

WARREN COUNTY SCHOOL DISTRICT

Planned Instruction

Course Title: Automotive Technology

Course Number: 00902 (AM) 00952 (PM)

Suggested Educational Level(s): 10-12

Suggested Periods Per Week: 15 (3 per day) **Length of Period:** 40 mins. per pd.

Suggested Length Of Course: 3 successive years

Units Of Credit (If Appropriate): 3 per year/9 total

Date Written: February 2005

Date Approved: March 14, 2005

Date Reviewed: February 2005

Implementation Year: 2005-2006

Teacher Certification Required: Vocational II—Automotive Mechanic

Standards Addressed:

Automotive Service Excellence

Career Education and Work: 13.1.11D; 13.2.11B,D,F,G; 13.3.11A

Science and Technology: 3.1.10A,E; 3.7.10A,B,D; 3.7.12A,B

Math: 2.3.11A,C; 2.5.11C

Reading, Writing, Speaking, and Listening: 1.1.11A; 1.2.11A; 1.4.1D,E; 1.6.11A

Relationship to Other Planned Instruction:

All course content is developed from Automotive Service Excellence-National Automotive Technicians Education Foundation (ASE-NATEF) standards and Pennsylvania Academic Standards and prepares students for future ASE certification.

Prerequisites:

Student must complete 9th grade before being accepted into the Automotive Technology Program. A state/Automotive Service Excellence (ASE) entrance exam will be given to students.

Special Requirements: Mechanical talents, problem solving, and the ability to use “head and hands together” are very important. Applied math, science, computer, and communication skills are also vital to this career field.

The Automotive Technology Safety Program must be completed with a minimum of 80% accuracy to continue with the Automotive planned instruction.

Writing Team Members: Gary Bish, Automotive Occupational Advisory Team, Mark Lindberg

Standards addressed:

13.1.11 Career Awareness and Planning

D: Justify the selection of a career.

13.2.11 Career Acquisition

B: Analyze and evaluate complex technical tasks using sophisticated processes.

D: Identify sources of health, safety and regulatory practices and their effect on the work environment.

F: Analyze Performance-based assessments components.

G: Analyze the need for manipulative/motor skills

13.3.11 Career Retention

A: Analyze work habits needed to advance within a career.

3.1.10 Unifying Themes

A: Discriminate among the concepts of systems, subsystems, feedback and control in solving Technological problems.

E. Describe pattern of change in nature, physical and man made systems.

3.7.10 Technological Devices

A. Identify and safely use a variety of tool, basic machines, materials and techniques to solve problems and answer questions.

B. Apply appropriate instruments and apparatus to examine a variety of objects and processes.

D: Utilize computer software to solve specific problems.

3.7.12 Technological Devices

A. Apply advanced tools, materials, and techniques to answer complex questions.

B: Evaluate appropriate instruments and apparatus to accurately measure materials and processes.

2.3.11 Measurement and Estimation

A: Select and use appropriate units and tools to measure to the degree of accuracy required in particular measurement situations.

C: Demonstrate the ability to produce measures with specified levels of precision.

2.5.11 Mathematical Problem Solving and Communication

C: Present mathematical procedures and results clearly, systematically, succinctly and correctly.

1.1.11 Learning to Read Independently

A: Locate various texts, media and traditional resources for assigned and independent projects before reading.

1.2.11 Reading Critically in All Content Areas

A: Read and understand essential content of informational texts and documents in all academic areas.

1.4.11 Types of Writing

D: Maintain a written record of activities, course work, experience, honors and interests.

E: Write a personal resume.

1.6.11 Speaking and Listening

A: Listen to others.

COURSE DESCRIPTION:

The Automotive Technology program provides students with specialized classroom and shop training including the use of technical and service manuals and the State Inspection Code.

All course content is developed from ASE-NATEF standards and Pennsylvania Academic Standards and prepares students for future ASE certification.

Automotive Technology is a competency-based program, developed and managed by the instructor, consisting of a series of planned courses designed to provide graduates with the skills, knowledge, and attitudes necessary for entry level employment and/or post-secondary training in related careers. The competency-based structure of the course requires students to successfully complete those tasks that have been verified by the Occupational Advisory Committee as being critical to achieve entry-level employment. All courses within the program also integrate safety, leadership skills, along with mathematics, science, and communications skills that are part of the student's academic program.

Professional attitudes will be developed through the VICA Club and class activities.

Tests do not award certification badges.

Specific Educational Objectives to be taught:

The student will be able to—

1. remove, install, and repair engines.
2. remove, install, and repair automatic transmissions and transaxles.
3. remove, install, and repair manual transmissions and transaxles.
4. diagnose and repair steering and suspensions systems.
5. diagnose and repair the complete brake system.
6. diagnose and repair the electrical and electronic systems of the automobile.
7. diagnose and repair the heating and air conditioning systems of an automobile.
8. diagnose and repair the ignition and fuel injection systems of an automobile.
9. apply essential safety practices to all areas of automotive technology.

Outline of Content Sequence and Recommended Time:

The outlines that follow describe the content of an ungraded course where Grade 10, 11, and 12 students work in specialty content areas determined by student choice rather than grade level, or a required sequence. A student can start with any of the specialty content area in the curriculum, then select a second and third and so on. The instructor provides continual and developing instruction while students work independently in one area listed below. The student must attain 60% competency in the knowledge and skills of one specialty area before moving to another.

