure resistance in spark plug high-tension leads to assure proper operation of ignition system	

Level 2 Skill/Concept	IVSM 3.6. Demonstrate access and proper usage of Technical Service Bulletins (TSB) and service manuals Examples: • Utilize service information to find vehicle specifications • Use vehicle owner's manual to find proper quantity and quality of oil to use to perform an engine oil and filter change • Use scan tool to pull trouble codes from vehicle's computer diagnostic system	
Level 3 Strategic Thinking	IVSM. 3.7. Comprehend the importance of calibration processes, systems, techniques using various measuring and testing devices Examples: • Calibrate of a dial indicator • Check the accuracy of an outside/inside micrometer • Calibrate an Ohm meter	

Notes

IVSM 4 Students understand scientific principles in relation to chemical, mechanical, and physical functions of various power plants and vehicle systems.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2 Skill/Concept	IVSM 4.1. Demonstrate knowledge of the operation of the internal combustion engine Examples: • Identify different types of gasoline and diesel engines and 2 & 4 stroke engines • Compare the similarities and differences in a 2 and 4 stroke cycle	Briggs and Stratton
Level 2 Skill/Concept	IVSM 4.2. Demonstrate a basic understanding of the operating principles of heating and air conditioning systems Examples: • Identify the components of heating and air conditioning systems • Describe the air flow and refrigerant flow in heating and air conditioning systems	
Level 2 Skill/Concept	IVSM 4.3. Compare alternate fuel and power sources Examples: • Identify and research hybrid, fuel cell, and electric vehicles for a written report or presentation	

Notes

IVSM 5 Students perform and document maintenance procedures according to manufacturers' specifications.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 3 Strategic Thinking	IVSM 5.1. Demonstrate the procedures and practices for manufacturer's repair and maintenance schedules Examples: • Change oil and filter according to manufacturer's specs • Check proper inflation and condition of vehicle tires • Check and refill critical fluids • Inspect belts and hoses	Briggs and Stratton
Level 3 Strategic Thinking	IVSM 5.2. Demonstrate the use of service information to repair a vehicle Examples: • Utilize service information to find vehicle specifications • Use vehicle owner manual to find proper quantity and quality of oil to use to perform an engine oil and filter change	
Level 3 Strategic Thinking	IVSM 5.3. Demonstrate proper procedures for work order, customer information, and billing information completion Examples: • Demonstrate the proper use of a repair order that contains critical information • Complete work orders with customer, labor, and parts information	

Notes

IVSM 6 Students will understand and apply appropriate business practices.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 3 Strategic Thinking	IVSM 6.1 Demonstrate the importance of, and the procedures for, maintaining accurate records Examples: • Recording the mileage of a vehicle on the work order for warranty purposes • Billing of customers and collection of funds • Taxes and required taxable income	
Level 3 Strategic Thinking	IVSM 6.2 Understand the concept and application of ethical business practices Examples: • Marking up parts for profit • Installation of quality new and/or used parts • Making only necessary repairs	
Level 3 Strategic Thinking	IVSM 6.3 Understand the concept and application of acceptable customer relations practices Examples: • Return all settings of radio, seat and steering wheel positions to customer's settings • Respect customer's opinions of the vehicle's problems	

Notes

IVSM7 Students will understand and apply appropriate vehicle service and repairs.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2 Skill/Concept	IVSM 7.1 Perform general engine diagnosis and repair in professional manner within National Automotive Technicians Education Foundation (NATEF) standards Examples: • Perform engine compression test (dry/wet) • Set gap, and replace spark plugs and wires as needed	
Level 2 Skill/Concept	IVSM 7.2 Demonstrate ability to maintain and service lubrication and cooling systems Examples: • Analyze engine oil pressure • Remove and install an oil pressure sending unit • Inspect and test cooling system and pressure cap	
Level 2 Skill/Concept	IVSM 7.3 Understand the basic operation of computer controlled systems, and location and identification of related parts Examples: • Use a code reader and or scanner to diagnose computer system failure • Locate and test computer components • Clear trouble codes from computer with scanner	

Notes

IVSM8 Students understand the function, principles and operation of electrical systems using manufacturers' and industry standards.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2 Skill/Concept	IVSM 8.1 Demonstrate an understanding of how to diagnose and repair electrical systems Examples: • Clean battery terminals and electrical connections • Use DVOM (digital volt ohm meter) to check voltage drop at connections • Use DVOM to check resistance in electrical circuits	
Level 2 Skill/Concept	IVSM8.2 Diagnose and service batteries Examples: • Check battery state-of-charge with hydrometer or DVOM • Check battery load capacity with load tester • Remove and replace battery	
Level 2 Skill/Concept	IVSM 8.3 Demonstrate knowledge needed to diagnose and repair starting and charging systems Examples: • Check starting system draw with starting system tester • Check charging system output with charging system tester	
Level 2 Skill/Concept	IVSM 8.4 Demonstrate ability to properly diagnose and repair lighting systems Examples: • Adjust headlights • Replace bulbs • Test electrical system circuits and components	
Level 2 Skill/Concept	IVSM 8.5 Demonstrate ability to properly diagnose and repair heating and air conditioning systems Examples: • Test strength and condition of coolant • Remove and replace coolant and flush if needed • Test output temperature of A/C system	

