Nichols Career Center
AUTOMOTIVE TECHNOLOGY
Course Syllabus
2021-2022

Instructor: Joe Hires
Conference Times: 10:55-11:45 am or after 3:00 pm
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COURSE DESCRIPTION:
Automotive Technology is an in-depth two-year study into the basic knowledge and skills of automotive diagnosis and repair, leading to a career in the automotive field. In an Odd /Even year pattern the following ASE/NATEF certified areas will be covered: Supplemental Tasks, Engine Repair, Engine Performance, Brakes, Automatic Transmission Trans Axle, Manual Drive Train and Axles. Skills that students learn throughout school are utilized in this course: math and science skills to solve automotive repair problems and communication skills in relating problems and solutions to customers and supervisors. The curriculum is computer based, and students learn a hands-on skill with hands-on learning in addition to written work. The program is ASE (Automotive Service Excellence) certified. A **"C"** or better average is required for both semesters in Automotive Technology I for students to return to Automotive Technology II. Students will be required to have approved work clothes/shoes.

Embedded Math for Automotive Technology
This course presents informational methods of contextual mathematical instruction directly related to Automotive Technology. Students will review pre-existing concepts and learn new concepts that are specific to the automotive industry. Relative mathematics will prepare students for higher education or provide them with the knowledge necessary to enter directly into the trade. Students will complete various assignments but not limited to projects and problem solving activities. Additionally, students will practice Compass-prep objectives.

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COURSE OUTLINE EVEN YEAR: 2021-22
Week

1- 2	Basic Information and shop safety
3- 4	General Engine repair
5- 7	Cooling and Lubrication and Cooling systems
8 - 9	Cylinder Head and Valve train
10-11	General engine performance
12 -13	Computerized Engine Controls
14-15	Air Fuel and Exhaust Systems
16-17	Emission Controls
18-19	General Brake Service
20-21	Hydraulic Brake systems
22-23	Drum Brakes- Disc Brakes
24-26	Electronic Brake traction control/ Miscellaneous
27-30	Automatic Transmission General service/in and off Vehicle service/ Manual transmission

31-33 EOC Exams

COURSE OUTLINE ODD YEAR:

Week

1- 2 Basic Information and shop safety
3- 4 General: Electrical System Diagnosis
5-6 Battery Diagnosis and Service
7 – 8 Starting System Diagnosis and Repair
9-10 Charging System Diagnosis and Repair
11 -12 Lighting Systems Diagnosis and Repair
13-14 Gauges, Warning Devices, and Driver Information Systems Diagnosis and Repair
15-16 Horn and Wiper/Washer Diagnosis and Repair
17-18 Accessories Diagnosis and Repair
19-20 General: Suspension and Steering Systems
21-22 Steering Systems Diagnosis and Repair
23-24 Suspension Systems Diagnosis and Repair
25-26 Related Suspension and Steering Service
27-28 Wheel Alignment Diagnosis, Adjustment, and Repair
29-30 General: A/C System Diagnosis and Repair
31-32 Refrigeration System Component Diagnosis and Repair-
Heating, Ventilation, and Engine Cooling Systems Diagnosis and Repair
31-33 EOC Exams

TEXTBOOKS, RESOURCE MATERIALS, MEDIA SUPPORT, ETC:

Text book/workbook: Duffy Modern Automotive Technology, 2004 edition; Electude; i-CAR; and All-Data Automotive Repair Mitchell 1 Prodemand

GRADING SYSTEM:

Categories:

- 10% Embedded math
- 15% Formative Assessment (Practicing Standards + Job readiness)
- 65% Summative Assessment Projects, Tests, Quizzes
- 10% Comprehensive Final Exam

Grade reports will be sent to students and parent(s)/guardian/(s) of students at the end of each nine-week period. The following grading scale is used.

93-100 A (Excellent Work)	80-82 B- (Superior Work)	67-69 D+ (Inferior Work)
90-92 A- (Excellent Work)	77-79 C+ (Average Work)	63-66 D (Inferior Work)
87-89 B+ (Superior Work)	73-76 C (Average Work)	60-62 D- (Inferior Work)
83-86 B (Superior Work)	70-72 C- (Average Work)	0-59 F (Failure)

IN …….Incomplete work, no credit given until requirements are completed, which

automatically becomes an "F" at the end of a semester, unless arrangements are made with the office.

W ……Withdrawn, passing work being done in a course dropped either by withdrawal from school or by permission of the director.

WF ……..Withdrawn failing, failing work being done at the time of withdrawal OR course is dropped after the deadline for schedule changes.

RETURN POLICY FOR SECOND SEMESTER:

Students who are performing below average, or who are failing the semester are subject to removal from the program at semester. A student/parent conference will be held prior to the end of the semester with the appropriate individuals present and alternatives will be discussed. Students with a grade below a 70% in any term may not be accepted for their second year.

ACADEMIC INTEGRITY:

The integrity of the academic program and evaluation of each student's achievement are of primary concern to educational institutions. Cheating on an educational exercise not only reflects dishonesty on the part of the cheater, but also diminishes the value of the work done by his/her classmates. Students who cheat or plagiarize shall be subject to disciplinary action that will include a zero for the exercise.

