



ILLINOIS VALLEY COMMUNITY COLLEGE

COURSE OUTLINE

DIVISION: Workforce Development

COURSE: ATO 2270 Automotive Service

Date: Spring 2022

Credit Hours: 4

Complete all that apply or mark "None" where appropriate:

Prerequisite(s): ATO 1210, 1220, 1240, 1250, 1260, 2200, 2210, 2220, 2230

Enrollment by assessment or other measure? Yes No

If yes, please describe:

Corequisite(s): None

Pre- or Corequisite(s): None

Consent of Instructor: Yes No

Delivery Method: **Lecture** 1 Contact Hours (1 contact = 1 credit hour)
 Seminar 0 Contact Hours (1 contact = 1 credit hour)
 Lab 6 Contact Hours (2-3 contact = 1 credit hour)
 Clinical 0 Contact Hours (3 contact = 1 credit hour)
 Online
 Blended
 Virtual Class Meeting (VCM)

Offered: **Fall** **Spring** **Summer**

CATALOG DESCRIPTION and IAI NUMBER (if applicable):

This course is designed to provide an on-the-job type experience to the advanced automotive student. The student will be given selected vehicles to diagnose and repair using knowledge acquired from previous automotive classes. The student may choose to specialize in one area or perform services in all areas much like the general automotive technician. This course will prepare the student for an entry-level job in the automotive service industry.

ACCREDITATION STATEMENTS AND COURSE NOTES:

The Automotive Technology program at Illinois Valley Community College is a ASE Education Foundation Master Certified Automotive Technology Program.

The program goes through an on-site evaluation every five years and the ASE Education Foundation tasks that are taught in this course are also updated every five years to align with any changes made by the ASE Education Foundation national automotive advisory council.

COURSE TOPICS AND CONTENT REQUIREMENTS:

Employee Responsibilities

- A. Good attitude
 - 1. Be positive
 - 2. Be responsible
 - 3. Accept criticism
 - 4. Learn from your mistakes
 - 5. 100% effort

- B. Proper attire
 - 1. Clean Uniform
 - 2. Steel toed Shoes
 - 3. Safety Glasses

- C. Work habits
 - 1. Keep your work area clean
 - 2. Don't let your work area become cluttered
 - 3. Always use common sense
 - 4. Safety First!
 - 5. Protect customer vehicle (Fender covers, floor mats, etc)

II. Interview Customers

- A. Filling out the Repair Order
 - 1. Customers full name, address and phone number
 - 2. Complaint or Service Desired
 - 3. Test Drive – Verify customer complaint
 - 4. Describe problem in detail
 - 5. Estimate
 - 6. Customers Signature

III. Estimating Repair Costs

- A. Look up Flat Rate.
- B. Estimate actual time needed to complete repair
- C. Additional Costs
 - 1. Disposal Fee's
 - 2. Diagnostic Fee's
 - 3. Chemicals
 - 4. Fee's for unknown problems (Broken bolts, etc.)
 - 5. Sublet repairs
- D. Call parts store for price and availability of parts needed.
- E. Calculate customers cost for part (Mark-up)

- F. Add labor and parts cost to determine total for estimate.
- G. Present to customer and explain costs
- H. Customers Signature

IV. Dealing with irate customers

- A. Stay Calm
- B. Allow the customer to vent his/her frustrations
- B. Don't argue with the customer
- C. Don't take anything the customer says personally
- D. Focus your statements on the real problem
 - 1. Summarize why the customer is angry
 - 2. Ask the customer to agree with your assessment
- E. If the problem was caused by the service facility
 - 1. Offer an immediate apology
- F. Provide a solution or several options to rectify the problem.
- G. Ask the customer to suggest a solution to the problem or to choose an option suggested.

INSTRUCTIONAL METHODS:

- 1. Lecture
- 2. Videos
- 3. Power point presentations
- 4. Demonstration of lab procedures
- 5. Lab practice (hands on)
- 5. Case Studies

EVALUATION OF STUDENT ACHIEVEMENT:

- 1. Punctuality
- 2. Attendance
- 3. Work Habits
- 4. Safety & Safety Practices
- 5. Ability to Produce Quality Work
- 6. Quantity of Work (productivity)
- 7. Time Use Effectiveness (efficiency)
- 8. Attitude
- 9. Ability and Willingness to Follow Directions
- 10. Appearance and Relationships
- 11. Pass all written tests and quizzes (60% minimum)

INSTRUCTIONAL MATERIALS:

Textbooks

- 1. Electude Online software
- 2. S/P 2 – Online Safety Software

Resources

- 1. Pro-Demand – Information System
- 2. All Data Pro - Information System

LEARNING OUTCOMES AND GOALS:

Institutional Learning Outcomes

- 1) Communication – to communicate effectively;
- 2) Inquiry – to apply critical, logical, creative, aesthetic, or quantitative analytical reasoning to formulate a judgement or conclusion;
- 3) Social Consciousness – to understand what it means to be a socially conscious person, locally and globally;
- 4) Responsibility – to recognize how personal choices affect self and society.