Notes

IVSM9 Students understand the function and principles of automotive brake, steering and suspension, automatic and manual transmission systems.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2 Skill/Concept	IVSM 9.1 Demonstrate how to diagnose and service hydraulic and friction systems Examples: • Check brake pad dimensions and conditions • Check condition of rotor and/or drum • Check for leaks, cracks or bulges in brake lines • Check emergency brake cable operation	
Level 2 Skill/Concept	IVSM 9.2 Demonstrate how to diagnose and service steering and suspension systems Examples: • Check for proper power steering fluid condition and level • Check condition of front and rear struts and/or shocks	
Level 2 Skill/Concept	IVSM 9.3 Demonstrate how to diagnose and service automatic and manual transmissions Examples: • Check automatic and manual transmission fluid levels • Replace automatic transmission fluid and filter	

Notes

Logistics Planning & Management

Career Cluster	Transportation, Distribution & Logistics
Course Code	20151
Prerequisite(s)	None
Credit	.5 or 1
Program of Study and Sequence	Foundational course, **Logistics Planning & Management**, Pathway Course or Capstone Experience
Student Organization	SkillsUSA
Coordinating Work-Based Learning	NA
Industry Certifications	NA
Dual Credit or Dual Enrollment	NA
Teacher Certification	Transportation, Distribution & Logistics Cluster Endorsement
Resources	

Course Description:

Logistics Planning & Management prepares students for entry into the warehouse and distribution career field. Course content emphasizes a deep understanding of the dynamics of distribution and logistics operations, the warehousing skills needed for the tracking and managing of inventory, and the problem-solving skills used by logisticians in today's complex business environments. Upon completion of this course, a proficient student will be have a thorough understanding of safety, tools, equipment, operations, processes, customer fulfillment, product lifecycle, future trends, and regulatory issues in the industry.

Program of Study Application:

Logistics Planning & Management is a cluster course in the Transportation, Distribution and Logistics pathway.

Course Standards

LPM 1 Students will recognize occupational safety guidelines.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 1: Recall	LPM 1.1 Demonstrate safety practices as identified in Occupational Safety and Health Administration (OSHA) and Environmental Protection Agency (EPA) requirements Examples: • Adhere to responsibilities, regulations, and OSHA policies regarding reporting of accidents and observed hazards, and regarding emergency response procedures. • Interpret Safety Data Sheets (SDS) to determine any hazards related to materials handled. Use appropriate signs and symbols to identify hazardous materials within warehouses and during transportation of the materials. • Maintain a portfolio record of written safety examinations and equipment examination for which the student has passed an operational checkout by the instructor. • Identify dangerous goods and discuss how they influence warehouse and transportation decisions. • Determine the appropriate corrective actions if faced with a hazardous situation, as outlined by the *Emergency Response Guidebook* published by the U.S. Department of Transportation.	• OSHA 10 • "Right to Know" Federal Law

Notes

LPM 2 Students will analyze and categorize Logistics and Transportation Operations.

[*Webb Level*	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	LPM 2.1 Research the four subdivisions of logistics in light of organizational management practices • Prepare an explanatory paper or presentation that discusses the similarities and differences between the subdivisions of logistics: ○ Business logistics ○ Military logistics ○ Event logistics ○ Service logistics	P21: Partnership for 21st Century Skills
Level 3: Strategic Thinking	LPM 2.2 Synthesize information from textbook, print and online industry sources • Describe each of the following: ○ Transportation ○ Warehouse and storage ○ Intermodal freight transport ○ Materials handling ○ Inventory control ○ Order fulfillment ○ Inventory forecasting ○ Production planning/scheduling ○ Customer service ○ Facility location ○ Return goods handling ○ Parts and service support ○ Salvage and scrap disposal	P21: Partnership for 21st Century Skills
Level 3: Strategic Thinking	LPM 2.3 Describe tradeoffs that occur between transportation and inventory costs Example: • Drawing on examples from real products and companies, explain when it is more profitable to use more expensive transportation and maintain smaller inventory, and when it is more advantageous to use cheaper transportation and maintain larger inventories. Discuss the application of key concepts such as Just-in-Time (JIT) strategy, lean dynamics, and Kanban systems.	P21: Partnership for 21st Century Skills

Level 3: Strategic Thinking	LPM 2.4 Demonstrate the ability to calculate and explain to others the purchase cost, ordering cost, and holding cost for a given material or product within the supply chain Example: • Determine total cost as a function of other costs and demonstrate the effects on profit for a specified price and quantity.	P21: Partnership for 21st Century Skills
Level 3: Strategic Thinking	LPM 2.5 Perform inventory calculations to minimize costs as would a logistics manager for a given company • Using algebraic reasoning and appropriate units, determine the economic order quantity (EOQ) and reorder point (ROP) for a given product. Research forecasting models for the specified product and to understand how companies predict EOQ and ROP using logistics management.	P21: Partnership for 21st Century Skills

Notes

LPM 3. Students will learn warehousing practices used in logistics and management.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 3: Strategic Thinking	LPM 3.1 Compare and contrast the warehousing requirements for a variety of different products Examples: • Perishable foods • Hazardous chemicals • Large items like furniture and appliances • School supplies • Seasonal items • Subassemblies for the manufacture of a given product**.**	P21: Partnership for 21st Century Skills
Level 3: Strategic Thinking	LPM 3.2 Describe various warehouse layouts and equipment used to move materials in each	P21: Partnership for 21st Century Skills
Level 2: Skill/Concept	LPM 3.3 List categories of aisle spacing and describe the advantages and disadvantages of each	P21: Partnership for 21st Century Skills
Level 2: Skill/Concept	LPM 3.4 Demonstrate the ability to complete and interpret warehouse documents including, but not limited to, packing slips, bills of lading, advance shipment notices, distribution sheets, pick lists, invoices, special orders, and inventory forms	P21: Partnership for 21st Century Skills
Level 2: Skill/Concept	LPM 3.5. Differentiate between bulk and rack storage, and indicate situations when each is employed.	P21: Partnership for 21st Century Skills