Engine Repair	minimum 120 hours required
Automatic Transmission and Transaxle	minimum 120 hours required
Manual Drive Train and Axles	minimum 100 hours required
Suspension and Steering	minimum 95 hours required
Brakes	minimum 105 hours required
Electrical/Electronic Systems	minimum 230 hours required
Heating and Air Conditioning.....	minimum 90 hours required
Engine Performance.....	minimum 220 hours required

Each specialty component is directly aligned to ASE standards and is designed to prepare students for future ASE certifications.

COURSE OBJECTIVES/ASE STANDARDS AUTOMOTIVE TECHNOLOGY

ENGINE REPAIR

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

- I. Verify and interpret engine concern; determine necessary action.
2. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action.
3. Diagnose engine noises and vibrations; determine necessary action.
4. Diagnose the cause of excessive oil consumption, unusual engine exhaust color, odor, and sound; determine necessary action.
5. Perform engine vacuum tests; determine necessary action.
6. Perform cylinder power balance tests; determine necessary action.
7. Perform cylinder compression tests; determine necessary action.
8. Perform cylinder leakage tests; determine necessary action.
9. Remove engine (front-wheel drive); prepare for disassembly.
10. Reinstall engine (front-wheel drive).
- II. Remove engine (rear-wheel drive); prepare for disassembly.
12. Reinstall engine (rear-wheel drive).

B. Cylinder Head and Valve Train Diagnosis and Repair

1. Remove cylinder head(s); visually inspect cylinder heads(s) for cracks; check gasket surface areas for warpage and leakage; check passage condition.
2. Install cylinder heads and gaskets; tighten according to manufacturer's specifications and procedures.
3. Inspect and test valve springs for squareness, pressure, and free height comparison; replace as needed.
4. Inspect valve spring retainers, locks, and valve grooves.
5. Replace valve stem seals.
6. Inspect valve guides for wear; check valve guide height and stem-to-guide clearance; recondition or replace as needed.
7. Resurface valves; perform necessary action.
8. Resurface valve seats; perform necessary action.
9. Check valve face-to-seat contact and valve seat concentricity (runout) service seats and valves as needed.
10. Check valve spring assembled height and valve stem height; service valve and spring assemblies as needed.
- II. Inspect pushrods, rocker arms, rocker arm pivots and shafts for wear, bending, cracks, looseness, and blocked oil passages (orifices); perform necessary action.
12. Inspect hydraulic or mechanical lifters; replace as needed.
13. Adjust valves (mechanical or hydraulic lifters).
14. Inspect camshaft drives (including gear wear and backlash, sprocket and chain wear); replace as necessary.
15. Inspect and replace timing belt(s), overhead camdrive sprockets, and tensioners; check belt tension; adjust as necessary.
16. Inspect camshaft for runout, journal wear and lobe wear.
17. Inspect and measure camshaft bearings for wear, damage, out-of-round, and alignment; determine necessary action.
18. Verify camshaft(s) timing according to manufacturer's specifications and procedure.

C. Engine Block Assembly Diagnosis and Repair

1. Inspect and replace pans, covers, gaskets, and seals.
2. Inspect engine block for visible cracks, passage condition, core and gallery plug condition, and surface warpage; determine necessary action.
3. Inspect internal and external threads; restore as needed (includes installing thread inserts).
4. Remove cylinder wall ridges.
5. Inspect and measure cylinder walls for damage and wear; determine necessary action.
6. Deglaze and clean cylinder walls.
7. Inspect and measure camshaft bearings for wear, damage, out-of-round, and alignment; determine necessary action.
8. Inspect crankshaft for surface cracks and journal damage; check oil passage condition; measure journal wear; determine necessary action.
9. Inspect and measure main and connecting rod bearings for damage, clearance, and end play; determine necessary action (includes the proper selection of bearings).
10. Identify piston and bearing wear patterns that indicate connecting rod alignment and main bearing bore problems; inspect rod alignment and bearing; bore condition.

D. Lubrication and Cooling Systems Diagnosis and Repair

1. Perform oil pressure tests; determine necessary action.
2. Inspect oil pump gears or rotors, housing, pressure relief devices, and pump drive; perform necessary action.
3. Perform cooling system, cap, and recovery system tests (pressure, combustion leakage, and temperature); determine necessary action.
4. Inspect, replace, and adjust drive belts, tensioners, and pulleys.
5. Inspect and replace engine cooling and heater system hoses.
6. Inspect, test, and replace thermostat and housing.
7. Test coolant; drain and recover coolant; flush and refill cooling system with recommended coolant; bleed air as required.
8. Inspect, test, remove, and replace water pump.
9. Remove and replace radiator.
10. Inspect, and test fans(s) (electrical or mechanical), fan clutch, fan shroud and air dams.
11. Inspect auxiliary oil coolers; replace as needed.
12. Inspect, test, and replace oil temperature and pressure switches and sensors.
13. Perform oil and filter change.

AUTOMATIC TRANSMISSION AND TRANSAXLE

A. General Transmission and Transaxle Diagnosis

1. Identify and interpret transmission concern; assure proper engine operation; determine necessary action.
2. Diagnose unusual fluid usage, level, and condition concerns; determine necessary action.
3. Perform pressure tests; determine necessary action.
4. Perform lock-up converter system tests; determine necessary action.
5. Diagnose electronic, mechanical, hydraulic, vacuum control system

concerns; determine necessary action.