Course Outcomes and Competencies

I. ENGINE REPAIR (ASE Education Foundation Tasks)

A. General

1. Research vehicle service information such as fluid type, internal combustion engine operation, vehicle service history, service precautions, technical service bulletins, and recalls including vehicles equipped with advanced driver assistance systems (ADAS).
2. Retrieve and record DTCs, OBD monitor status, and freeze frame data; clear codes and data when directed.
3. Verify operation of the instrument panel engine warning indicators.
4. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine needed action.
5. Install engine covers using gaskets, seals, and sealers as required.
6. Verify engine mechanical timing.
7. Inspect, remove, and/or replace engine mounts.
8. Identify service precautions related to service of the internal combustion engine of a hybrid electric vehicle.
9. Remove and reinstall engine on a newer vehicle equipped with OBD; reconnect all attaching components and restore the vehicle to running condition.

I. ENGINE REPAIR

B. Cylinder Head and Valve Train

2. Remove cylinder head; inspect gasket condition; install cylinder head and gasket; tighten according to manufacturer's specification and procedure.
3. Clean and visually inspect a cylinder head for cracks; check gasket surface areas for warpage and surface finish; check passage condition.
4. Inspect valve actuating mechanisms for wear, bending, cracks, looseness, and blocked oil passages (orifices); determine needed action.
5. Adjust valves (mechanical or hydraulic lifters).
6. Inspect and replace camshaft and drive belt/chain; includes checking drive gear wear and backlash, end play, sprocket and chain wear, overhead cam drive sprocket(s), drive belt(s), belt tension, tensioners, camshaft reluctor ring/tone-wheel, and valve timing components; verify correct camshaft timing.
8. Replace valve stem seals on an assembled engine; inspect valve spring retainers, locks/keepers, and valve lock/keeper grooves; determine needed action.
12. Inspect valve lifters and hydraulic lash adjusters; determine needed action.

I. ENGINE REPAIR

D. Lubrication and Cooling Systems

1. Identify lubrication and cooling system components and configurations
2. Perform engine oil and filter change; use proper fluid type per manufacturer specification; reset maintenance reminder as required.
3. 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 needed action.
4. Identify causes of engine overheating.
5. Inspect, replace, and/or adjust drive belts, tensioners, and pulleys; check pulley and belt alignment.
6. Inspect and test coolant; drain and recover coolant; flush and/or refill cooling system; use proper fluid type per manufacturer specification; bleed air as required.
7. Inspect, remove, and replace water pump.
8. Remove, inspect, and replace thermostat and gasket/seal.
9. Remove and replace radiator.
10. Inspect and test fan(s), fan clutch (electrical or mechanical), fan shroud, and air dams; determine needed action.
11. Perform oil pressure tests; determine needed action.
12. Inspect auxiliary coolers; determine needed action.
13. Inspect, test, and/or replace oil temperature and pressure switches and sensors.
14. Inspect oil pump gears or rotors, housing, pressure relief devices, and pump drive; determine needed action

II. AUTOMATIC TRANSMISSION AND TRANSAXLE

A. General

1. Research vehicle service information such as fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including vehicles equipped with advanced driver assistance systems (ADAS).
2. Identify automatic transmission and transaxle components and configurations.
3. Retrieve and record DTCs, OBD monitor status, and freeze frame data; clear codes and data when directed.
4. Inspect transmission fluid condition; check fluid level; inspect for leaks on transmission or transaxle equipped with a dipstick.
5. Inspect transmission fluid condition; check fluid level; inspect for leaks on transmission or transaxle not equipped with a dipstick.
6. Diagnose transmission/transaxle gear reduction/multiplication concerns using driving, driven, and held member (power flow) principles.
7. Diagnose pressure concerns in a transmission using hydraulic principles (Pascal's Law).
8. Identify and interpret transmission/transaxle concerns, differentiate between engine performance and transmission/transaxle concerns; determine needed action.
9. Diagnose fluid loss and condition concerns; determine needed action.
10. Perform stall test; determine needed action.
11. Perform lock-up converter system tests; determine needed action.
12. Perform pressure tests on transmissions/transaxles equipped with electronic pressure control; determine needed action.
13. Diagnose electronic transmission/transaxle control systems using appropriate test equipment and service information.

14. Diagnose noise and vibration concerns; determine needed action.

II. AUTOMATIC TRANSMISSION AND TRANSAXLE

B. In-Vehicle Transmission/Transaxle

1. Inspect, adjust, and/or replace external manual valve shift linkage, transmission range sensor/switch, and/or park/neutral position switch.
2. Drain and replace fluid and filter(s); use proper fluid type per manufacturer specification.
3. Perform relearn procedures.
4. Inspect, replace/or and align powertrain mounts.
5. Inspect for leakage; replace external seals, gaskets, and bushings.
6. Inspect, test, adjust, repair, and/or replace electrical/electronic components and circuits.

II. AUTOMATIC TRANSMISSION AND TRANSAXLE

C. Off-Vehicle Transmission and Transaxle

3. Remove and reinstall transmission/transaxle and torque converter; inspect engine core plugs, rear crankshaft seal, dowel pins, dowel pin holes, and mounting surfaces.
4. Inspect, leak test, flush, and/or replace transmission/transaxle oil cooler, lines, and fittings.
5. Inspect converter flex (drive) plate, converter attaching bolts, converter pilot, converter pump drive surfaces, converter end play, and crankshaft pilot bore.
7. Inspect, measure, clean, and replace valve body (includes surfaces, bores, springs, valves, switches, solenoids, sleeves, retainers, brackets, check valves/balls, screens, spacers, and gaskets).