CLASSROOM/LABORATORY EXPECTATIONS/GUIDELINES:

Students learn good work habits by performing daily task on vehicles or components. Students are expected to learn how to become a professional in the automotive field, and practice this trait while learning their profession. Monday thru Wednesday students work from modules (workbooks) and receive grades from task and test. Thursday and Friday students work on live work or components, write work orders, and diagnose problems on vehicles or components. Work here is graded by the instructor's judgment. The judgment is based on student's work habits and professionalism. Results have no bearing on grade unless students do not finish, or do not correct mistakes.

STUDENT SERVICES:

Student services are available to help students succeed in their classes. Students in technical programs are eligible for extra assistance by asking for help from their teacher or by having their teacher refer them to the Vocational Resource Educator. Career Planning is available to students who are looking for part-time or full-time jobs or need help with writing a resume. In addition, persons knowledgeable about financial aid for post high school training/education are available, as well as persons who can help students assess their vocational strengths and preferences in order to make more informed career choices.

STUDENT YOUTH ORGANIZATIONS:

Skills/USA is the youth organization designed to develop the student's leadership abilities, in addition to his/her particular skill or trade, which will aid him/her in becoming a successful employee. It is also designed to create a common bond among all students. The Skills/USA organization is used to help the student learn about their community and the automotive field.

DISCRIMINATION POLICY:
The Jefferson City School District does not discriminate on the basis of race, color, religion, national origin, gender, age, or disability. This policy pertains to admission/access to, or treatment/employment in its programs and activities.

COURSE OBJECTIVES:

Term 1 (Even and Odd years)

REQUIRED SUPPLEMENTAL TASKS
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. Demonstrate awareness of the safety aspects of supplemental restraint systems (SRS), electronic brake control systems, and hybrid vehicle high voltage circuits.

14. Demonstrate awareness of the safety aspects of high voltage circuits (such as high intensity discharge (HID) lamps, ignition systems, injection systems, etc.).

15. Locate and demonstrate knowledge of material safety data sheets (MSDS).

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.

5. Demonstrate proper use of precision measuring tools (i.e. micrometer, dial-indicator, dial-caliper).

Preparing Vehicle for Service

1. Identify information needed and the service requested on a repair order.

2. Identify purpose and demonstrate proper use of fender covers, mats.

3. Demonstrate use of the three C's (concern, cause, and correction).

4. Review vehicle service history.

5. 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.).

(EVEN YRS)

I. ENGINE REPAIR

A. General: Engine Diagnosis; Removal and Reinstallation (R & R)

1. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. P-1

2. Research applicable vehicle and service information, such as internal engine operation, vehicle service history, service precautions, and technical service bulletins. P-1

3. Verify operation of the instrument panel engine warning indicators. P-1

4. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action. P-1

5. Install engine covers using gaskets, seals, and sealers as required. P-1

6. Remove and replace timing belt; verify correct camshaft timing. P-1

7. 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

8. Inspect, remove and replace engine mounts. P-2

9. Identify hybrid vehicle internal combustion engine service precautions. P-3

10. Remove and reinstall engine in an OBDII or newer vehicle; reconnect all attaching components and restore the vehicle to running condition. P-3

I. ENGINE REPAIR
B. Cylinder Head and Valve Train Diagnosis and Repair

1. Remove cylinder head; inspect gasket condition; install cylinder head and gasket; tighten according to manufacturer's specifications and procedures. P-1

2. Clean and visually inspect a cylinder head for cracks; check gasket surface areas for warpage and surface finish; check passage condition. P-1

3. Inspect pushrods, rocker arms, rocker arm pivots and shafts for wear, bending, cracks, looseness, and blocked oil passages (orifices); determine necessary action. P-2

4. Adjust valves (mechanical or hydraulic lifters). P-1

5. 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. P-1

6. Establish camshaft position sensor indexing. P-1

I. ENGINE REPAIR
C. Engine Block Assembly Diagnosis and Repair

1. Remove, inspect, or replace crankshaft vibration damper (harmonic balancer). P-2

I. ENGINE REPAIR
D. Lubrication and Cooling Systems Diagnosis and Repair

1. Perform cooling system pressure and dye tests to identify leaks; check coolant condition and level; inspect and test radiator, pressure cap, coolant recovery tank, and heater core and galley plugs; determine necessary action. P-1

2. Identify causes of engine overheating. P-1

3. Inspect, replace, and adjust drive belts, tensioners, and pulleys; check pulley and belt alignment. P-1

4. Inspect and test coolant; drain and recover coolant; flush and refill cooling system with recommended coolant; bleed air as required. P-1

