south dakota DEPARTMENT OF EDUCATION
Learning. Leadership. Service.

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	1.0
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	SkillsUSA
Coordinating Work-Based Learning	N/A
Industry Certifications	Automotive Service Excellence (ASE) Student Certification
Dual Credit or Dual Enrollment	See: https://sdmylife.com/images/Approved-CTE-Dual-Credit.pdf
Teacher Certification	Transportation, Distribution & Logistics Cluster Endorsement
Resources	N/A

Course Description
Students in this course will learn theory and operation as well as diagnosis and repair of brake systems and manual drivetrains. 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 include what students may test for ASE (Automotive Service Excellence) certification). Course standards are based on the Maintenance and Light Repair (MLR) standards for ASE MLR.

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*
Two 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

AB 2: Students will demonstrate knowledge of brake system theory and procedure.	
Webb Level	*Sub-indicator*
Two Skills/Concepts	AB 2.1 Analyze and diagnose automotive brake hydraulic and friction systems. ● Identify and interpret brake system concerns; determine needed action ● Research vehicle service information including fluid type, vehicle service history, service precautions, and technical service bulletins ● Describe procedure for performing a road test to check brake system operation including an anti-lock brake system (ABS) ● Identify brake system components and configuration

AB 3: Students will demonstrate knowledge and procedure of the hydraulic brake system.	
Webb Level	*Sub-indicator*
Three Strategic Thinking	AB 3.1 Analyze and draw conclusions concerning malfunctions of brake hydraulic systems. ● Diagnose pressure concerns in the brake system using hydraulic principles (Pascal's Law) ● Check master cylinder for internal/external leaks and proper operation; determine needed action ● Identify components of hydraulic brake warning light system ● Diagnose poor stopping, pulling or dragging concerns caused by malfunctions in the hydraulic system; determine needed action
Two Skills/Concepts	AB 3.2 Apply repair skills to correct malfunctions of brake hydraulic systems. ● Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging, wear, and loose fittings/supports; determine needed action ● Remove, bench bleed, and reinstall master cylinder ● Replace brake lines, hoses, fittings, and supports ● Fabricate brake lines using proper material and flaring procedures (double flare and ISO types) ● Select, handle, store, and fill brake fluids to proper level; use proper fluid type per manufacturer specification ● Inspect, test, and/or replace components of brake warning light system ● Bleed and/or flush brake system

	● Test brake fluid for contamination ● Measure brake pedal height, travel, and free play (as applicable); determine needed action

AB 4: Students will demonstrate knowledge of theory and repair procedures for drum brake systems.	
Webb Level	*Sub-indicator*
Three Strategic Thinking	AB 4.1 Assess and evaluate operation of drum brake systems. ● Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging or pedal pulsation concerns; determine needed action
Two Skill/Concept	AB 4.2 Repair drum brake systems. ● Remove, clean, and inspect brake drum; measure brake drum diameter; determine serviceability ● Refinish brake drum and measure final drum diameter; compare with manufacturer's specification ● 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 ● Inspect wheel cylinders for leaks and proper operation; remove and replace as needed ● Pre-adjust brake shoes and parking brake; install brake drums or drum/hub assemblies and wheel bearings; perform final checks and adjustments

AB 5: Students will demonstrate knowledge of theory and repair procedures for disc brake systems.	
Webb Level	*Sub-indicator*
Three Strategic Thinking	AB 5.1 Assess and evaluate operation of disc brake systems. ● Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging, or pulsation concerns; determine needed action ● Inspect caliper mounting and slides/pins for proper operation, wear, and damage; determine needed action ● Describe importance of operating vehicle to burnish/break-in replacement brake pads according to manufacturer's recommendations
Two Skill/Concept	AB 5.2 Repair disc brake systems. ● Remove, inspect, and/or replace brake pads and retaining hardware; determine needed action ● Lubricate and reinstall caliper, brake pads, and related hardware; seat brake pads; inspect for leaks ● Clean and inspect rotor and mounting surface; measure rotor thickness, thickness variation, and lateral runout; determine needed action ● Remove and reinstall/replace rotor ● Refinish rotor on vehicle; measure final rotor thickness and compare with specification ● Refinish rotor off vehicle; measure final rotor thickness and compare with specification ● Retract and re-adjust caliper piston on an integrated parking brake system.