6. Diagnose noise and vibration concerns; determine necessary action.

B. Transmission and Transaxle Maintenance and Adjustment

1. Inspect, adjust or replace throttle (TV) linkages or cables, check gear select indicator (as applicable).

2. Service transmission; perform visual inspection; replace fluids and filters.

C. In-Vehicle Transmission and Transaxle Repair

1. Inspect, adjust or replace(as applicable) vacuum modulator; inspect and repair or replace lines and hoses.

2. Inspect, repair, and replace governor assembly.

3. Inspect and replace external seals and gaskets.

4. Inspect extension housing, bushings and seals; perform necessary action.

5. Inspect, leak test, flush, and replace cooler, lines, and fittings.

6. Inspect and replace speedometer drive gear, driven gear, vehicle speed sensor (VSS), and retainers.

7. Inspect and test, adjust, repair or replace transmission related electrical and electronic components (includes computers, solenoids, sensors, relays, switches, and harnesses).

8. Inspect, replace, and align powertrain mounts.

D. Off- Vehicle Transmission and Transaxle Repair

I. Removal, Disassembly, and Reinstallation

1. Remove and reinstall transmission and torque converter (rear-wheel drive).

2. Remove and reinstall transaxle and torque converter assembly.

3. Disassemble, clean, and inspect transmission/transaxle.

4. Inspect, measure, clean, and replace valve body (includes surfaces and bores, springs, valves, sleeves, retainers, brackets, check-balls, screens, spacers, and gaskets), and torque valve body bolts.

5. Inspect servo bore, piston, seals, pin, spring, and retainers; determine necessary action.

6. Inspect accumulator bore, piston, seals spring, and retainer; determine necessary action.

7. Assemble transmission/transaxle.

II. Oil Pump and Converter

1. Inspect converter flex plate, attaching parts, pilot, pump drive, and seal areas.

2. Measure torque converter endplay and check for interference; check stator clutch.

3. Inspect, measure, and replace oil pump assembly and components.

4. Check torque converter and transmission cooling system for contamination.

III. Gear Train, Shafts, Bushings and Case

1. Measure endplay or preload; determine necessary action.

2. Inspect, measure, and replace thrust washers and bearings.

3. Inspect oil delivery seal rings, ring grooves, and sealing surface areas.

4. Inspect bushings; replace as needed.

5. Inspect and measure planetary gear assembly (includes sun, ring gear, thrust washers, planetary gears, and carrier assembly); replace as needed.

6. Inspect case bores, passages, bushings, vents, and mating surfaces; determine necessary action.

7. Inspect transaxle drive, link chains, sprockets, gears, bearings, and

- bushings; perform necessary action.
8. Inspect, measure, repair, adjust or replace transaxle final drive components.
 9. Inspect and reinstall parking pawl, shaft, spring, and retainer; determine necessary action.

IV. Friction and Reaction Units

1. Inspect clutch drum, piston, check-balls, springs, retainers, seals, and friction and pressure plates; replace as needed.
2. Measure clutch pack clearance; adjust as needed.
3. Air test operation of clutch and servo assemblies.
4. Inspect roller and sprag clutch, races, rollers, sprags, springs, cages, and retainers; replace as needed.
5. Inspect bands and drums; adjust or replace as needed.

MANUAL DRIVE TRAIN AND AXLES

A. Clutch Diagnosis and Repair

1. Diagnose clutch noise, binding, slippage, pulsation, and chatter; determine necessary action.
2. Inspect clutch pedal linkage, cables, automatic adjuster mechanisms, brackets, bushings, pivots, and springs; perform necessary action.
3. Inspect hydraulic clutch slave and master cylinders, lines, and hoses; perform necessary action.
4. Inspect release (throw-out) bearing, lever, and pivot; perform necessary action.
5. Inspect and replace clutch pressure plate assembly and clutch disc.
6. Inspect, remove or replace crankshaft pilot bearing or bushing (as applicable).
7. Inspect flywheel and ring gear for wear and cracks, measure runout; determine necessary action.
8. Inspect engine block, clutch (bell) housing, and transmission/transaxle case mating surfaces; determine necessary action.
9. Measure flywheel-to-block runout and crankshaft endplay; determine necessary action.

B. Transmission/Transaxle Diagnosis and Repair

1. Remove and reinstall transmission/transaxle.
2. Disassemble, clean, and reassemble transmission/transaxle components.
3. Inspect transmission/transaxle case, extension housing, case mating surfaces, bores, bushings, and vents; perform necessary action.
4. Diagnose noise, hard shifting, jumping out of gear, and fluid leakage concerns; determine necessary action.
5. Inspect, adjust, and reinstall shift linkages, brackets, bushings, cables, pivots, and levers.
6. Inspect and reinstall powertrain mounts.
7. Inspect and replace gaskets, seals, and sealants; inspect sealing surfaces.
8. Remove and replace transaxle final drive.
9. Inspect, adjust, and reinstall shift cover, forks, levers, grommets, shafts, sleeves, detent mechanism, interlocks, and springs.
10. Measure endplay or preload (shim or spacer selection procedure) on transmission/transaxle shafts; perform necessary action.
11. Inspect and reinstall synchronizer hub, sleeve, keys (inserts), springs, and blocking rings.
12. Inspect and reinstall speedometer drive gear, driven gear, vehicle speed

- sensor (VSS), and retainers.
13. Diagnose transaxle final drive assembly noise and vibration concerns; determine necessary action.
 14. Remove, inspect, measure, adjust and reinstall transaxle final drive pinion gears (spiders), shaft, side gears, side bearings, thrust washers, and case assembly.
 15. Inspect lubrication devices (oil pump or slingers); perform necessary action.
 16. Inspect, test and replace transmission/transaxle sensors and switches.