5. Inspect, remove, and replace water pump. P-2

6. Remove and replace radiator. P-2

7. Remove, inspect, and replace thermostat and gasket/seal. P-1

8. Inspect and test fan(s) (electrical or mechanical), fan clutch, fan shroud, and air dams. P-1

9. Perform oil pressure tests; determine necessary action. P-1

10. Perform engine oil and filter change. P-1

11. Inspect auxiliary coolers; determine necessary action. P-3

12. Inspect, test, and replace oil temperature and pressure switches and sensors. P-2

Term 2

VIII. ENGINE PERFORMANCE
A. General: Engine Diagnosis

1. Identify and interpret engine performance concerns; determine necessary action. P-1

2. Research applicable vehicle and service information, vehicle service history, service precautions, and technical service bulletins. P-1

3. Diagnose abnormal engine noises or vibration concerns; determine necessary action. P-3

4. Diagnose the cause of excessive oil consumption coolant consumption, unusual exhaust color, odor, and sound; determine necessary action. P-2

5. Perform engine absolute (vacuum/boost) manifold pressure tests; determine necessary action. P-1

6. Perform cylinder power balance test; determine necessary action. P-2

7. Perform cylinder cranking and running compression tests; determine necessary action. P-1

8. Perform cylinder leakage test; determine necessary action. P-1

9. Diagnose engine mechanical, electrical, electronic, fuel, and ignition concerns; determine necessary action. P-2

10. Verify engine operating temperature; determine necessary action. P-1

11. Verify correct camshaft timing. P-1

VIII. ENGINE PERFORMANCE
B. Computerized Controls Diagnosis and Repair

1. Retrieve and record diagnostic trouble codes, OBD monitor status, and freeze frame data; clear codes when applicable. P-1

2. Access and use service information to perform step-by-step (troubleshooting) diagnosis. P-1

3. Perform active tests of actuators using a scan tool; determine necessary action. P-2

4. Describe the importance of running all OBDII monitors for repair verification. P-1

VIII. ENGINE PERFORMANCE
C. Ignition System Diagnosis and Repair

1. Diagnose (troubleshoot) ignition system related problems such as no-starting, hard starting, engine misfire, poor drivability, spark knock, power loss, poor mileage, and emissions concerns; determine necessary action. P-2

2. Inspect and test crankshaft and camshaft position sensor(s); perform necessary action. P-1

3. Inspect, test, and/or replace ignition control module, powertrain/engine control module; reprogram as necessary. P-3

4. Remove and replace spark plugs; inspect secondary ignition components for wear and damage. P-1

VIII. ENGINE PERFORMANCE
D. Fuel, Air Induction, and Exhaust Systems Diagnosis and Repair

1. Check fuel for contaminants; determine necessary action. P-2

2. Inspect and test fuel pumps and pump control systems for pressure, regulation, and volume; perform necessary action. P-1

3. Replace fuel filter(s). P-1

4. Inspect, service, or replace air filters, filter housings, and intake duct work. P-1

5. Inspect throttle body, air induction system, intake manifold and gaskets for vacuum leaks and/or unmetered air. P-2

6. Inspect and test fuel injectors. P-2
7. Verify idle control operation. P-1

8. Inspect integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shields; perform necessary action. P-1

9. Inspect condition of exhaust system hangers, brackets, clamps, and heat shields; repair or replace as needed. P-1

10. Perform exhaust system back-pressure test; determine necessary action. P-2

11. Check and refill diesel exhaust fluid (DEF). P-3

VIII. ENGINE PERFORMANCE
E. Emissions Control Systems Diagnosis and Repair

1. Diagnose oil leaks, emissions, and drivability concerns caused by the positive crankcase ventilation (PCV) system; determine necessary action. P-3

2. Inspect, test, and service positive crankcase ventilation (PCV) filter/breather cap, valve, tubes, orifices, and hoses; perform necessary action. P-2

3. Diagnose emissions and drivability concerns caused by the exhaust gas recirculation (EGR) system; determine necessary action. P-3

4. Inspect, test, service, and replace components of the EGR system including tubing, exhaust passages, vacuum/pressure controls, filters, and hoses; perform necessary action. P-2

5. Inspect and test electrical/electronically-operated components and circuits of air injection systems; perform necessary action. P-3

6. Inspect and test catalytic converter efficiency. P-2

7. Inspect and test components and hoses of the evaporative emissions control system; perform necessary action. P-1

8. Interpret diagnostic trouble codes (DTCs) and scan tool data related to the emissions control systems; determine necessary action. P-3

Term 3

V. BRAKES
A. General: Brake Systems Diagnosis

1. Identify and interpret brake system concerns; determine necessary action. P-1

2. Research applicable vehicle and service information, vehicle service history, service precautions, and technical service bulletins. P-1

3. Describe procedure for performing a road test to check brake system operation; including an anti-lock brake system (ABS). P-1

4. Install wheel and torque lug nuts. P-1

V. BRAKES
B. Hydraulic System Diagnosis and Repair

1. Diagnose pressure concerns in the brake system using hydraulic principles (Pascal's Law). P-1

2. Measure brake pedal height, travel, and free play (as applicable); determine necessary action. P-1

3. Check master cylinder for internal/external leaks and proper operation; determine necessary action. P-1

4. Remove, bench bleed, and reinstall master cylinder. P-1

5. Diagnose poor stopping, pulling or dragging concerns caused by malfunctions in the hydraulic system; determine necessary action. P-3

6. Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging, and wear; check for loose fittings and supports; determine necessary action. P-1

7. Replace brake lines, hoses, fittings, and supports. P-2

8. Fabricate brake lines using proper material and flaring procedures (double flare and ISO types). P-2

9. Select, handle, store, and fill brake fluids to proper level. P-1

10. Inspect, test, and/or replace components of brake warning light system. P-3

11. Identify components of brake warning light system. P-2

12. Bleed and/or flush brake system. P-1

13. Test brake fluid for contamination. P-1

V. BRAKES
C. Drum Brake Diagnosis and Repair

1. Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging or pedal pulsation concerns; determine necessary action. P-1

2. Remove, clean, inspect, and measure brake drum diameter; determine necessary action. P-1

3. Refinish brake drum and measure final drum diameter; compare with specifications. P-1

4. Remove, clean, and inspect brake shoes, springs, pins, clips, levers, adjusters/self-adjusters, other related brake hardware, and backing support plates; lubricate and reassemble. P-1

5. Inspect wheel cylinders for leaks and proper operation; remove and replace as needed. P-2

6. Pre-adjust brake shoes and parking brake; install brake drums or drum/hub assemblies and wheel bearings; perform final checks and adjustments. P-2

V. BRAKES
D. Disc Brake Diagnosis and Repair

1. Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging, or pulsation concerns; determine necessary action. P-1

2. Remove and clean caliper assembly; inspect for leaks and damage/wear to caliper housing; determine necessary action. P-1

3. Clean and inspect caliper mounting and slides/pins for proper operation, wear, and damage; determine necessary action. P-1

4. Remove, inspect, and replace pads and retaining hardware; determine necessary action. P-1

5. Lubricate and reinstall caliper, pads, and related hardware; seat pads and inspect for leaks. P-1

6. Clean and inspect rotor; measure rotor thickness, thickness variation, and lateral runout; determine necessary action. P-1

7. Remove and reinstall rotor. P-1

8. Refinish rotor on vehicle; measure final rotor thickness and compare with specifications. P-1
9. Refinish rotor off vehicle; measure final rotor thickness and compare with specifications. P-1

10. Retract and re-adjust caliper piston on an integrated parking brake system. P-3

11. Check brake pad wear indicator; determine necessary action. P-2

12. Describe importance of operating vehicle to burnish/break-in replacement brake pads according to manufacturer's recommendations. P-1

V. BRAKES
E. Power-Assist Units Diagnosis and Repair

1. Check brake pedal travel with, and without, engine running to verify proper power booster operation. P-2

2. Check vacuum supply (manifold or auxiliary pump) to vacuum-type power booster. P-1

3. Inspect vacuum-type power booster unit for leaks; inspect the check-valve for proper operation; determine necessary action. P-1

4. Inspect and test hydraulically-assisted power brake system for leaks and proper operation; determine necessary action. P-3

5. Measure and adjust master cylinder pushrod length. P-3

V. BRAKES
F. Miscellaneous (Wheel Bearings, Parking Brakes, Electrical, Etc.) Diagnosis and Repair

1. Diagnose wheel bearing noises, wheel shimmy, and vibration concerns; determine necessary action. P-3

2. Remove, clean, inspect, repack, and install wheel bearings; replace seals; install hub and adjust bearings. P-1

3. Check parking brake cables and components for wear, binding, and corrosion; clean, lubricate, adjust or replace as needed. P-2

4. Check parking brake operation and parking brake indicator light system operation; determine necessary action. P-1

5. Check operation of brake stop light system. P-1

6. Replace wheel bearing and race. P-2

7. Inspect and replace wheel studs. P-1

8. Remove and reinstall sealed wheel bearing assembly. P-2

V. BRAKES
G. Electronic Brake, Traction and Stability Control Systems Diagnosis and Repair

1. Identify and inspect electronic brake control system components; determine necessary action. P-1

2. Identify traction control/vehicle stability control system components. P-3

3. Describe the operation of a regenerative braking system. P-3

Term 4

II. AUTOMATIC TRANSMISSION AND TRANSAXLE
A. General: Transmission and Transaxle Diagnosis

1. Identify and interpret transmission/transaxle concern, differentiate between engine performance and transmission/transaxle concerns; determine necessary action. P-1

2. Research applicable vehicle and service information fluid type, vehicle service history, service precautions, and technical service bulletins. P-1

3. Diagnose fluid loss and condition concerns; determine necessary action. P-1

4. Check fluid level in a transmission or a transaxle equipped with a dip-stick. P-1

5. Check fluid level in a transmission or a transaxle not equipped with a dip-stick. P-1

6. Perform stall test; determine necessary action. P-3

7. Perform lock-up converter system tests; determine necessary action. P-3

8. Diagnose transmission/transaxle gear reduction/multiplication concerns using driving, driven, and held member (power flow) principles. P-1

9. Diagnose pressure concerns in a transmission using hydraulic principles (Pascal's Law). P-2

II. AUTOMATIC TRANSMISSION AND TRANSAXLE
B. In-Vehicle Transmission/Transaxle Maintenance and Repair

1. Inspect, adjust, and replace external manual valve shift linkage, transmission range sensor/switch, and park/neutral position switch. P-2