III. MANUAL DRIVE TRAIN AND AXLES

A. General

1. Research vehicle service information such as fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including vehicles equipped with advanced driver assistance systems (ADAS).
3. Retrieve and record DTCs, OBD monitor status, and freeze frame data; clear codes and data when directed.
4. Check fluid condition; check for leaks; determine needed action.
4. Drain and refill manual transmission/transaxle; use proper fluid type per manufacturer specification.
5. Diagnose drive train concerns; determine needed action.

III. MANUAL DRIVE TRAIN AND AXLES

B. Clutch

1. Check and adjust clutch master cylinder fluid level; check for leaks; use proper fluid type per manufacturer specification.
2. Diagnose clutch noise, binding, slippage, pulsation, and chatter; determine needed action.
3. Inspect clutch pedal linkage, cables, automatic adjuster mechanisms, brackets, bushings, pivots, and springs; determine needed action.
4. Inspect and/or replace clutch pressure plate assembly, clutch disc, release (throw-out) bearing, linkage, and pilot bearing/bushing (as applicable).

5. Bleed clutch hydraulic system.
6. Inspect flywheel and ring gear for wear, cracks, and discoloration; determine needed action.
7. Measure flywheel runout and crankshaft end play; determine needed action.

III. MANUAL DRIVE TRAIN AND AXLES

C. Transmission/Transaxle

2. Inspect, adjust, lubricate, and/or replace shift linkages, brackets, bushings, cables, pivots, and levers.
3. Diagnose noise concerns through the application of transmission/transaxle powerflow principles; determine needed action.
4. Diagnose hard shifting and jumping out of gear concerns; determine needed action.
5. Diagnose transaxle final drive assembly noise and vibration concerns; determine needed action.

III. MANUAL DRIVE TRAIN AND AXLES

D. Drive Shaft and Half Shaft, Universal and Constant-Velocity (CV) Joints (Front, Rear, All-wheel, and Four-wheel Drive)

1. Inspect and/or remove/replace bearings, hubs, and seals.
2. Inspect and/or service/replace shafts, yokes, boots, and universal/CV joints.
3. Check for leaks at drive assembly and transfer case seals; check vents; check fluid level; use proper fluid type per manufacturer specification.
4. Diagnose constant-velocity (CV) joint noise and vibration concerns; determine needed action.
5. Diagnose universal joint noise and vibration concerns; determine needed action.
6. Check shaft balance and phasing; measure shaft runout; measure and adjust driveline angles; determine needed action.

III. MANUAL DRIVE TRAIN AND AXLES

E. Differential and Drive Axles

E.1 Ring and Pinion Gears and Differential Case Assembly

1. Inspect differential housing; check for leaks; inspect housing vent.
2. Check and adjust differential housing fluid level; use proper fluid type per manufacturer specification.
3. Drain and refill differential housing; use proper fluid type per manufacturer specification.
4. Inspect and replace companion flange and/or pinion seal; measure companion flange runout.
5. Inspect ring gear and measure runout; determine needed action.
6. Diagnose noise and vibration concerns; determine needed action.
7. Remove, inspect, reinstall or replace drive pinion and ring gear, spacers, sleeves, and bearings.
8. Measure and adjust drive pinion depth.
9. Measure and adjust drive pinion bearing preload.
10. Measure and adjust side bearing preload and ring and pinion gear total backlash and backlash variation on a differential carrier assembly (threaded cup or shim types).
11. Check ring and pinion tooth contact patterns; determine needed action.

12. Disassemble, inspect, measure, adjust, and/or replace differential pinion gears (spiders), shaft, side gears, side bearings, thrust washers, and case.
13. Reassemble and reinstall differential case assembly; measure runout; determine needed action.

E.2 Drive Axles

1. Inspect and replace drive axle wheel studs.
2. Remove and replace drive axle shafts.
3. Inspect and replace drive axle shaft seals, bearings, and retainers.
4. Measure drive axle flange runout and shaft end play; determine needed action.
5. Diagnose drive axle shafts, bearings, and seals for noise, vibration, and fluid leakage concerns; determine needed action.

E.3 Limited Slip Differential

1. Diagnose noise, slippage, and chatter concerns including electronically controlled systems; determine needed action.
2. Measure rotating torque; determine needed action.

III. MANUAL DRIVE TRAIN AND AXLES

F. Four-wheel Drive/All-wheel Drive

1. Identify concerns related to variations in tire circumference and/or final drive ratios.
2. Inspect, adjust, and repair shifting controls (mechanical, electrical, and vacuum), bushings, mounts, levers, and brackets.
3. Inspect axle locking mechanisms; determine needed action(s).
4. Check for leaks at drive assembly and transfer case seals; check vents; check fluid level; use proper fluid type per manufacturer specification.
5. Diagnose noise, vibration, and unusual steering concerns; determine needed action.
6. Diagnose, test, adjust, and/or replace electrical/electronic components of four-wheel drive/all-wheel drive systems.
7. Disassemble, service, and reassemble transfer case and components.