Notes

LPM 4. Students will learn regulations associated with Logistics and Management.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 4: Extended Thinking	LPM 4.1 List international, national, state, and local agencies and organizations that regulate some part of the supply chain and the role played by each. Indicate over what areas each agency has jurisdiction Examples: • U.S. Department of Transportation (DOT) • U. S. Customs and Border Protection (CBP) • Homeland Security (HS) • Environmental Protection Agency (EPA) • Occupational Safety and Health Administration (OSHA) • World Shipping Council • United Nations, including the International Maritime Organization (IMO) • International Organization for Standardization (ISO) • World Customs Organization (WCO) • City and county laws and ordinances • State laws	P21: Partnership for 21st Century Skills
Level 3: Strategic Thinking	LPM 4.2 Analyze the impact of international trade agreements on logistics decisions	P21: Partnership for 21st Century Skills
Level 2: Skill/Concept	LPM 4.3 Research International Commercial Terms (INCOTERMS®) developed by the International Chamber of Commerce Example: • Create a table or chart to indicate what each of the three letter standard terms means by delineating the respective obligations of the buyer and seller involved in the delivery of goods from the seller to the buyer.	P21: Partnership for 21st Century Skills

Notes

LPM 5. Students will learn problem solving trends associated with Logistics and Management.

Webb Level	Sub-indicator	Integrated Content
Level 3: Strategic Thinking	LPM 5.1 Solve given problems related to transportation of goods and warehousing by evaluating data and presenting solutions or recommending appropriate decisions Example: • Use spreadsheets and/or other software in calculating "what if" scenarios as appropriate. Types of problems should include scenarios such as: a. Selecting routes and modes of transportation between a distribution center and various markets b. Calculating the carbon footprint of similar products shipped from different locations and by different modes of transportation c. Optimizing warehouse usage d. Planning for the moving and handling of hazardous goods e. Analyzing the impact of natural disasters on supply chain **f.** Developing strategies for working toward the sustainable use of specific materials and modes of transportation.	P21: Partnership for 21st Century Skills
Level 3: Strategic Thinking	LPM 5.2 Plan for the storage, movement, and delivery of a specified good or service from one location to another Examples: • Using logistics data and applying concepts learned in the course, justify the tradeoff decisions (i.e., mode of transport, holding time, delivery constraints such as fuel cost) in a proposed plan, coherently explaining the logic behind each choice as if presenting to a senior manager. • Outline a plan for fulfilling an order for a personal computer by a fixed date and transporting it through customs to a purchaser in a foreign country.	P21: Partnership for 21st Century Skills

Notes

LPM 6. Students will learn trends associated with Logistics and Management.

Webb Level	Sub-Indicator	Integrated Content
Level 3; Strategic Thinking	LPM 6.1 Analyze case studies of the logistics operations of various retail companies to see how they plan for and adjust their operations to remain competitive Example: • Compare a regional company with companies such as Amazon, WalMart, and Kroger.	P21: Partnership for 21st Century Skills
Level 4: Extended Thinking	LPM 6.2 Using websites and journals from professional organizations related to transportation, distribution and logistics, identify trends that are impacting local, regional, national, and international supply chains Examples: • Trends could include such factors as rising fuel costs, movements toward fully automated warehouses, and greening the supply chain. • Summarize research in an informative essay that includes: o description of the trend and explanation of how it affects the supply chain, o examples of how various businesses are responding to the trend, and o an outline of the information that must be considered before a business implements any change, including a formal cost-benefit analysis.	P21: Partnership for 21st Century Skills

Notes

Maintenance and Light Repair

Career Cluster	Transportation, Distribution & Logistics
Course Code	20104
Prerequisite(s)	none
Credit	0.5 or 1
Program of Study and Sequence	Any foundation course – **Maintenance and Light Repair (MLR)** – Any advanced course
Student Organization	SkillsUSA
Coordinating Work-Based Learning	NA
Industry Certifications	NA
Dual Credit or Dual Enrollment	NA
Teacher Certification	Transportation, Distribution & Logistics Cluster Endorsement; Automotive Technology Pathway Endorsement; *Automotive Technology
Resources	

Course Description:

This is an entry level course where students will learn basic maintenance procedures and safe work practices. The desire for the students to receive industry-based training at the basic level and step up to the higher level of competency in this field is the ultimate goal of this course. Students who complete this course should be able to test for their ASE certification in this field.

Program of Study Application

Maintenance and Light Repair is a cluster course in the transportation, distribution and logistics career cluster. Success in Maintenance and Light Repair will prepare a student to enter any of the pathways in the cluster.

Course Standards

MLR 1 Students will demonstrate safety practices for automotive repair.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2 Skill/Concept	MLR 1.1 Identify and demonstrate general shop safety rules and procedures using Occupational Safety and Health Administration (OSHA) standards Examples: • Examine basic shop safety using OSHA standards • Utilize proper ventilation procedures for working within the lab/shop area • Identify marked safety areas • Identify location and types of fire extinguishers and other fire safety equipment • Identify location and use of eyewash stations • Identify location of posted evacuation routes • Demonstrate knowledge of industry requirements for personal protective clothing and equipment • Identify and wear proper clothing, hair styles and jewelry for lab/shop activities • Locate and demonstrate knowledge of safety data sheets (SDS)	

Notes

MLR 2 Students will demonstrate an understanding of the safe and appropriate use of tools and equipment.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2 Skill/Concept	MLR 2.1 Utilize safe procedures for handling of tools and equipment Examples: • Identify and use proper placement of floor jacks and jack stands • Identify and use proper procedures for safe lift operation • Demonstrate knowledge of safety aspects of supplemental restraint systems (SRS), electronic brake control systems and hybrid vehicle high voltage circuits • Demonstrate awareness of the safety aspects of high voltage circuits (such as high intensity discharge [HID] lamps, ignition systems, injection systems, etc.)	