2. Inspect for leakage; replace external seals, gaskets, and bushings. P-2

3. Inspect, test, adjust, repair, or replace electrical/electronic components and circuits including computers, solenoids, sensors, relays, terminals, connectors, switches, and harnesses. P-1

4. Drain and replace fluid and filter(s). P-1

5. Inspect, replace and align powertrain mounts. P-2

II. AUTOMATIC TRANSMISSION AND TRANSAXLE
C. Off-Vehicle Transmission and Transaxle Repair

1. Remove and reinstall transmission/transaxle and torque converter; inspect engine core plugs, rear crankshaft seal, dowel pins, dowel pin holes, and mating surfaces. P-1

2. Inspect, leak test, and flush or replace transmission/transaxle oil cooler, lines, and fittings. P-1

3. Inspect converter flex (drive) plate, converter attaching bolts, converter pilot, converter pump drive surfaces, converter end play, and crankshaft pilot bore. P-2

4. Describe the operational characteristics of a continuously variable transmission (CVT). P-3

5. Describe the operational characteristics of a hybrid vehicle drive train. P-3

III. MANUAL DRIVE TRAIN AND AXLES
A. General: Drive Train Diagnosis

1. Identify and interpret drive train concerns; determine necessary action. P-1

2. Research applicable vehicle and service information, fluid type, vehicle service history, service precautions, and technical service bulletins. P-1

3. Check fluid condition; check for leaks; determine necessary action. P-1

4. Drain and refill manual transmission/transaxle and final drive unit. P-1

III. MANUAL DRIVE TRAIN AND AXLES
B. Clutch Diagnosis and Repair

1. Diagnose clutch noise, binding, slippage, pulsation, and chatter; determine necessary action. P-1

2. Inspect clutch pedal linkage, cables, automatic adjuster mechanisms, brackets, bushings, pivots, and springs; perform necessary action. P-1

3. Inspect and replace clutch pressure plate assembly, clutch disc, release (throw-out) bearing and linkage, and pilot bearing/bushing (as applicable). P-1

4. Bleed clutch hydraulic system. P-1

5. Check and adjust clutch master cylinder fluid level; check for leaks. P-1

6. Inspect flywheel and ring gear for wear and cracks; determine necessary action. P-1

7. Measure flywheel runout and crankshaft end play; determine necessary action. P-2

III. MANUAL DRIVE TRAIN AND AXLES
C. Transmission/Transaxle Diagnosis and Repair

1. Inspect, adjust, and reinstall shift linkages, brackets, bushings, cables, pivots, and levers. P-2

2. Describe the operational characteristics of an electronically-controlled manual transmission/transaxle. P-3

III. MANUAL DRIVE TRAIN AND AXLES
D. Drive Shaft and Half Shaft, Universal and Constant-Velocity (CV) Joint Diagnosis and Repair

1. Diagnose constant-velocity (CV) joint noise and vibration concerns; determine necessary action. P-1

2. Diagnose universal joint noise and vibration concerns; perform necessary action. P-2

3. Inspect, remove, and replace front wheel drive (FWD) bearings, hubs, and seals. P-1

4. Inspect, service, and replace shafts, yokes, boots, and universal/CV joints. P-1

5. Check shaft balance and phasing; measure shaft runout; measure and adjust driveline angles. P-2

III. MANUAL DRIVE TRAIN AND AXLES
E. Drive Axle Diagnosis and Repair
1. Ring and Pinion Gears and Differential Case Assembly

1. Clean and inspect differential housing; check for leaks; inspect housing vent. P-2

2. Check and adjust differential housing fluid level. P-1

3. Drain and refill differential housing. P-1

4. Inspect and replace companion flange and pinion seal; measure companion flange runout. P-2

2. Drive Axles

1. Inspect and replace drive axle wheel studs. P-1

2. Remove and replace drive axle shafts. P-1

3. Inspect and replace drive axle shaft seals, bearings, and retainers. P-2

4. Measure drive axle flange run out and shaft end play; determine necessary action. P-2

III. MANUAL DRIVE TRAIN AND AXLES
F. Four-wheel Drive/All-wheel Drive Component Diagnosis and Repair

1. Inspect, adjust, and repair shifting controls (mechanical, electrical, and vacuum), bushings, mounts, levers, and brackets. P-3

2. Inspect front-wheel bearings and locking hubs; perform necessary action(s). P-3

3. Check for leaks at drive assembly seals; check vents; check lube level. P-3

4. Identify concerns related to variations in tire circumference and/or final drive ratios. P-3

Term 1-2 (ODD)

VI. ELECTRICAL/ELECTRONIC SYSTEMS
A. General: Electrical System Diagnosis

1. Research applicable vehicle and service information, vehicle service history, service precautions, and technical service bulletins. P-1

2. Demonstrate knowledge of electrical/electronic series, parallel, and series-parallel circuits using principles of electricity (Ohm's Law). P-1