IV. SUSPENSION AND STEERING

A. General

1. Research vehicle service information such as fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including vehicles equipped with advanced driver assistance systems (ADAS).
2. Identify suspension and steering system components and configurations.
3. Retrieve and record DTCs, OBD monitor status, and freeze frame data; clear codes and data when directed.
4. Disable and enable supplemental restraint system (SRS); verify indicator lamp operation.
5. Identify and interpret suspension and steering system concerns; determine needed action.

IV. SUSPENSION AND STEERING

B. Steering Systems

1. Inspect rack and pinion steering gear tie rod ends (sockets) and bellows boots; repair or replace as needed.
2. Inspect power steering fluid level and condition.

3. Drain and replace power steering system fluid; use proper fluid type per manufacturer specification.
4. Inspect for power steering fluid leakage; determine needed action.
5. Remove, inspect, replace, and/or adjust power steering pump drive belt.
6. Inspect, remove, and/or replace power steering hoses and fittings.
7. Inspect, remove, and/or replace pitman arm, relay (centerlink/intermediate) rod, idler arm, mountings, and steering linkage damper.
8. Inspect, replace, and/or adjust tie rod ends (sockets), tie rod sleeves, and clamps (non-rack and pinion).
9. Inspect and test electric power steering system; determine needed action.
11. Diagnose steering column noises, looseness, and binding concerns (including tilt/telescoping mechanisms); determine needed action.
12. Diagnose power steering gear (non-rack and pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine needed action.
13. Diagnose power steering gear (rack and pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine needed action.
14. Inspect steering shaft universal joint(s), flexible coupling(s), collapsible column, lock cylinder mechanism, and steering wheel; determine needed action.
15. Remove and replace rack and pinion steering gear; inspect mounting bushings and brackets.
16. Remove and reinstall power steering pump.
17. Remove and reinstall press fit power steering pump pulley; check pulley and belt alignment.

IV. SUSPENSION AND STEERING

C. Suspension Systems

1. Inspect, remove, and/or replace upper and/or lower control arms, bushings, and shafts.
2. Inspect and replace rebound/jounce bumpers.
3. Inspect, remove, and/or replace track bar, strut rods/radius arms, and related mounts and bushings.
4. Inspect, remove, and/or replace upper and/or lower ball joints (with or without wear indicators).
5. Inspect, remove, and/or replace suspension system coil springs and spring insulators.
6. Inspect, remove, and/or replace torsion bars and mounts
7. Inspect, remove, and/or replace front/rear stabilizer bar (sway bar) bushings, brackets, and links.
8. Inspect, remove, and/or replace strut assembly, strut coil spring, insulators, and upper strut bearing mount.
9. Inspect, remove, and/or replace components of suspension systems (Coil, Leaf, and Torsion).
10. Inspect, remove, and/or replace components of electronically controlled suspension systems.
11. Inspect, remove, and/or replace steering knuckle assemblies.
12. Diagnose suspension system noises, body sway, and uneven ride height concerns; determine needed action

IV. SUSPENSION AND STEERING

D. Related Suspension and Steering Service

1. Inspect, remove, and/or replace shock absorbers; inspect mounts and bushings
2. Inspect, service, and/or replace front and rear wheel bearings.

IV. SUSPENSION AND STEERING

E. Wheel Alignment

1. Perform pre-alignment inspection; measure vehicle ride height; determine needed action.
3. Prepare vehicle for wheel alignment on alignment machine; perform four-wheel alignment by checking and adjusting front caster, front and rear camber, and toe as required; center steering wheel.
4. Check toe-out-on-turns (turning radius); determine needed action.
5. Check steering axis inclination (SAI) and included angle; determine needed action.
6. Check rear wheel thrust angle; determine needed action.
7. Check for front wheel setback; determine needed action.
8. Identify front and/or rear cradle (subframe) misalignment; determine needed action.
9. Reset steering angle sensor.
10. Diagnose vehicle wander, drift, pull, hard steering, bump steer, memory steer, torque steer, and steering return concerns; determine needed action.

IV. SUSPENSION AND STEERING

F. Wheels and Tires

1. Inspect tire condition/age; identify tire wear patterns; check for correct tire size, application (service-class, load, and speed ratings), and air pressure as listed on the tire information placard/label.
2. Rotate tires according to manufacturer's recommendation including vehicles equipped with tire pressure monitoring systems (TPMS)
3. Dismount, inspect, and remount tire on wheel (with/without TPMS); balance wheel and tire assembly.
4. Inspect tire and wheel assembly for air loss; determine needed action.
5. Repair tire following tire manufacturer approved procedure.
6. Identify indirect and direct tire pressure monitoring system (TPMS); calibrate/relearn system; verify operation of instrument panel lamps.
7. Demonstrate knowledge of steps required to remove and replace sensors (per OEM/sensor manufacturer) in a tire pressure monitoring system (TPMS).
9. Diagnose wheel/tire vibration, shimmy, and noise; determine needed action.
10. Measure wheel, tire, axle flange, and hub runout; determine needed action.
11. Diagnose tire pull problems; determine needed action.

V. BRAKES

A. General

1. Research vehicle service information such as fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including vehicles equipped with advanced driver assistance systems (ADAS).
3. Retrieve and record DTCs, OBD monitor status, and freeze frame data; clear codes and data when directed.