Notes

MLR 3 Students will locate needed information.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 1 – Recall	MLR 3.1 Identify sources of service information Examples: • Locate and use paper and electronic manuals P-1 • Locate and use Technical Service Bulletins (TSB) P-1 • Demonstrate awareness of special service messages, service campaigns/recalls, vehicle/service warranty applications, and service interval recommendations	• NATEF Tasks that pertain to this sub-indicator
Level 1 – Recall	MLR 3.2 Identify proper vehicle identification information Examples: • Locate vehicle identification number (VIN) and production date code P-1 • Apply knowledge of VIN information P-1 • Demonstrate awareness of other vehicle information labels (such as tire, emissions, etc.) P-1	• NATEF Tasks that pertain to this sub-indicator

Notes

MLR 4 Students will prepare vehicle for service.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 1 – Recall	MLR 4.1 Prepare vehicle for service Examples: • Identify information needed and the service requested on a repair order P-1 • Identify purpose and demonstrate proper use of fender covers and mats • Demonstrate the use of the three C's (concern, cause, and correction) • Review vehicle service history P-1 • Complete work order with appropriate information P-1	• NATEF Tasks that pertain to this sub-indicator

Notes

MLR 5 Students will prepare vehicle for customer.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2 Skill/Concept	MLR 5.1 Ensure vehicle is prepared to return to the customer per school/company policy Example: • Inspect vehicle after repair and remove protective covers	• NATEF Tasks that pertain to this sub-indicator

Notes

MLR 6 Students will perform basic vehicle service.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2 Skill/Concept	MLR 6.1 Perform basic vehicle service Examples: • Determine fluid type requirements and identify fluid P-1 • Check and adjust engine oil P-1 • Check and adjust engine coolant level P-1 • Check and adjust power steering fluid level P-1 • Check and adjust brake fluid level P-1 • Check and adjust windshield washer fluid level • Check and adjust differential /transfer case fluid level P-1 • Check and adjust transmission fluid level P-1 • Check and replace wiper blades • Inspect drive belts, tensioners, and pulleys; check pulley and belt alignment P-1 • Inspect and replace air filter P-1 • Check and adjust tire air pressure P-1 • Inspect exhaust system P-1	• NATEF Tasks that pertain to this sub-indicator

Notes

MLR 7 Students will inspect and repair engine.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2 Skill/Concept	MLR 7.1 Test and perform actions necessary to repair engine Examples: • Demonstrate knowledge of four-cycle engine P-1 • Inspect engine assembly for fuel, oil coolant and other leaks; determine necessary action P-1 • Perform cooling system pressure tests; test coolant condition; inspect and test radiator, pressure cap, coolant recovery tank and hoses; perform necessary action P-1 • Test cooling system for the presence of combustion gases P-1 • Drain and recover coolant; flush and refill cooling system with recommended coolant; bleed air as required P-1 • Perform oil and filter change; reset oil life monitoring system where applicable P-1 • Remove and replace radiator; replace radiator hoses • Inspect powertrain mounts; determine necessary action P-1	• NATEF Tasks that pertain to this sub-indicator

Notes

MLR 8 Students will service an automatic transmission.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2 Skill/Concept	MLR 8.1 Service transmission system Examples: • Drain automatic transmission fluid P-1 • Visually inspect the amount of debris in oil pan P-1 • Remove filter and install new filter. P-1 • Install the proper fluid to the proper level P-1	• NATEF Tasks that pertain to this sub-indicator

Notes

MLR 9 Students will inspect, diagnose and repair manual drive train and axles.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2 Skill/Concept	MLR 9.1 Diagnose and repair manual drive train and axles Examples: • Diagnose fluid loss, level, and condition concerns; determine necessary action. P-1 • Drain and fill transmission/transaxle and final drive unit P-1 • Identify and inspect clutch pedal linkage, cables, automatic adjuster mechanisms, brackets, bushings, pivots, and springs; determine necessary action P-1 • Identify and inspect hydraulic clutch slave and master cylinders, lines and hoses; determine necessary action. P-1 • Bleed clutch hydraulic system • Inspect constant velocity (CV) joint boots P-1 • Remove and replace rear wheel drive shaft P-1	• NATEF Tasks that pertain to this sub-indicator

Notes

MLR 10 Students will repair suspension and steering.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2 Skill/Concept	MLR 10.1 Diagnose suspension and steering; determine necessary action. Examples: • Determine proper power steering fluid types P-1 • Flush, fill and bleed power steering system P-1 • Diagnose power steering fluid leakage; determine necessary action. P-1 • Lubricate suspension and steering systems P-1 • Inspect, remove and replace shock absorbers P-1 • Inspect and install stabilizer bar bushings, brackets, and links. P-1 • Inspect and install strut cartridge or assembly, coil spring, insulators (silencers), and upper strut mount P-1 • Perform pre-alignment inspection and measure vehicle ride height; determine necessary action P-1 • Demonstrate knowledge of the principles of steering geometry using caster, camber and toe P-1	• NATEF Tasks that pertain to this sub-indicator
Level 2 Skill/Concept	MLR 10.2 Inspect and repair tire and wheel assembly Examples: • Diagnose tire wear patterns; determine necessary action P-1 • Diagnose wheel/tire vibration, shimmy, and noise; determine necessary action P-1 • Identify vehicles equipped with a tire pressure monitoring system (TPMS) P-1 • Demonstrate knowledge of service considerations of vehicles equipped with a TPMS P-1 • Rotate tires according to manufacturer's recommendations. P-1 • Balance wheel and tire assembly (static and dynamic) P-1 • Dismount, inspect, and remount tire on wheel P-1 • Repair tire using internal patch P-1 • Reinstall wheel; torque lug nuts P-1	• NATEF Tasks that pertain to this sub-indicator