3. Demonstrate proper use of a digital multimeter (DMM) when measuring source voltage, voltage drop (including grounds), current flow and resistance. P-1

4. Demonstrate knowledge of the causes and effects from shorts, grounds, opens, and resistance problems in electrical/electronic circuits. P-1

5. Check operation of electrical circuits with a test light. P-1

6. Check operation of electrical circuits with fused jumper wires. P-1

7. Use wiring diagrams during the diagnosis (troubleshooting) of electrical/electronic circuit problems. P-1

8. Diagnose the cause(s) of excessive key-off battery drain (parasitic draw); determine necessary action. P-1

9. Inspect and test fusible links, circuit breakers, and fuses; determine necessary action. P-1

10. Inspect and test switches, connectors, relays, solenoid solid state devices, and wires of electrical/electronic circuits; determine necessary action. P-1

11. Replace electrical connectors and terminal ends. P-1

12. Repair wiring harness. P-1

13. Perform solder repair of electrical wiring. P-1

14. Check electrical/electronic circuit waveforms; interpret readings and determine needed repairs. P-2

15. Repair CAN/BUS wiring harness. P-1

VI. ELECTRICAL/ELECTRONIC SYSTEMS
B. Battery Diagnosis and Service

1. Perform battery state-of-charge test; determine necessary action. P-1

2. Confirm proper battery capacity for vehicle application; perform battery capacity test; determine necessary action. P-1

3. Maintain or restore electronic memory functions. P-1

4. Inspect and clean battery; fill battery cells; check battery cables, connectors, clamps, and hold-downs. P-1

5. Perform slow/fast battery charge according to manufacturer's recommendations. P-1

6. Jump-start vehicle using jumper cables and a booster battery or an auxiliary power supply. P-1

7. Identify high-voltage circuits of electric or hybrid electric vehicle and related safety precautions. P-3

8. Identify electronic modules, security systems, radios, and other accessories that require reinitialization or code entry after reconnecting vehicle battery. P-1

9. Identify hybrid vehicle auxiliary (12v) battery service, repair, and test procedures. P-3

VI. ELECTRICAL/ELECTRONIC SYSTEMS
C. Starting System Diagnosis and Repair

1. Perform starter current draw tests; determine necessary action. P-1

2. Perform starter circuit voltage drop tests; determine necessary action. P-1

3. Inspect and test starter relays and solenoids; determine necessary action. P-2

4. Remove and install starter in a vehicle. P-1

5. Inspect and test switches, connectors, and wires of starter control circuits; determine necessary action. P-2

6. Differentiate between electrical and engine mechanical problems that cause a slow-crank or a no-crank condition. P-2

VI. ELECTRICAL/ELECTRONIC SYSTEMS
D. Charging System Diagnosis and Repair

1. Perform charging system output test; determine necessary action. P-1

2. Diagnose (troubleshoot) charging system for causes of undercharge, no-charge, or overcharge conditions. P-1

3. Inspect, adjust, or replace generator (alternator) drive belts; check pulleys and tensioners for wear; check pulley and belt alignment. P-1

4. Remove, inspect, and re-install generator (alternator). P-1

5. Perform charging circuit voltage drop tests; determine necessary action. P-1

VI. ELECTRICAL/ELECTRONIC SYSTEMS
E. Lighting Systems Diagnosis and Repair

1. Diagnose (troubleshoot) the causes of brighter-than-normal, intermittent, dim, or no light operation; determine necessary action. P-1

2. Inspect interior and exterior lamps and sockets including headlights and auxiliary lights (fog lights/driving lights); replace as needed. P-1

3. Aim headlights. P-2

4. Identify system voltage and safety precautions associated with high-intensity discharge headlights. P-2

VI. ELECTRICAL/ELECTRONIC SYSTEMS
F. Gauges, Warning Devices, and Driver Information Systems Diagnosis and Repair

1. Inspect and test gauges and gauge sending units for causes of abnormal gauge readings; determine necessary action. P-2

2. Diagnose (troubleshoot) the causes of incorrect operation of warning devices and other driver information systems; determine necessary action. P-2

VI. ELECTRICAL/ELECTRONIC SYSTEMS
G. Horn and Wiper/Washer Diagnosis and Repair

1. Diagnose (troubleshoot) causes of incorrect horn operation; perform necessary action. P-1

2. Diagnose (troubleshoot) causes of incorrect wiper operation; diagnose wiper speed control and park problems; perform necessary action. P-2

3. Diagnose (troubleshoot) windshield washer problems; perform necessary action. P-2

VI. ELECTRICAL/ELECTRONIC SYSTEMS
H. Accessories Diagnosis and Repair

1. Diagnose (troubleshoot) incorrect operation of motor-driven accessory circuits; determine necessary action. P-2

2. Diagnose (troubleshoot) incorrect electric lock operation (including remote keyless entry); determine necessary action. P-2