5. Install wheel and torque lug nuts.
6. Identify and interpret brake system concerns; determine needed action.

V. BRAKES

B. Hydraulic System

1. Diagnose pressure concerns in the brake system using hydraulic principles (Pascal's Law).
2. Measure brake pedal height, travel, and free play (as applicable); determine needed action.
3. Check master cylinder for internal/external leaks and proper operation; determine needed action.
4. Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging, wear, and loose fittings/supports; determine needed action.
5. Select, handle, store, and fill brake fluids to proper level; use proper fluid type per manufacturer specification.
7. Bleed and/or replace fluid in the brake system.
8. Test brake fluid for contamination.
9. Remove, bench bleed, and reinstall master cylinder.
10. Diagnose poor stopping, pulling, or dragging concerns caused by malfunctions in the hydraulic system; determine needed action.
11. Replace brake lines, hoses, fittings, and supports.
12. Fabricate brake lines using proper material and flaring procedures.
13. Inspect, test, and/or replace components of brake warning light system.

V. BRAKES

C. Drum Brakes

1. Remove, clean, and inspect brake drum; measure brake drum diameter; determine serviceability.
2. Refinish brake drum and measure final drum diameter; compare with specification.
3. 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.
4. Inspect wheel cylinders for leaks and proper operation; remove and replace as needed.
5. Pre-adjust brake shoes and parking brake; install brake drums or drum/hub assemblies and wheel bearings; perform final checks and adjustments.
6. Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging, or pedal pulsation concerns; determine needed action.

V. BRAKES

D. Disc Brakes

1. Remove and clean caliper assembly; inspect for leaks, damage, and wear; determine needed action.
2. Inspect caliper mounting and slides/pins for proper operation, wear, and damage; determine needed action.
3. Remove, inspect, and/or replace brake pads and retaining hardware; determine needed action.
4. Lubricate and reinstall caliper, brake pads, and related hardware; seat brake pads against rotor; inspect for leaks.

5. Clean and inspect rotor and mounting surface; measure rotor thickness, thickness variation, and lateral runout; determine needed action.
6. Remove and reinstall/replace rotor.
7. Refinish rotor on vehicle; measure final rotor thickness and compare with specification.
8. Refinish rotor off vehicle; measure final rotor thickness and compare with specification.
9. Retract and re-adjust caliper piston on an integrated parking brake system.
10. Describe importance of operating vehicle to burnish/break-in replacement brake pads according to manufacturer's recommendation.
11. Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging, or pulsation concerns; determine needed action.

V. BRAKES

E. Power-Assist Units

1. Check brake pedal travel with and without engine running to verify proper power booster operation.
3. Inspect vacuum-type power booster unit for leaks; inspect the check-valve for proper operation; check vacuum supply (manifold or auxiliary pump) to vacuum-type power booster determine needed action.
4. Inspect and test hydraulically assisted power brake system for leaks and proper operation; determine needed action.
5. Inspect electric power booster unit; determine needed action.

V. BRAKES

F. Related Systems (i.e., Wheel Bearings, Parking Brakes, Electrical)

1. Remove, clean, inspect, repack/replace, and install wheel bearings; remove and install bearing races; replace seals; install hub and adjust bearings.
2. Check parking brake system components for wear, binding, and corrosion; clean, lubricate, adjust and/or replace as needed.
3. Check parking brake operation (including electric parking brakes); check parking brake indicator light system operation; determine needed action.
4. Check operation of brake stop light system.
5. Inspect and replace wheel studs.
6. Remove, reinstall, and/or replace sealed wheel bearing assembly.
7. Diagnose wheel bearing noises, wheel shimmy, and vibration concerns; determine needed action.

V. BRAKES

G. Electronic Brake Control Systems: Antilock Brake (ABS), Traction Control (TCS), and Electronic Stability Control (ESC) Systems

1. Identify and inspect electronic brake control system components and describe function (ABS, TCS, ESC); determine needed action.
3. Bleed the electronic brake control system hydraulic circuits.
4. Diagnose poor stopping, wheel lock-up, abnormal pedal feel, unwanted application, and noise concerns associated with the electronic brake control system; determine needed action.

5. Diagnose electronic brake control system electronic control(s) and components by retrieving diagnostic trouble codes, and/or using recommended test equipment; determine needed action.
6. Depressurize high-pressure components of an electronic brake control system.
7. Test, diagnose, and service electronic brake control system speed sensors (digital and analog), toothed ring (tone wheel), and circuits using a graphing multimeter (GMM)/digital storage oscilloscope (DSO) (includes output signal, resistance, shorts to voltage/ground, and frequency data).
8. Diagnose electronic brake control system braking concerns caused by vehicle modifications (tire size, curb height, final drive ratio, etc.).