Notes

MLR 11 Students will inspect, diagnose and repair brake assembly.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2 Skill/Concept	MLR 11.1 Diagnose and repair brake fluid system Examples: • Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging or wear; tighten loose fittings and support; determine necessary action P-1 • Select, handle, and fill brake fluids to proper level P-1 • Bleed brake system P-1 • Test brake fluid for contamination; determine necessary action P-1	• NATEF Tasks that pertain to this sub-indicator
Level 2 Skill/Concept	MLR 11.2 Inspect and repair brake shoes and drum assemblies Examples: • Remove, clean, inspect and measure brake drums; determine necessary action P-1 • Refinish brake drum; measure final drum diameter P-1 • Remove, clean, inspect brake shoes, springs, pins, clips, levers, adjuster/self-adjuster, other related brake hardware, and backing support plates; lubricate and reassemble P-1 • Inspect and install wheel cylinders P-1 • Pre-adjust brake shoes and parking brake; install brake drums or drum/hub assemblies and wheel bearings P-1 • Install wheel, torque lug nuts, and make final checks and adjustments P-1	• NATEF Tasks that pertain to this sub-indicator
Level 2 Skill/Concept	MLR 11.3 Inspect and repair caliper assembly Examples: • Remove caliper assembly; inspect for leaks and damage to caliper housing; determine necessary action P-1 • Clean and inspect caliper mounting and slides/pins for wear, operation and damage; determine necessary action P-1 • Remove, inspect and replace pads and retaining hardware; determine necessary action P-1 • Reassemble, lubricate, and reinstall caliper, pads and related hardware; seat pads and inspect for leaks P-1	• NATEF Tasks that pertain to this sub-indicator

Level 2 Skill/Concept	MLR 11.4 Inspect and repair rotor assembly Examples: • Clean, inspect and measure rotor thickness, lateral runout and thickness variation; determine necessary action P-1 • Remove and reinstall rotor P-1 • Refinish rotor on vehicle; measure final rotor thickness P-1 • Refinish rotor off vehicle; measure final rotor thickness P-1 • Install wheel. Torque lug nuts and make final checks and adjustments P-1	• NATEF Tasks that pertain to this sub-indicator
Level 1 – Recall	MLR 11.5 Inspect and repair vacuum supply Examples: • Check vacuum supply (manifold or auxiliary pump) to vacuum-type power booster P-1 • Inspect vacuum-type power booster unit for leaks; inspect the check valve for proper operation; verify proper booster function P-1 • Demonstrate knowledge of the causes of wheel bearing noises, wheel shimmy and vibration concerns P-1 • Check parking brake cables and components for wear, binding and corrosion; clean, lubricate, adjust or replace as needed. P-1	• NATEF Tasks that pertain to this sub-indicator
Level 2 Skill/Concept	MLR 11.6 Inspect and repair brake indicator light components Example: • Check parking brake and indicator light system operation; determine necessary action P-1 • Check operation of brake stop light system; determine necessary action P-1 • Replace tapered roller wheel bearing and race P-1 • Clean, inspect, lubricate, install and adjust wheel bearing P-1 • Identify and inspect electronic brake control system components; determine necessary action P-1 • Demonstrate knowledge of the operation of the brake hydraulic failure warning light P-1	• NATEF Tasks that pertain to this sub-indicator

Notes

MLR 12 Students will inspect, test and repair electrical/electronic systems.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 1 – Recall	MLR 12.1 Diagnose electrical circuit problems Examples: • Diagnose electrical/electronic integrity of series, parallel and series-parallel circuits using principles of electricity (Ohm's Law) P-1 • Demonstrate use of wiring diagrams during diagnosis of electrical circuit problems. P-1 • Demonstrate the proper use of a digital multimeter (DMM) during diagnosis of electrical circuit problems, including source voltage, voltage drop, current flow and resistance P-1 • Check electrical circuits with a test light; determine necessary action P-1 • Check electrical circuits using fused jumper wires; determine necessary action P-1 • Demonstrate knowledge of the causes and effects of shorts, grounds, opens and resistance problems in electrical/electronic circuits P-1 • Measure key-off battery drain (parasitic draw); determine necessary action P-1 • Inspect and test fusible links, circuit breakers and fuses; determine necessary action P-1 • Inspect and test switches, connectors, relays and wires of electrical/electronic circuits P-1 • Repair connectors and terminal ends P-1 • Perform solder repair of electrical wiring P-1	• NATEF Tasks that pertain to this sub-indicator
Level 2 Skill/Concept	MLR 12.2 Inspect and repair battery problems Examples: • Perform battery state-of-charge test; determine necessary action P-1 • Perform battery capacity test; confirm proper battery capacity for vehicle application; determine necessary action P-1 • Maintain or restore electronic memory functions P-1 • Inspect, clean, fill, and/or replace battery, battery cables, connectors, clamps and hold-downs P-1	• NATEF Tasks that pertain to this sub-indicator