C. 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.
2. Diagnose universal joint noise and vibration concerns; perform necessary action.
3. Replace front wheel drive (FWD) front wheel bearing.
4. Inspect, service, and replace shafts, yokes, boots, and CV joints.
5. Inspect, service, and replace shaft center support bearings.
6. Check shaft balance; measure shaft runout; measure and adjust driveline angles.

D. Drive Axle Diagnosis and Repair

1. Ring and Pinion Gears and Differential Case Assembly
1. Diagnose noise and vibration concerns; determine necessary action.
 2. Diagnose fluid leakage concerns; determine necessary action.
 3. Remove and replace drive axle shafts.
 4. Inspect and replace drive axle shaft seals, bearings, and retainers.
 5. Measure drive axle flange runout and shaft endplay; determine necessary action.

E. Four-wheel Drive/All-wheel Drive Component Diagnosis and Repair.

1. Diagnose noise, vibration, and unusual steering concerns; determine necessary action.
2. Inspect, adjust, and repair shifting controls (mechanical, electrical, and vacuum), bushings, mounts, levers, and brackets.
3. Remove and reinstall transfer case.
4. Disassemble, service, and reassemble transfer case and components.
5. Inspect front-wheel bearings and locking hubs; perform necessary action.
6. Check drive assembly seals and vents; check lube level
7. Diagnose test, adjust, and replace electrical/electronic components of four-wheel drive systems.

SUSPENSION AND STEERING

A. Steering Systems Diagnosis and Repair

1. Disable and enable supplemental restraint system (SRS) in accordance with manufacturer's procedures.
2. Remove and replace steering wheel; center/time supplemental restraint system (SRS) coil in accordance with manufacturer's procedures.
3. Diagnose steering column noises, looseness, and binding concerns (including tilt mechanisms), determine necessary action.
4. Diagnose power steering gear (non-rack and pinion) binding, uneven

- turning effort, looseness, hard steering, and fluid leakage concerns; determine necessary action.
5. Diagnose power steering gear (rack and pinion) binding, uneven turning effort, looseness, hard steering, and fluid leakage concerns; determine necessary action.
 6. Inspect steering shaft universal-joint(s), flexible coupling(s), collapsible column, lock cylinder mechanism, and steering wheel; perform necessary action.
 7. Adjust manual or power non-rack and pinion worm bearing preload and sector lash.
 8. Remove and replace manual or power rack and pinion steering gear; inspect mounting bushings and brackets.
 9. Disassemble, inspect, perform necessary action and reassemble rack and pinion steering gear.
 10. Adjust manual or power rack and pinion steering gear.
 11. Inspect and replace manual or power rack and pinion steering gear inner tie rod ends (sockets) and bellows boots.
 12. Inspect power steering fluid levels and condition.
 13. Flush, fill, and bleed power steering system.
 14. Diagnose power steering fluid leakage; determine necessary action.
 15. Remove, inspect, replace, and adjust power steering pump belt.
 16. Remove, inspect, and replace power steering pump, mounts, seals, and gaskets.
 17. Remove, inspect, and replace power steering pump pulley; check alignment.
 18. Inspect and replace power steering hoses and fittings.
 19. Inspect and replace pitman arm, relay (centerlink/intermediate) rod, idler arm and mountings, and steering linkage damper.
 20. Inspect, replace, and adjust tie rod ends (sockets), tie rod sleeves, and clamps.
 21. Diagnose and adjust components of electronically controlled steering systems; determine necessary action.

B. Suspension Systems Diagnosis and Repair

I. Front Suspension

1. Diagnose short and long arm suspension system noises, body sway, and uneven riding height concerns; determine necessary action.
2. Diagnose MacPherson strut suspension system noises, body sway, and uneven riding height concerns; determine necessary action.
3. Remove, inspect, and install upper and lower control arms, bushings, shafts, and rebound bumpers.
4. Remove, inspect, install, and adjust strut (compression/tension) rods and bushings.
5. Remove, inspect, and install upper and lower ball joints on short and long arm suspension systems.
6. Remove, inspect, and install steering knuckle assemblies.
7. Remove, inspect, and install short and long arm suspension system coil springs and spring insulators.
8. Remove, inspect, install, and adjust suspension system torsion bars; inspect mounts.

9. Remove, inspect, and install stabilizer bar bushings, brackets, and links.
10. Remove, inspect, and install MacPherson strut cartridge or assembly, strut coil spring, insulators (silencers), and upper strut bearing mount.
11. Lubricate suspension and steering systems.

II. Rear Suspensions

1. Remove, inspect, and install coil springs and spring insulators.
2. Remove, inspect, and install transverse links, control arms, bushings, and mounts.
3. Remove, inspect, and install leaf springs, leaf spring insulators (silencers), shackles, brackets, bushings, and mounts.
4. Remove, inspect, and install MacPherson strut cartridge or assembly, strut coil spring, and insulators (silencers).