VI. ELECTRICAL/ELECTRONIC SYSTEMS

A. General

1. Research vehicle service information such as fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including vehicles equipped with advanced driver assistance systems (ADAS).
3. Retrieve and record DTCs, OBD monitor status, and freeze frame data; clear codes and data when directed.
5. Demonstrate proper use of a digital multimeter (DMM) when measuring source voltage, voltage drop (including grounds), current flow and resistance.
6. Demonstrate knowledge of the causes and effects from shorts, grounds, opens, and resistance problems in electrical/electronic circuits.
8. Use fused jumper wires to check operation of electrical circuits per service information.
9. Use wiring diagrams during the diagnosis of electrical/electronic circuit problems.
10. Diagnose the cause(s) of excessive key-off battery drain (parasitic draw); determine needed action.
11. Inspect and test fusible links, circuit breakers, and fuses; determine needed action.
12. Inspect, test, repair, and/or replace components, connectors, terminals, harnesses, and wiring in electrical/electronic systems (including solder repairs); determine needed action.
13. Test and measure circuit using an oscilloscope and/or graphing multimeter (GMM); interpret results; determine needed action.

VI. ELECTRICAL/ELECTRONIC SYSTEMS

B. Batteries (Conventional 12-volt)

1. Perform battery state-of-charge test; determine needed action.
2. Confirm proper battery capacity, size, type, and application for vehicle; perform battery capacity and load test; determine needed action.
3. Maintain or restore electronic memory functions as recommended by manufacturer.
4. Inspect and clean battery; fill battery cells (if applicable); check battery cables, connectors, clamps, and hold-downs.
5. Perform battery charging according to manufacturer's recommendations.
6. Jump-start vehicle using jumper cables and a booster battery or an auxiliary power supply.
7. Identify electrical/electronic modules, security systems, radios, and other accessories that require reinitialization or code entry after reconnecting vehicle battery.

VI. ELECTRICAL/ELECTRONIC SYSTEMS

C. Starting System

1. Perform starter current draw test; determine needed action.
2. Perform starter circuit voltage drop tests; determine needed action.
3. Inspect and test starter relays and solenoids; determine needed action.
4. Remove and install starter in a vehicle.
5. Inspect and test switches, connectors, and wires of starter control circuits; determine needed action.
7. Differentiate between electrical and engine mechanical problems that cause a slow-crank or a no-crank condition.
8. Diagnose a no-crank condition using a wiring diagram and test equipment; determine needed action.

VI. ELECTRICAL/ELECTRONIC SYSTEMS

D. Charging System

1. Perform charging system output test; determine needed action.
2. Inspect, adjust, and/or replace generator (alternator) drive belts; check pulleys and tensioners for wear; check pulley and belt alignment; determine needed action.
3. Remove, inspect, and/or replace generator (alternator); determine needed action.
4. Perform charging circuit voltage drop tests; determine needed action.
5. Diagnose charging system for causes of undercharge, no-charge, or overcharge conditions; determine needed action.

VI. ELECTRICAL/ELECTRONIC SYSTEMS

E. Lighting Systems

1. Inspect interior and exterior lamps and sockets including headlights and auxiliary lights (fog lights/driving lights); determine needed action.
2. Aim headlights.
3. Diagnose the causes of brighter-than-normal, intermittent, dim, or no light operation; determine needed action.

VI. ELECTRICAL/ELECTRONIC SYSTEMS

F. Instrument Cluster and Driver Information Systems

1. Verify operation of instrument panel gauges and warning/indicator lights; reset maintenance indicators as required.
2. Inspect and test gauges and gauge sending units for causes of abnormal readings; determine needed action.
3. Diagnose the causes of incorrect operation of warning devices and other driver information systems; determine needed action.

VI. ELECTRICAL/ELECTRONIC SYSTEMS

G. Body Electrical Systems

1. Diagnose vehicle comfort, convenience, access, safety, and related systems operation; determine needed action.
2. Remove and reinstall door panel.
3. Diagnose operation of security/anti-theft systems and related circuits (such as: theft deterrent, door locks, remote keyless entry, remote start, and starter/fuel disable); determine needed action.
5. Verify windshield wiper and washer operation; replace wiper blades.

6. Diagnose operation of entertainment and related circuits (such as: radio, DVD, remote CD changer, navigation, amplifiers, speakers, antennas, and voice-activated accessories); determine needed action.
7. Diagnose operation of safety systems and related circuits (such as: horn, airbags, seat belt pretensioners, occupancy classification, wipers, washers, speed control/collision avoidance, heads-up display, parking assist, and back-up camera); determine needed action.
8. Diagnose body electronic systems circuits using a scan tool; check for module communication errors (data communication bus systems); determine needed action.

VII. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

A. General

1. Research vehicle service information, including refrigerant/oil/fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including vehicles equipped with advanced driver assistance systems (ADAS).
3. Retrieve and record DTCs, OBD monitor status, and freeze frame data; clear codes and data when directed.
4. Perform A/C system performance test; interpret results; determine needed action.
5. Identify abnormal operating noises in the A/C system; determine needed action.
6. Leak test A/C system; determine needed action.
7. Identify and interpret heating and air conditioning problems; determine needed action.
8. Identify refrigerant type; test for sealant; select and connect proper gauge set/test equipment; record temperature and pressure readings.
9. Inspect condition/quantity of refrigerant oil removed from A/C system; determine needed action.
10. Determine recommended oil and oil capacity for system application and component(s) replacement.