	• Perform battery charge P-1 • Start a vehicle using jumper cables and a battery or auxiliary power supply. P-1	
Level 2 Skill/Concept	MLR 12.3 Diagnose and repair starter Examples: • Perform starter current draw tests; determine necessary action P-1 • Perform starter circuit voltage drop tests; determine necessary action P-1 • Inspect and test starter relays and solenoids; determine necessary action. P-1 • Remove and replace starter P-1	• NATEF Tasks that pertain to this sub-indicator
Level 2 Skill/Concept	MLR 12.4 Diagnose and repair charging system Examples: • Perform charging system output test; determine necessary action. P-1 • Remove and replace generator (alternator) P-1 • Diagnose the cause of dim, or no light operation; determine necessary action. P-1 • Inspect, replace, and aim headlights and bulbs P-1	• NATEF Tasks that pertain to this sub-indicator

Notes

MLR 13 Students will inspect, diagnose and repair heating and air conditioning.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2 Skill/Concept	MLR 13.1 Identify and visually inspect A/C system components Examples: • Locate refrigerant label and identify specified refrigerant type (e.g., R-12, R-134a) P-1 • Conduct preliminary performance test of A/C system and determine necessary action P-1 • Conduct performance test of the heater/ventilation system P-1 • Inspect and replace cabin air filter P-1	• NATEF Tasks that pertain to this sub-indicator

Notes

MLR 14 Students will inspect, diagnose and improve engine performance.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2 Skill/Concept	MLR 14.1 Perform the necessary tests and repairs to improve engine performance Examples: • Perform engine cranking and running vacuum tests; determine necessary action P-1 • Perform cylinder power balance test; determine necessary action P-1 • Perform cylinder cranking compression test; determine necessary action. P-1 • Perform cylinder leakage test; determine necessary action**.** P-1 • Verify engine operating temperature; determine necessary action P-1 • Retrieve and record stored diagnostic trouble codes, On-Board Diagnostics (OBD) monitor status and freeze frame data; clear codes when applicable P-1 • Obtain and interpret scan tool data. P-1 • Perform fuel pressure test P-1 • Replace fuel filters. P-1 • Remove and replace secondary ignition components P-1 • Remove and replace thermostat and gasket/seal P-1 • Perform common fastener and thread repair, to include: removing broken bolt, restoring internal and external threads, and repairing internal threads with a threaded insert P-1	• NATEF Tasks that pertain to this sub-indicator

Notes

MLR 15 Students explore career opportunities in the transportation, distribution and logistics career cluster and develop leadership skills.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 1 – Recall	MLR 15.1 Research career opportunities in the transportation, distribution and logistics (TD&L) fields Examples: • Utilizing career exploration software, research and write a report on career opportunities in the TD&L field • Utilizing career exploration software, research educational requirements for a chosen career path • Utilizing career exploration software, update the student's portfolio	SD MyLife

Notes

Nonstructural Analysis and Damage Repair

Career Cluster	Transportation, Distribution & Logistics
Course Code	20115
Prerequisite(s)	Introduction to Auto Body and Estimating 20120
Credit	1
Program of Study and Sequence	Intro to Auto Body & Estimating – **Nonstructural Analysis and Damage Repair –**Structural Analysis and Damage Repair
Student Organization	SkillsUSA
Coordinating Work-Based Learning	Youth Internships and industry field trips.
Industry Certifications	ASE (Automotive Service Excellence) OSHA 10 (Occupational Safety and Health Administration)
Dual Credit or Dual Enrollment	NA
Teacher Certification	Transportation, Distribution & Logistics Cluster Endorsement; Autobody Technology Pathway Endorsement; *Autobody Technology
Resources	

Course Description:

Non-Structural Analysis and Damage Repair is for students who wish to obtain in-depth knowledge and skills in procedures for non-structural repairs in preparation for postsecondary training and careers as collision repair technicians. Upon completion of this course, proficient students will be able to analyze non-structural collision damage and write and revise repair plans. Students will read and interpret technical texts to determine, understand, and safely perform appropriate repair techniques and procedures. Standards in this course include preparing vehicles for repair, removing and replacing panels and body components, metal finishing, body filling, removing and replacing moveable glass and hardware, metal welding and cutting, and repair of plastics.

Program of Study Application

Non-Structural Analysis and Damage Repair is an advanced pathway course in the Transportation, Distribution and Logistics career cluster, Automotive Body Collision and Refinishing pathway.

Course Standards

NA 1 Students will demonstrate understanding of auto body safety precautions.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	NA 1.1 Demonstrate auto body technology safety practices Examples: • Select and use proper personal safety equipment; take necessary precautions with hazardous operations and materials in accordance with federal, state, and local regulations. HP-I • Locate procedures and precautions that may apply to the vehicle being repaired. HP-I • Identify vehicle system hazard types (supplemental restraint system (SRS), hybrid/electric/alternative fuel vehicles), locations and recommended procedures before inspecting or replacing components. HP-I • Select and use a National Institute of Occupational Safety and Health (NIOSH) approved air purifying respirator, Inspect condition and hazardous operations and materials in accordance with federal, state, and local regulation (e.g. OSHA Standard 1910.134) and applicable state and local regulation. HP-I	• National Automotive Technicians Education Foundation (NATEF) tasks that pertain to this sub-indicator. • Occupational Safety and Health Administration – OSHA 10