III. Miscellaneous Service

1. Inspect, remove, and replace shock absorbers.
2. Remove, inspect, and service or replace front and rear wheel bearings.
3. Diagnose, inspect, adjust, repair or replace components of electronically controlled suspension systems.

C. 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.
2. Perform prealignment inspection; perform necessary action.
3. Measure vehicle riding height, determine necessary action.
4. Check and adjust front and rear wheel camber; perform necessary action.
5. Check and adjust caster; perform necessary action.
6. Check and adjust front wheel toe; adjust as needed.
7. Center steering wheel.
8. Check toe-out-on-turns (turning radius); determine necessary action.
9. Check SAI (steering axis inclination) and included angle; determine necessary action.
10. Check and adjust rear wheel toe.
11. Check rear wheel thrust angle; determine necessary action.
12. Check for front wheel setback; determine necessary action.
13. Check front cradle (subframe) alignment; determine necessary action.

D. Wheel and Tire Diagnosis and Repair

1. Diagnose tire wear patterns; determine necessary action.
2. Inspect tires; check and adjust air pressure.
3. Diagnose wheel/tire vibration, shimmy, and noise; determine necessary action.
4. Rotate tires according to manufacturer's recommendations.
5. Measure wheel, tire, axle, and hub runout; determine necessary action.
6. Diagnose tire pull (lead) problem; determine necessary action.
7. Balance wheel and tire assembly (static and dynamic).
8. Dismount, inspect, repair, and remount tire on wheel.
9. Reinstall wheel; torque lug nuts.

BRAKES

A. Hydraulic System Diagnosis and Repair

1. Measure and adjust pedal height.

2. Check master cylinder for internal and external leaks and proper operation; determine necessary action.
3. Remove, bench bleed, and reinstall master cylinder.
4. Diagnose poor stopping, pulling or dragging concerns caused by problems in the hydraulic system; determine necessary action.
5. Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging or wear; tighten loose fittings and supports; determine necessary action.
6. Fabricate and install brake lines (double flare and ISO types); replace hoses, fittings, and supports as needed.
7. Select, handle, store, and install brake fluids to proper level.
8. Inspect, test, and replace metering (hold-off), proportioning (balance), pressure differential, and combination valves.
9. Inspect, test, replace, and adjust height (load) sensing proportioning valve.
10. Inspect, test, and replace components of brake warning light system.
11. Bleed (manual, pressure, vacuum or surge) brake system.
12. Flush hydraulic system.

B. Drum Brake Diagnosis and Repair

1. Diagnose poor stopping, noise, pulling, grabbing, dragging or pedal pulsation concerns; determine necessary action.
2. Remove, clean (using proper safety procedures), inspect, and measure brake drums; service or replace as needed.
3. Mount brake drum on lathe; machine braking surface.
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.
5. Remove, inspect, and install wheel cylinders.
6. Pre-adjust brake shoes and parking brake before installing brake drums or drum/hub assemblies and wheel bearings.
7. Install wheel, torque lug nuts, and make final checks and adjustments.

C. Disc Brake Diagnosis and Repair

1. Diagnose poor stopping, noise, pulling, grabbing, dragging or pedal pulsation concerns; determine necessary action.
2. Remove caliper assembly from mountings; clean and inspect for leaks and damage to caliper housing; determine necessary action.
3. Clean and inspect caliper mounting and slides for wear and damage; determine necessary action.
4. Remove, clean, and inspect pads and retaining hardware; determine necessary action.
5. Disassemble and clean caliper assembly; inspect parts for wear, rust, scoring, and damage; replace seal, boot, and damaged or worn parts.
6. Reassemble, lubricate, and reinstall caliper, pads, and related hardware. Seat pads, and inspect for leaks.
7. Clean, inspect, and measure rotor with a dial indicator and a micrometer; follow manufacturer's recommendations in determining need to machine or replace.
8. Refinish rotor according to manufacturer's recommendations.
9. Adjust calipers with integrated parking brake system.
10. Install wheel, torque lug nuts, and make final checks and adjustments.

11. Remove and replace rotor.

D. Power Assist Units Diagnosis and Repair

1. Test pedal free travel with and without engine running; check power assist operation.
2. Check vacuum supply (manifold or auxiliary pump) to vacuum-type power booster.
3. Inspect the vacuum-type power booster unit for vacuum leaks; inspect the check valve for proper operation; determine necessary action.
4. Inspect and test hydro-boost system and accumulator for leaks and proper operation; determine necessary action.

E. Miscellaneous (Wheel Bearings, Parking Brakes, Electrical, Etc.) Diagnosis and Repair

1. Diagnose wheel bearing noises, wheel shimmy, and vibration concerns; determine necessary action.
2. Remove, clean, inspect, repack, and install wheel bearings and replace seals; install hub and adjust wheel bearings.
3. Check parking brake cables and components for wear, rusting, binding, and corrosion; clean, lubricate, and replace as needed.
4. Check parking brake operation; adjust as needed.
5. Check operation of parking brake indicator light system.
6. Check operation of brake stop light system; adjust and service as needed.
7. Replace wheel bearing and race.