	● Check brake pad wear indicator; determine needed action ● Remove and clean caliper assembly; inspect for leaks, damage, and wear; determine needed action

AB 6: Students will demonstrate knowledge of theory and repair procedures for power assist units.	
Webb Level	*Sub-indicator*
Two Skill/Concept	AB 6.1 Analyze power-assist units. ● Check brake pedal travel with and without engine running to verify proper power booster operation ● Identify components of the brake power assist system (vacuum and hydraulic); check vacuum supply (manifold or auxiliary pump) to vacuum-type power booster

AB 7: Students will demonstrate knowledge of theory and repair procedures for related systems – Wheel Bearings, Parking Brakes and Electrical.	
Webb Level	*Sub-indicator*
Two Skill/Concept	AB 7.1 Diagnose related systems (i.e., wheel bearings, parking brakes, electrical). ● Diagnose wheel bearing noises, wheel shimmy, and vibration concerns; determine needed action ● Check parking brake system components for wear, binding, and corrosion; clean, lubricate, adjust and/or replace as needed ● Check parking brake operation and parking brake indicator light system operation; determine needed action ● Check operation of brake stop light system
Two Skill/Concept	AB 7.2 Repair related systems. ● Replace wheel bearing and race ● Inspect and replace wheel studs ● Remove, reinstall, and/or replace sealed wheel bearing assembly ● Remove, clean, inspect, repack, and install wheel bearings; replace seals; install hub and adjust bearings

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*
Two Skill/Concept	AB 8.1 Diagnose Electronic Brake Control Systems: ABS, TCS and ESC Systems ● Identify and inspect electronic brake control system components (ABS, TCS, ESC); determine needed action. ● 2. Describe the operation of a regenerative braking system

AB 9: Students will demonstrate knowledge of theory and repair procedures for manual drivetrain and axles.	
Webb Level	*Sub-indicator*
One Recall and Reproduction	AB 9.1 Identify manual transmission information. ● Research vehicle service information including fluid type, vehicle service history, service precautions, and technical service bulletins

	● Identify manual drivetrain and axle components and configuration
Two Skill/Concept	AB 9.2 Perform general maintenance procedures. ● Drain and refill manual transmission/transaxle and final drive unit; use proper fluid type per manufacturer's specification ● Check fluid condition; check for leaks

AB 10: Students will perform maintenance procedures for hydraulic clutches.	
Webb Level	*Sub-indicator*
Two Skill/Concept	AB 10.1 Check clutch hydraulic system. ● Check and adjust clutch master cylinder fluid level; use proper fluid type per manufacturer specification ● Check for hydraulic system leaks

AB 11: Students will define the operation of electronic manual transmission/transaxle.	
Webb Level	*Sub-indicator*
One Recall and Reproduction	AB 11.1 Research Manual Transmission/Transaxle. ● Describe the operational characteristics of an electronically controlled manual transmission/transaxle

AB 12: Students will inspect, diagnose, and perform repair procedures for drivetrain components.	
Webb Level	*Sub-indicator*
One Recall and Reproduction	AB 12.1 Inspect, diagnose, and repair drive shaft, half shafts, universal joints and constant-velocity (CV) joints. ● Inspect, remove, and/or replace bearings, hubs, and seals ● Inspect, service, and/or replace shafts, yokes, boots, and universal/CV joints ● Inspect locking hubs ● Check for leaks at drive assembly and transfer case seals; check vents; check fluid level; use proper fluid type per manufacturer specification

AB 13: Students will inspect, diagnose, and perform repair procedures for the differential assembly.	
Webb Level	*Sub-indicator*
Two Skill/Concept	AB 13.1 Perform maintenance on differential case assembly. ● Clean and inspect differential case; check for leaks; inspect housing vent ● Check and adjust differential case fluid level; use proper fluid type per manufacturer's specification ● Drain and refill differential housing ● Inspect and replace drive axle wheel studs

AB 14: Students will understand and apply appropriate business practices.	
Webb Level	*Sub-indicator*
Three Strategic Thinking	AB 14.1 Demonstrate the importance of, and the procedures for, maintaining accurate records.
Three	AB 14.2 Understand the concept and application of ethical business practices.

Strategic Thinking	
Three Strategic Thinking	AB 14.3 Understand the concept and application of excellent customer relations practices.