Notes: HP-I – High Priority Individual and HP-G – High Priority Group

NA 2 Students will learn and demonstrate preparation for nonstructural repair.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	NA 2.1 Analyze and demonstrate processes involved in preparation for nonstructural inspection and repair Examples: • Review damage report and analyze damage to determine appropriate methods for overall repair; develop and document a repair plan. HP-I • Inspect, remove, label, store, and reinstall exterior trim and moldings. HP-I • Inspect, remove, label, store, and reinstall interior trim and components. HP-I • Inspect, remove, label, store, and reinstall body panels and components that may interfere with, or be damaged during, repair. HP-I • Inspect, remove, protect label, store, and reinstall vehicle mechanical and electrical components that may interfere with, or be damaged during, repair. HP-G • Protect panels, glass, interior parts, and other vehicles adjacent to the repair area. HP-I • Soap and water wash entire vehicle; complete pre-repair inspection checklist. HP-I • Prepare damaged area using water-based and solvent-based cleaners. HP-I • Remove corrosion protection, undercoatings, sealers, and other protective coatings as necessary to perform repairs. HP-I • Inspect, remove, and reinstall repairable plastics and other components for off-vehicle repair. HP-I	• NATEF tasks that pertain to this sub-indicator.

Notes

NA 3 Students will learn and demonstrate procedures for outer body panel repairs, replacements and adjustments.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	NA 3.1 Demonstrate the processes involved in outer body panel repairs, replacements, and adjustments Examples: • Inspect/locate direct, indirect, or hidden damage and direction of impact. HP-I • Inspect, remove, replace, and align hood, hood hinges, and hood latch. HP-I • Inspect, remove, replace, and align deck lid, lid hinges, and lid latch. HP-I • Inspect, remove, replace, and align doors, latches, hinges, and related hardware. HP-I • Inspect, remove, replace and align tailgates, hatches, liftgates and sliding doors. HP-G • Inspect, remove, replace, and align bumpers, covers, reinforcements, guards, impact absorbers, and mounting hardware. HP-I • Inspect, remove, replace and align fenders, and related panels. HP-I • Restore corrosion protection during and after the repair. HP-I • Restore sound deadeners and foam materials. HP-G • Diagnose and repair water leaks, dust leaks, and wind noise. HP-G	• NATEF tasks that pertain to this sub-indicator.

Notes

NA 4 Students will perform metal finishing and body filling.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	NA 4.1 Understand and demonstrate the processes involved in metal finishing and body filling Examples: • Prepare a panel for body filler by abrading or removing the coatings; featheredge and refine scratches before the application of body filler. HP-I • Locate and repair surface irregularities on a damaged body panel using power tools, hand tools, and weld-on pulling attachments. HP-I • Demonstrate hammer and dolly techniques. HP-I • Heat shrink stretched panel areas to proper contour. HP-G • Cold shrink stretched panel areas to proper contour. HP-I • Identify body filler defects; correct the cause and condition (pinholing, ghosting, staining, over catalyzing, etc.). HP-I • Identify different types of body fillers. HP-G • Shape body filler to contour; finish sand. HP-I • Straighten contours of damaged panels to a suitable condition for body fillings or metal finishing using power tools, hand tools, and weld-on pulling attachments. HP-I	• NATEF tasks that pertain to this sub-indicator.

Notes

NA 5 Students will demonstrate service procedures for moveable glass and hardware.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	NA 5.1 Understand and demonstrate proper repair procedures for moveable glass and hardware Examples: • Inspect, adjust, repair or replace window regulators, run channels, glass, power mechanisms, and related controls. HP-I • Inspect, adjust, repair, remove, reinstall or replace weather-stripping. HP-G • Inspect, repair or replace, and adjust removable power operated roof panel and hinges, latches, guides, handles, retainer, and controls of sunroofs. HP-G • Initialize electrical components as needed. HP-G	• NATEF tasks that pertain to this sub-indicator.

Notes

NA 6 Students will demonstrate plastic repair.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	NA 6.1 Understand and demonstrate repair processes and use of adhesives involved in plastic repair Examples: • Identify the types of plastic; determine reparability. HP-I • Clean and prepare the surface of plastic parts; identify the types of plastic repair procedures. HP-I • Repair rigid, semi-rigid, and flexible plastic panels. HP-I • Remove or repair damaged areas from rigid exterior composite panels. HP-G • Replace bonded rigid exterior composite body panels; straighten or align panel supports. HP-G	• NATEF tasks that pertain to this sub-indicator.

Notes

Structural Analysis and Damage Repair

Career Cluster	Transportation, Distribution & Logistics
Course Code	20117
Prerequisite(s)	Introduction to Auto Body & Estimating 20120
Credit	.5-1
Program of Study and Sequence	Introduction to Auto Body & Estimating – **Structural Analysis and Damage Repair** – Auto Body Painting & Refinishing
Student Organization	Skills USA
Coordinating Work-Based Learning	Youth Internships, Industry Guest Speakers and Tour of Local Industries.
Industry Certifications	Automotive Service of Excellence (ASE) and Occupational Safety and Health Administration (OSHA) 10
Dual Credit or Dual Enrollment	NA
Teacher Certification	Transportation, Distribution & Logistics Cluster Endorsement; Autobody Technology Pathway Endorsement; *Autobody Technology
Resources	

Course Description:

Students will measure and repair structural and frame damage. The desire for the students to receive industry based training at the basic level and step up to higher level of competency in this field is the ultimate goal of this course.

Program of Study Application

Structural Analysis and Damage Repair is an advanced pathway course in the Transportation, Distribution and Logistics career cluster, Automotive Body Collision and Refinishing pathway.