3. Diagnose (troubleshoot) incorrect operation of cruise control systems; determine necessary action. P-3

4. Diagnose (troubleshoot) supplemental restraint system (SRS) problems; determine necessary action. P-2

5. Disable and enable an airbag system for vehicle service; verify indicator lamp operation. P-1

6. Remove and reinstall door panel. P-1

7. Check for module communication errors (including CAN/BUS systems) using a scan tool. P-2

8. Describe the operation of keyless entry/remote-start systems. P-3

9. Verify operation of instrument panel gauges and warning/indicator lights; reset maintenance indicators. P-1

10. Verify windshield wiper and washer operation, replace wiper blades. P-1

11. Diagnose (troubleshoot) radio static and weak, intermittent, or no radio reception; determine necessary action. P-3

12. Diagnose (troubleshoot) body electronic system circuits using a scan tool; determine necessary action. P-3

13. Diagnose the cause(s) of false, intermittent, or no operation of anti-theft systems. P-3

14. Describe the process for software transfers, software updates, or flash reprogramming on electronic modules. P-3

Term 3

IV. SUSPENSION AND STEERING
A. General: Suspension and Steering Systems

1. Research applicable vehicle and service information, vehicle service history, service precautions, and technical service bulletins. P-1

2. Identify and interpret suspension and steering system concerns; determine necessary action. P-1

IV. SUSPENSION AND STEERING
B. Steering Systems Diagnosis and Repair

1. Disable and enable supplemental restraint system (SRS). P-1

2. Remove and replace steering wheel; center/time supplemental restraint system (SRS) coil (clock spring). P-1

3. Diagnose steering column noises, looseness, and binding concerns (including tilt mechanisms); determine necessary action. P-2

4. Diagnose power steering gear (non-rack and pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine necessary action. P-2

5. Diagnose power steering gear (rack and pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine necessary action. P-2

6. Inspect steering shaft universal-joint(s), flexible coupling(s), collapsible column, lock cylinder mechanism, and steering wheel; perform necessary action. P-2

7. Remove and replace rack and pinion steering gear; inspect mounting bushings and brackets. P-2

8. Inspect rack and pinion steering gear inner tie rod ends (sockets) and bellows boots; replace as needed. P-2

9. Determine proper power steering fluid type; inspect fluid level and condition. P-1

10. Flush, fill, and bleed power steering system. P-2

11. Inspect for power steering fluid leakage; determine necessary action. P-1

12. Remove, inspect, replace, and adjust power steering pump drive belt. P-1

13. Remove and reinstall power steering pump. P-2

14. Remove and reinstall press fit power steering pump pulley; check pulley and belt alignment. P-2

15. Inspect and replace power steering hoses and fittings. P-2

16. Inspect and replace pitman arm, relay (centerlink/intermediate) rod, idler arm and mountings, and steering linkage damper. P-2

17. Inspect, replace, and adjust tie rod ends (sockets), tie rod sleeves, and clamps. P-1

18. Test and diagnose components of electronically-controlled steering systems using a scan tool; determine necessary action. P-3

19. Identify hybrid vehicle power steering system electrical circuits and safety precautions. P-2

20. Inspect electric power-assisted steering. P-3

IV. SUSPENSION AND STEERING
C. Suspension Systems Diagnosis and Repair

1. Diagnose short and long arm suspension system noises, body sway, and uneven ride height concerns; determine necessary action. P-1

2. Diagnose strut suspension system noises, body sway, and uneven ride height concerns; determine necessary action. P-1

3. Inspect, remove and install upper and lower control arms, bushings, shafts, and rebound bumpers. P-3

4. Inspect, remove and install strut rods and bushings. P-3

5. Inspect, remove and install upper and/or lower ball joints (with or without wear indicators). P-2

6. Inspect, remove and install steering knuckle assemblies. P-3

7. Inspect, remove and install short and long arm suspension system coil springs and spring insulators. P-3

8. Inspect, remove and install torsion bars and mounts P-3

9. Inspect, remove and install front stabilizer bar (sway bar) bushings, brackets, and links. P-3

10. Inspect, remove and install strut cartridge or assembly, strut coil spring, insulators (silencers), and upper strut bearing mount. P-3

11. Inspect, remove and install track bar, strut rods/radius arms, and related mounts and bushings. P-3

12. Inspect rear suspension system leaf spring(s), bushings, center pins/bolts, and mounts. P-1

IV. SUSPENSION AND STEERING
D. Related Suspension and Steering Service

1. Inspect, remove, and replace shock absorbers; inspect mounts and bushings. P-1

2. Remove, inspect, and service or replace front and rear wheel bearings. P-1

3. Describe the function of the power steering pressure switch. P-3

IV. SUSPENSION AND STEERING
E. Wheel Alignment Diagnosis, Adjustment, and Repair

1. Diagnose vehicle wander, drift, pull, hard steering, bump steer, memory steer, torque steer, and steering return concerns; determine necessary action. P-1

2. Perform prealignment inspection and measure vehicle ride height; perform necessary action. P-1

3. Prepare vehicle for wheel alignment on alignment machine; perform four-wheel alignment by checking and adjusting front and rear wheel caster, camber and toe as required; center steering wheel. P-1