F. Anti-lock Brake System

1. Inspect and test anti-lock brake system (ABS) components; determine necessary action
2. Diagnose poor stopping, wheel lock-up, abnormal pedal feel or pulsation, and noise concerns caused by the anti-lock brake system (ABS); determine necessary action.
3. Diagnose anti-lock brake system (ABS) electronic control(s) and components using self-diagnosis and/or recommended test equipment; determine necessary action.
4. Depressurize high-pressure components of the anti-lock brake system (ABS).
5. Bleed the anti-lock brake system's (ABS) front and rear hydraulic circuits.
6. Remove and install anti-lock brake system (ABS) electrical/electronic and hydraulic components.
7. Service, test, and adjust anti-lock brake system (ABS) speed sensors.
8. Diagnose anti-lock brake system (ABS) braking concerns caused by P-3 vehicle modifications (tire size, curb height, final drive ratio, etc.).

ELECTRICAL/ELECTRONICS SYSTEMS

A. General Electrical System Diagnosis

1. Use wiring diagrams during diagnosis of electrical circuit problems.
2. Check electrical circuits with a test light; determine necessary action.
3. Check voltage and voltage drop in electrical/electronic circuits using a digital multimeter (DMM); determine necessary action.
4. Check current flow in electrical/electronic circuits and components using an ammeter; determine necessary action.
5. Check continuity and resistances in electrical/electronic circuits and components with an ohmmeter; determine necessary action.
6. Check electrical circuits using jumper wires; determine necessary action.
7. Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine necessary action.
8. Measure and diagnose the cause(s) of abnormal key-off battery drain; determine necessary action.
9. Inspect and test fusible links, circuit breakers, and fuses; determine necessary action.
10. Inspect and test switches, connectors, relays, and wires of electrical/electronic circuits; perform necessary action.
11. Repair wiring harnesses and connectors.
12. Perform solder repair of electrical wiring.

B. Battery Diagnosis and Service

1. Perform battery state-of-charge test; determine needed service.
2. Perform battery capacity test; determine needed service.
3. Maintain or restore electronic memory functions.
4. Inspect, clean, fill and replace battery.
5. Perform slow/fast battery charge.
6. Inspect and clean battery cables, connectors, clamps, and hold-downs; repair or replace as needed.
7. Start a vehicle using jumper cables and a battery or auxiliary power supply according to manufactures recommended specifications.

C. Starting System Diagnosis and Repair

1. Perform starter current draw tests; determine necessary action.
2. Perform starter circuit voltage drop test; determine necessary action.
3. Inspect and test starter relays and solenoids; replace as needed.
4. Remove and install starter.
5. Perform starter bench tests; determine necessary action.
6. Inspect and test switches, connectors, and wires of starter control circuits; perform necessary action.
7. Disassemble, clean, inspect, and test starter components; replace as needed.

D. Charging System Diagnosis and Repair

1. Perform charging system output test; determine necessary action.
2. Diagnose charging system for the cause of undercharge, no-charge, and overcharge conditions.
3. Inspect and adjust generator (alternator) drive belts; replace as needed.
4. Inspect and test voltage regulator/regulating circuit; perform necessary action.
5. Remove, inspect, and install generator (alternator).
6. Disassemble generator (alternator), clean, inspect, test components;

determine necessary action.

7. Perform charging circuit voltage drop tests; determine necessary action.

E. Lighting System Diagnosis and Repair

1. Diagnose the cause of brighter than normal, intermittent, dim, or no light operation; determine necessary action.

2. Inspect, replace, and aim headlights and bulbs.

3. Inspect and diagnose incorrect turn signal or hazard light operation; perform necessary action

F. Gauges, Warning Devices, and Driver Information Systems Diagnosis and Repair

1. Inspect and test gauges and gauge sending units for cause of intermittent, high, low, or no gauge readings; determine necessary action.

2. Inspect and test connectors, wires, and printed circuit boards of gauge circuits; determine necessary action.

3. Diagnose the cause of incorrect operation of warning devices and other driver information systems; determine necessary action.

4. Inspect and test sensors, connectors, and wires of electronic instrument circuits; determine necessary action.

G. Horn and Wiper/Washer Diagnosis and Repair

1. Diagnose incorrect horn operation; perform necessary action.

2. Diagnose incorrect wiper operation; diagnose wiper speed control and park problems, perform necessary action.

3. Diagnose incorrect windshield washer operation; perform necessary action.

H. Accessories Diagnosis and Repair

1. Diagnose incorrect operation of motor-driven accessory circuits; determine necessary action.

2. Diagnose incorrect heated glass operation; determine necessary action.

3. Diagnose incorrect electric lock operation; determine necessary action.

4. Diagnose incorrect operation of cruise control systems; repair as needed.

5. Diagnose supplemental restraint system (SRS) concerns; determine necessary action. (Note: Follow manufacturer's safety procedures to prevent accidental deployment.)

6. Diagnose radio static and weak, intermittent, or no radio reception; determine necessary action.

HEATING AND AIR CONDITIONING

A. A/C System Diagnosis and Repair

1. Diagnose unusual operating noises in the A/C system; determine necessary action.

2. Identify refrigerant type; conduct a performance test of the A/C system; determine necessary action.

3. Leak test A/C; determine necessary action.

4. Inspect the condition of discharged oil; determine necessary action.

5. Select oil type; measure, and add oil to the A/C system as needed.

B. Refrigeration System Component Diagnosis and Repair

I. Compressor and Clutch

1. Diagnose A/C system conditions that cause the protection devices (pressure, thermal, and PCM) to interrupt system operation; determine necessary action.