Course Standards

SA 1 Students will demonstrate auto body technology safety practices.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	SA 1.1 Demonstrate auto body technology safety practices Examples: • Select and use proper personal safety equipment; take necessary precautions with hazardous operations and materials in accordance with federal, state, and local regulations. HP-I • Locate procedures and precautions that may apply to the vehicle being repaired. HP-I • Identify vehicle system hazard types (supplemental restraint system (SRS), hybrid/electric/alternative fuel vehicles), locations and recommended procedures. HP-I • Inspect or replace components. HP-I • Select and use a National Institute of Occupational Safety and Health (NIOSH) approved air purifying respirator. • Inspect condition and hazardous operations and materials in accordance with federal, state, and local regulation (e.g. OSHA Regulation 1910.134) and applicable state and local regulation. HP-I	• National Automotive Technicians Education Foundation (NATEF) Tasks that pertain to this indicator. • OSHA 10

Notes: HP-I – High Priority Individual and HP-G – High Priority Group

SA 2 Students will inspect and repair frames.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	SA 2.1 Measure and analyze structural damage Examples: • Measure and diagnose structural damage using a tram gauge. HP-I • Analyze mash, sag, side sway, twist, and diamond damage. HP-G • Identify heat limitations and monitoring procedures for structural components. HP-G • Measure and diagnose structural damage using a three-dimensional measuring system (mechanical, electronic, laser) etc. HP-G • Determine the extent of direct and indirect damage and the direction of impact; document the methods and sequence of repair. HP-I • Analyze and identify crush/collapse zones. HP-I	• NATEF Tasks that pertain to this indicator.
Level 2: Skill/Concept	SA 2.2 Make necessary repairs to the frame Examples: • Attach vehicle to anchoring devices. HP-G • Demonstrate an understanding of structural foam applications. HP-G	• NATEF Tasks that pertain to this indicator.

Notes

SA 3 Students will inspect, measure and repair unibody and unitized structures.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	SA 3.1 Analyze and determine unibody and unitized structural damage Examples: • Measure and diagnose unibody damage using a tram gauge. HP-I • Measure and diagnose unibody vehicles using a dedicated (fixture) measuring system. HP-G • Diagnose and measure unibody vehicles using a three-dimensional measuring system (mechanical, electronic, and laser etc.). HP-G • Determine the extent of the direct and indirect damage and the direction of impact; plan and document the methods and sequence of repair. HP-I • Analyze and identify crush/collapse zones. HP-I	• NATEF Tasks that pertain to this indicator.
Level 2: Skill/Concept	SA 3.2 Repair unibody and unitized structures Examples: • Attach anchoring devices to vehicle; remove or reposition components as necessary. HP-I • Identify proper cold stress relief methods. HP-I • Determine sectioning procedures of a steel body structure. HP-I • Remove and replace damaged structural components. HP-G • Restore corrosion protection to repaired or replaced structural areas and anchoring locations. HP-I	• NATEF Tasks that pertain to this indicator.

Notes

SA 4 Students will inspect and repair or replace stationary glass.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	SA 4.1 Inspect vehicles for glass damage and determine manufacturer's specifications for glass window replacement Examples: • Identify considerations for removal, handling, and installation of advanced glass systems (rain sensors, navigation, cameras, and collision avoidance systems). HP-G • Remove and reinstall or replace modular glass using recommended materials. HP-G • Check for water leaks, dust leaks, and wind noise. HP-G	• NATEF Tasks that pertain to this indicator.

Notes

SA 5 Students will demonstrate proficiency in welding, cutting and joining.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 1: Recall	SA 5.1 Analyze and identify correct welding procedures to be used in auto body repair work Examples: • Identify the considerations for cutting, removing, and welding various types of steel, aluminum, and other metals. HP-G • Determine the correct Gas Metal Arc Welding (GMAW) welder type, electrode/wire type, diameter, and gas to be used in a specific welding situation. HP-I • Identify hazards, foam coatings and flammable materials prior to welding/cutting procedures. HP-G • Determine the joint type (butt weld with backing, lap, etc.) for weld being made. HP-I • Determine the type of weld (continuous, stitch weld, plug, etc.) for each specific welding operation. HP-I • Identify different methods of attaching structural components (squeeze type resistance spot welding, riveting, structural adhesive, Metal Inert Gas (MIG) bronze, etc.)	• NATEF Tasks that pertain to this indicator
Level 2: Skill/Concept	SA 5.2 Perform proper welding operations to specific auto body repairs Examples: • Set up attach work clamp (ground) and adjust the GMAW welder to "tune" for proper electrode stickout, voltage, polarity, flow rate, and wire-feed speed required for the substrate being welded. HP-I • Store, handle, and install high-pressure gas cylinders; test for leaks. HP-1 • Determine the proper angle of the gun to the joint and direction of gun travel for the type of weld being made. HP-I • Protect adjacent panels, glass, vehicle interior, etc. from welding and cutting operations. HP-I • Clean and prepare the metal to be welded, assure good metal fit-up, apply weld through primer if necessary, clamp or tack as required. HP-I • Perform the following welds: plug, butt weld with and without	• NATEF Tasks that pertain to this indicator

	backing, and fillet, in the flat, horizontal, vertical and overhead positions. HP-I • Perform visual evaluation and destructive test on each weld type. HP-I • Identify the causes of various welding defects; make necessary adjustments. HP-I • Identify cause of contact tip burn-back and failure of wire to feed; make necessary adjustments. HP-I • Identify cutting process for different substrates and locations; perform cutting operation. HP-I	

Notes