VII. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

B. Refrigeration System Components

1. Inspect, remove, and/or replace A/C compressor drive belts, pulleys, tensioners; determine needed action.
2. Inspect for proper A/C condenser airflow; determine needed action.
3. Inspect evaporator housing condensation drain; determine needed action.
4. Inspect, test, and/or service A/C compressor clutch components and/or assembly; determine needed action.
5. Remove, inspect, reinstall, and/or replace A/C compressor and mountings; determine recommended oil type and quantity.
6. Remove and inspect A/C system mufflers, hoses, lines, fittings, O-rings, seals, and service valves; determine needed action.
7. Remove, inspect, and replace receiver/drier or accumulator/drier; determine recommended oil type and quantity.
8. Remove, inspect, and install expansion valve or orifice (expansion) tube.
9. Diagnose A/C system conditions that cause the protection devices (pressure, thermal, and/or control module) to interrupt system operation; determine needed action.
11. Remove, inspect, reinstall, and/or replace condenser; determine required oil type and quantity.

VII. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

C. Heating, Ventilation, and Engine Cooling Systems

1. Inspect engine cooling and heater systems hoses and pipes; determine needed action.
2. Inspect and test heater control valve(s); determine needed action
3. Diagnose temperature control problems in the HVAC system related to the engine cooling system, including electric heating; determine needed action.

VII. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

D. Operating Systems and Related Controls

1. Inspect HVAC system ducts, doors, hoses, cabin filters, and outlets; determine needed action.
2. Identify the source of HVAC system odors.
3. Inspect and test HVAC system blower motors, resistors, switches, relays, wiring, and protection devices; determine needed action.
4. Diagnose A/C compressor control systems; determine needed action.
5. Diagnose malfunctions in the vacuum, mechanical, and/or electrical components and controls of the HVAC system; determine needed action.
6. Inspect, test, remove and/or replace HVAC system control panel; determine needed action.
7. Check operation of automatic HVAC control systems; determine needed action.

VII. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

E. Refrigerant Recovery, Recycling, and Handling

1. Demonstrate awareness of the need to recover, recycle, and handle refrigerants using proper equipment and procedures.
2. Use and maintain refrigerant handling equipment according to equipment manufacturer's standards.
3. Identify A/C system refrigerant; test for sealants; recover, evacuate, and charge A/C system; add refrigerant oil as required.
4. Recycle, label, and store refrigerant.

VIII. ENGINE PERFORMANCE

A. General

1. Research vehicle service information such as fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including vehicles equipped with advanced driver assistance systems (ADAS).
2. Retrieve and record DTCs, OBD monitor status, and freeze frame data; clear codes and data when directed.
3. Verify proper engine cooling system operation; determine needed action.
4. Verify correct camshaft timing including engines equipped with variable valve timing (VVT) systems; determine needed action.
5. Identify and interpret engine performance concerns; determine needed action.
6. Diagnose abnormal engine noises or vibration concerns; determine needed action.
7. Diagnose the cause of excessive oil consumption, coolant consumption, unusual exhaust color, odor, and sound; determine needed action.
8. Perform engine manifold pressure tests (vacuum/boost); determine needed action.
9. Perform cylinder power balance test; determine needed action.
10. Perform cylinder cranking and running compression tests; determine needed action.

11. Perform cylinder leakage test; determine needed action.
12. Diagnose engine mechanical, electrical, electronic, fuel, and ignition concerns; determine needed action.

VIII. ENGINE PERFORMANCE

B. Computerized Controls

1. Identify computerized control system components and configurations.
2. Access and use service information to perform step-by-step (troubleshooting) diagnosis.
3. Perform active tests of actuators using a scan tool; determine needed action.
4. Describe the use of OBD monitors for repair verification.
5. Inspect and test computerized engine control system sensors, powertrain/engine control module (PCM/ECM), actuators, and circuits using a graphing multimeter (GMM), digital storage oscilloscope (DSO), and/or scan tool; determine needed action.
7. Diagnose the causes of emissions or driveability concerns with stored or active diagnostic trouble codes (DTC); obtain, graph, and interpret scan tool data.
8. Diagnose emissions or driveability concerns without stored or active diagnostic trouble codes; determine needed action.
9. Diagnose driveability and emissions problems resulting from malfunctions of interrelated systems (cruise control, security alarms, suspension controls, traction controls, HVAC, automatic transmissions, non-OEM installed accessories, or similar systems); determine needed action.

VIII. ENGINE PERFORMANCE

C. Ignition System

1. Identify ignition system components and configurations.
2. Remove and replace spark plugs; inspect secondary ignition components for wear and damage; determine needed action.
3. Diagnose ignition system related problems such as no-starting, hard starting, engine misfire, poor driveability, spark knock, power loss, poor mileage, and emissions concerns; determine needed action.
4. Inspect and test crankshaft and camshaft position sensor(s); determine needed action.
5. Inspect, test, and/or replace ignition control module and/or powertrain/engine control module; reprogram/initialize as needed.

VIII. ENGINE PERFORMANCE

D. Fuel, Air Induction, and Exhaust Systems

1. Identify fuel, air induction, and exhaust system components and configurations.
2. Replace fuel filter(s) where applicable.
3. Inspect, service, or replace air filters, filter housings, and intake duct work.
4. Inspect integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shields; determine needed action.
5. Inspect condition of exhaust system hangers, brackets, clamps, and heat shields; determine needed action.
6. Check and refill diesel exhaust fluid (DEF).
7. Check fuel for quality, composition, and contamination; determine needed action.