2. Inspect A/C compressor drive belts; replace and adjust as needed.

3. Inspect, test, and replace A/C compressor clutch components or assembly.

4. Remove and replace A/C compressor and mountings.

II. Evaporator, Condenser, and Related Components

1. Determine need for A/C system filter; perform necessary action.
2. Remove and inspect A/C system mufflers, hoses, lines, fittings, o-rings, seals, and service valves; perform necessary action.
3. Inspect A/C condenser for airflow restrictions; perform necessary action.
4. Remove and install receiver/drier or accumulator/drier.
5. Remove and install expansion valve or orifice (expansion) tube.
6. Inspect evaporator housing water drain; perform necessary action.

C. Heating, Ventilation, and Engine Cooling Systems Diagnosis and Repair

1. Diagnose temperature control problems in the heater/ventilation systems; determine necessary action.
2. Perform cooling system, cap, and recovery system tests (pressure, combustion leakage, and temperature); determine necessary action.
3. Inspect engine cooling and heater system hoses and belts; perform necessary action.
4. Inspect, test, and replace thermostat and housing.
5. Determine coolant condition; drain and recover coolant.
6. Flush system; refill system with recommended coolant; bleed system.
7. Inspect and test fan, fan clutch (electrical and mechanical), fan shroud, and air dams; perform necessary action.
8. Inspect and test electrical fan control system and circuits.
9. Inspect and test heater control valve(s); perform necessary action.

D. Operating Systems and Related Controls Diagnosis and Repair

1. Diagnose failures in the electrical controls of heating, ventilation, and A/C(HVAC) systems; determine necessary action.
2. Inspect and test A/C-heater blower, motors, resistors, switches, relays, wiring, and protection devices; perform necessary action.
3. Test A/C compressor load cut-off systems; determine necessary action.
4. Diagnose failures in the vacuum and mechanical components and controls of the heating, ventilation, and A/C (HVAC) system; determine necessary action.
5. Inspect and test A/C-heater control panel assembly; determine necessary action.
6. Inspect and test A/C-heater control cables and linkages; perform necessary action.
7. Inspect and test A/C-heater ducts, doors, hoses, and outlets; perform necessary action.
8. Check operation of automatic and semi-automatic heating, ventilation, and air-conditioning (HVAC) control systems; determine necessary action.

E. Refrigerant Recovery , Recycling, and Handling

1. Verify correct operation and maintenance of refrigerant handling equipment.
2. Identify (by label application or use of a refrigerant identifier) and recover A/C system refrigerant.
3. Recycle refrigerant.
4. Label and store refrigerant.
5. Test recycled refrigerant for non-condensable gases.
6. Evacuate and charge A/C system.

ENGINE PERFORMANCE

A. General Engine Diagnosis

1. Interpret and verify concern; determine necessary action.
2. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action.
3. Diagnose unusual engine noise or vibration concerns; determine necessary action.
4. Diagnose unusual exhaust color, odor, and sound; determine necessary action.
5. Perform engine absolute (vacuum/boost) manifold pressure tests; determine necessary action.
6. Perform cylinder power balance test; determine necessary action.
7. Perform cylinder compression test; determine necessary action.
8. Perform cylinder leakage test; determine necessary action.
9. Diagnose engine mechanical, electrical, electronic, fuel, and ignition concerns with an oscilloscope and engine diagnostic equipment; determine necessary action.
10. Prepare 4 or 5 gas analyzer; inspect and prepare vehicle for test, and obtain exhaust readings; interpret readings, and determine necessary action.

B. Computerized Engine Controls Diagnosis and Repair

1. Retrieve and record stored OBD I diagnostic trouble codes; clear codes.
 2. Retrieve and record stored OBD II diagnostic trouble codes; clear codes.
 3. Diagnose the causes of emissions or driveability concerns resulting from failure of computerized engine controls with stored diagnostic trouble codes.
 5. Diagnose emissions or driveability concerns resulting from failure of computerized engine controls with no stored diagnostic trouble codes; determine necessary action.
 6. Obtain and interpret digital multimeter (DMM) readings.
 7. Access and use electronic service information (ESI).
 8. Locate and interpret vehicle and major component identification numbers (VIN , vehicle certification labels, and calibration decals).
 9. Inspect and test power and ground circuits and connections; service or replace as needed.
 10. Practice recommended precautions when handling static sensitive devices.
- II. Diagnose driveability and emissions problems resulting from failures of interrelated systems (cruise control, security alarms, suspension controls, traction controls, A/C, automatic transmissions, non-OEM-installed accessories, and similar systems); determine necessary action.

C. Ignition System Diagnosis and Repair

1. Diagnose no-starting, driveability, and emissions concerns on vehicles with electronic ignition (EI/DIS)(distributorless) systems; determine necessary action.
2. Diagnose no-starting, driveability , and emissions concerns on vehicles with distributor ignition (DI) systems; determine necessary action.
3. Inspect and test ignition primary circuit wiring and components; perform necessary action.
4. Inspect and test distributor; perform necessary action.

5. Inspect and test ignition system secondary circuit wiring and components; perform necessary action.
6. Inspect and test ignition coil(s); perform necessary action.
7. Check and adjust (where applicable) ignition system timing and timing advance/retard.
8. Inspect and test ignition system pick-up sensor or triggering devices; perform necessary action.
9. Inspect and test ignition control module; perform necessary action.