4. Check toe-out-on-turns (turning radius); determine necessary action. P-2

5. Check SAI (steering axis inclination) and included angle; determine necessary action. P-2

6. Check rear wheel thrust angle; determine necessary action. P-1

7. Check for front wheel setback; determine necessary action. P-2

8. Check front and/or rear cradle (subframe) alignment; determine necessary action. P-3

9. Reset steering angle sensor P-2

IV. SUSPENSION AND STEERING
F. Wheels and Tires Diagnosis and Repair

1. Inspect tire condition; identify tire wear patterns; check for correct tire size and application (load and speed ratings) and adjust air pressure; determine necessary action. P-1

2. Diagnose wheel/tire vibration, shimmy, and noise; determine necessary action. P-2

3. Rotate tires according to manufacturer's recommendations. P-1

4. Measure wheel, tire, axle flange, and hub runout; determine necessary action. P-2

5. Diagnose tire pull problems; determine necessary action. P-2

6. Dismount, inspect, and remount tire on wheel; balance wheel and tire assembly (static and dynamic). P-1

7. Dismount, inspect, and remount tire on wheel equipped with tire pressure monitoring system sensor. P-2

8. Inspect tire and wheel assembly for air loss; perform necessary action. P-1
9. Repair tire using internal patch. P-1

10. Identify and test tire pressure monitoring system (indirect and direct) for operation; calibrate system; verify operation of instrument panel lamps. P-2

11. Demonstrate knowledge of steps required to remove and replace sensors in a tire pressure monitoring system. P-1

Term 4

VII. HEATING AND AIR CONDITIONING
A. General: A/C System Diagnosis and Repair

1. Identify and interpret heating and air conditioning problems; determine necessary action. P-1

2. Research applicable vehicle and service information, vehicle service history, service precautions, and technical service bulletins. P-1

3. Performance test A/C system; identify problems. P-1

4. Identify abnormal operating noises in the A/C system; determine necessary action. P-2

5. Identify refrigerant type; select and connect proper gauge set; record temperature and pressure readings. P-1

6. Leak test A/C system; determine necessary action. P-1

7. Inspect condition of refrigerant oil removed from A/C system; determine necessary action. P-2

8. Determine recommended oil and oil capacity for system application. P-1

9. Using a scan tool, observe and record related HVAC data and trouble codes. P-3

VII. HEATING AND AIR CONDITIONING
B. Refrigeration System Component Diagnosis and Repair

1. Inspect and replace A/C compressor drive belts, pulleys, and tensioners; determine necessary action. P-1

2. Inspect, test, service or replace A/C compressor clutch components and/or assembly; check compressor clutch air gap; adjust as needed. P-2

3. Remove, inspect, and reinstall A/C compressor and mountings; determine recommended oil quantity. P-2

4. Identify hybrid vehicle A/C system electrical circuits and service/safety precautions. P-2

5. Determine need for an additional A/C system filter; perform necessary action. P-3

6. Remove and inspect A/C system mufflers, hoses, lines, fittings, O-rings, seals, and service valves; perform necessary action. P-2

7. Inspect A/C condenser for airflow restrictions; perform necessary action. P-1

8. Remove, inspect, and reinstall receiver/drier or accumulator/drier; determine recommended oil quantity. P-2

9. Remove, inspect, and install expansion valve or orifice (expansion) tube. P-1

10. Inspect evaporator housing water drain; perform necessary action. P-1

11. Determine procedure to remove and reinstall evaporator; determine required oil quantity. P-2

VII. HEATING AND AIR CONDITIONING
C. Heating, Ventilation, and Engine Cooling Systems Diagnosis and Repair

1. Inspect engine cooling and heater systems hoses; perform necessary action. P-1

2. Inspect and test heater control valve(s); perform necessary action. P-2

3. Determine procedure to remove inspect, and reinstall heater core. P-2

VII. HEATING AND AIR CONDITIONING
D. Operating Systems and Related Controls Diagnosis and Repair

1. Inspect and test A/C-heater blower motors, resistors, switches, relays, wiring, and protection devices; perform necessary action. P-1

2. Diagnose A/C compressor clutch control systems; determine necessary action. P-2

3. Diagnose malfunctions in the vacuum, mechanical, and electrical components and controls of the heating, ventilation, and A/C (HVAC) system; determine necessary action. P-2

4. Inspect and test A/C-heater control panel assembly; determine necessary action. P-3

5. Inspect and test A/C-heater control cables, motors, and linkages; perform necessary action. P-3

6. Inspect A/C-heater ducts, doors, hoses, cabin filters, and outlets; perform necessary action. P-1

7. Identify the source of A/C system odors. P-2

8. Check operation of automatic or semi-automatic heating, ventilation, and air-conditioning (HVAC) control systems; determine necessary action. P-2

VII. HEATING AND AIR CONDITIONING
E. Refrigerant Recovery, Recycling, and Handling

1. Perform correct use and maintenance of refrigerant handling equipment according to equipment manufacturer's standards. P-1

2. Identify and recover A/C system refrigerant. P-1

3. Recycle, label, and store refrigerant. P-1

4. Evacuate and charge A/C system; add refrigerant oil as required. P-1