8. Inspect and test fuel pump(s) and pump control system for pressure, regulation, and volume; determine needed action.
9. Inspect throttle body, air induction system, intake manifold and gaskets for vacuum leaks and/or unmetered air.
10. Inspect, test, and/or replace fuel injectors on low- and high-pressure systems.
11. Verify proper idle speed; determine needed action.
12. Perform exhaust system back-pressure test; determine needed action.
13. Diagnose hot or cold no-starting, hard starting, poor driveability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, poor mileage, dieseling, and emissions problems; determine needed action.
14. Test the operation of turbocharger/supercharger systems; determine needed action.

VIII. ENGINE PERFORMANCE

E. Emissions Control Systems

1. Identify emission control system components and configurations.
2. Inspect, test, service, and/or replace positive crankcase ventilation (PCV) filter/breather, valve, tubes, orifices, and hoses; determine needed action.
3. Diagnose oil leaks, emissions, and driveability concerns caused by the positive crankcase ventilation (PCV) system; determine needed action.
4. Diagnose emissions and driveability concerns caused by the exhaust gas recirculation (EGR) system; inspect, test, service and/or replace electrical/electronic sensors, controls, wiring, tubing, exhaust passages, vacuum/pressure controls, filters, and hoses of exhaust gas recirculation (EGR) systems; determine needed action.
5. Inspect and test electrical/electronically operated components and circuits of secondary air injection systems; determine needed action.
6. Diagnose emission and driveability concerns caused by catalytic converter system; determine needed action.
7. Diagnose emissions and driveability concerns caused by the evaporative emissions control (EVAP) system; determine needed action.
8. Interpret diagnostic trouble codes (DTCs) and scan tool data related to the emissions control systems; determine needed action.

FOUNDATIONAL TASKS – 2022

Shop and Personal Safety

1. Identify general shop safety rules and procedures.
2. Utilize safe procedures for handling of tools and equipment.
3. Identify and use proper placement of floor jacks and jack stands.
4. Identify and use proper procedures for safe lift operation.
5. Utilize proper ventilation procedures for working within the lab/shop area.
6. Identify marked safety areas.
7. Identify the location and the types of fire extinguishers and other fire safety equipment; demonstrate knowledge of the procedures for using fire extinguishers and other fire safety equipment.
8. Identify the location and use of eye wash stations.
9. Identify the location of the posted evacuation routes.
10. Comply with the required use of safety glasses, ear protection, gloves, and shoes during lab/shop activities.

11. Identify and wear appropriate clothing for lab/shop activities.
12. Secure hair and jewelry for lab/shop activities.
13. Identify vehicle systems which pose a safety hazard during service such as: supplemental restraint systems (SRS), electronic brake control systems, stop/start systems, and remote start systems.
14. Identify vehicle systems which pose a safety hazard during service due to high voltage such as: hybrid/electric drivetrain, lighting systems, ignition systems, A/C systems, injection systems, etc.
15. Locate and demonstrate knowledge of safety data sheets (SDS).

Tools and Equipment

1. Identify tools and their usage in automotive applications.
2. Identify standard and metric designation.
3. Demonstrate safe handling and use of appropriate tools.
4. Demonstrate proper cleaning, storage, and maintenance of tools and equipment.

Preparing for Vehicle Service

1. Identify information needed and the service requested on a repair order.
2. Identify purpose and demonstrate proper use of vehicle protection such as: fender covers, mats, seat, and steering wheel covers.
3. Perform a vehicle walk-around inspection; identify and document existing vehicle conditions such as body damage, paint damage, windshield damage.
4. Perform a vehicle multi-point inspection and complete a vehicle inspection report.
5. Demonstrate use of the three C's (concern, cause, and correction).
6. Create a plan of action for each specific service or diagnostic situation.
7. Review vehicle service history.
8. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.

Preparing Vehicle for Customer

1. Ensure vehicle is prepared to return to customer per school/company policy (floor mats, steering wheel cover, etc.).

Personal Standards

1. Reports to work daily on time; able to take directions and motivated to accomplish the task at hand.
2. Dresses appropriately and uses language and manners suitable for the workplace.
3. Maintains personal hygiene appropriate for the workplace.
4. Meets and maintains employment eligibility criteria, such as drug/alcohol-free status, clean driving record, etc.
5. Demonstrates honesty, integrity, and reliability.

Work Habits / Ethic

1. Complies with workplace policies/laws.
2. Contributes to the success of the team, assists others and requests help when needed.

3. Works well with all customers and coworkers.
4. Negotiates solutions to interpersonal and workplace conflicts.
5. Contributes ideas and initiative.
6. Follows directions.
7. Communicates effectively, both in writing and verbally, with customers and coworkers.
8. Reads and interprets workplace documents; writes clearly and concisely.
9. Analyzes and resolves problems that arise in completing assigned tasks.
10. Organizes and implements a productive plan of work.
11. Uses scientific, technical, engineering and mathematics (STEM) principles and reasoning to accomplish assigned tasks.
12. Identifies and addresses the needs of all customers, providing helpful, courteous, and knowledgeable service and advice as needed.
13. Respectful of tools and property used in school and workplace environment.
14. Contributes to an inclusive environment where every coworker and customer feels welcomed, heard, and valued.