D. Fuel, Air Induction, and Exhaust Systems Diagnosis and Repair

1. 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 on vehicles with carburetor-type fuel systems; determine necessary action.
2. 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 on vehicles with injection-type fuel systems; determine necessary action.
3. Inspect fuel tank and fuel cap, fuel lines, fittings, and hoses; perform necessary action.
4. Check fuel for contaminants and quality; determine necessary action.
5. Inspect and test mechanical and electrical fuel pumps and pump control systems; perform necessary action.
6. Replace fuel filters.
7. Inspect and test fuel pressure regulation system and components of injection-type fuel systems; perform necessary action.
8. Inspect and test cold enrichment system and components; perform necessary action.
9. Remove, service, and install throttle body; adjust related linkages.
10. Inspect, test, and clean fuel injectors.
11. Inspect throttle body mounting plates, air induction and filtration system, intake manifold, and gaskets, perform necessary action.
12. Check idle speed and fuel mixture.
13. Adjust idle speed and fuel mixture.
14. Remove, inspect, and test vacuum and electrical circuits, components and connections of fuel system; perform necessary action.
15. Inspect exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shield(s); perform necessary action.
16. Perform exhaust system back-pressure test; determine necessary action.
17. Test the operation of turbocharger/supercharger systems; determine necessary action.

E. Emissions Control Systems Diagnosis and Repair

I. Positive Crankcase Ventilation

1. Diagnose oil leaks, emissions, and driveability problems resulting from failure of the positive crankcase ventilation (PCV) system; determine necessary action.
2. Inspect and test positive crankcase ventilation (PCV) filter/breather cap, valve, tubes, orifices, and hoses; perform necessary action.

II. Exhaust Gas Recirculation

1. Diagnose emissions and driveability problems caused by failure of the exhaust gas recirculation (EGR) system; determine necessary action.
2. Inspect and test valve, valve manifold, and exhaust passages of exhaust gas recirculation (EGR) systems; perform necessary action.
3. Inspect and test vacuum/pressure controls, filters, and hoses of exhaust gas recirculation (EGR) systems; perform necessary action.
4. Inspect and test electrical/electronic sensors, controls, and wiring of exhaust gas recirculation (EGR) systems; perform necessary action.

III. Exhaust Gas Treatment

1. Diagnose emission and drivability problems resulting from failure of the secondary air injection and catalytic converter systems; determine necessary action.
2. Inspect and test mechanical components of secondary air injection systems; perform necessary action.
3. Inspect and test electrical/electronically-operated components and circuits of air injection systems; perform necessary action.
4. Inspect and test components of catalytic converter systems; perform necessary action.

Intake Air Temperature Controls

1. Diagnose emissions and driveability problems resulting from failure of the intake air temperature control system; determine necessary action.
2. Inspect and test components of intake air temperature control system; perform necessary action.

Early Fuel Evaporation (Intake Manifold Temperature) Controls

1. Diagnose emissions and driveability problems resulting from failure of early fuel evaporation control system; determine necessary action.
2. Inspect and test components of early fuel evaporation control system; perform necessary action.

Evaporative Emissions Controls

1. Diagnose emissions and driveability problems resulting from failure of evaporative emissions control system; determine necessary action.
2. Inspect and test components and hoses of evaporative emissions control system; perform necessary action.

F. Engine Related Service

1. Adjust valves on engines with mechanical or hydraulic lifters.
2. Verify correct camshaft timing; determine necessary action.
3. Verify engine operating temperature; determine necessary action.
4. Perform cooling system pressure tests; check coolant condition; inspect and test radiator, pressure cap, coolant recovery tank, and hoses, perform necessary action.
5. Inspect and test thermostat, by-pass, and housing; perform necessary action.
6. Inspect and test mechanical/electrical fans, fan clutch, fan shroud/ducting, air dams, and fan control devices; perform necessary action.

Formative Assessments:

- Quizzes
- Written tests
- Teacher monitoring and assessment of hands-on activities

Summative Assessments:

A student's competency (60%) in a chosen specialty area is assessed through

1. teacher monitoring of student work and teacher evaluation using ASE checklists, and
2. written assessments in ASE format for a given specialty area.
3. **The Automotive Technology Safety Program must be completed with a minimum of 80% accuracy to continue with the Automotive planned instruction.**

Required/Approved Textbooks and Materials:

Book Title: Automotive Service

Publisher: Delmar Publishers

ISBN# 1401812341

Copyright: 2004

Date of Adoption:

Required equipment to comply to ASE aligned instruction:

In addition to the Automotive Shop equipment inventory for ASE/NATEF certification in the following specialty areas: Brakes, Steering and Suspension, Heating and Air Conditioning, Engine Repair, Engine Performance, Automatic and Manual Transmissions & Electrical Systems, these tools and equipment are required.

1. Student required hand tool sets
2. Coolant recycling system
3. Transmission fluid cleaning and recycling system
4. On-car brake lathe
5. Oil filter crusher (EPA requirement)
6. Shop Key (student progress)
7. ASE Safety Program

Automotive Technology Safety Program

1. General safety pledge
2. Daily safety requirements
3. Discipline plan
4. Class rules and consequences
5. Safety modules from textbook and interactive video program, including assessment
6. Act 116 Eye Protection Standards
7. Oxy-Acetylene safety worksheet
8. On-going safety training as appropriate for each specialty module.

The Automotive Technology Safety Program must be completed with a minimum of 80% accuracy to continue with the Automotive planned instruction.

Two or More Sample Units:

(see attached pages)