This is an introductory course that covers theory, knowledge, and skills necessary to understand automotive steering and suspension systems and related components. Instruction is given and lab experience provided which will enable students to successfully perform related diagnostics and repair. The coursework is based on the Automotive Service Excellence (ASE) Tasks and Standards intended to prepare students for the ASE A-4 Suspension & Steering Certification examination.
1. Analyze and diagnose automotive engines and related components for correct system operation.
2. Interpret and measure vehicle suspension and alignment concerns.
3. Demonstrate mastery of diagnostic tools and equipment used for automotive repair.
4. Demonstrate an ability to self-assess progress and development in a specific area and to further design and pursue a course of action based on the self-assessment.

COURSE OBJECTIVES:
1. Pass the SP-2 Mechanical Safety and Mechanical Pollution Prevention Test.
2. Describe steering and suspension operation and related theory.
3. Describe the operation of various power steering systems including electric steering.
4. Identify wheel alignment-angles and effects on steering, vehicle handling and control.
5. Analyze and interpret steering and suspension system-related wiring diagrams.
6. Identify component failures using analytical skills, systematic diagnostic processes, and industry-accepted procedures.
7. Perform correct steering and suspension-related alignment, services and repairs.

COURSE CONTENT:

LECTURE CONTENT:

A. Safety
   1. Basic Auto Technology shop safety instruction and demonstrations
   2. SP-2 Mechanical Safety and Mechanical Pollution Prevention tests

B. Technical service and repair information
   1. Acquiring vehicle service and repair information online, hard-copy
   2. Vehicle service history, service precautions, and Technical Service Bulletins (TSB’s)
   3. Vehicle and major component identification numbers (VIN, vehicle certification labels, calibration decals)

C. Steering systems concepts, diagnosis and repair
   1. Supplemental Restraint Systems (SRS)
   2. Steering wheel SRS coil
   3. Power-steering (P/S) systems
   4. Rack-and-pinion bearing sector lash
   5. Tie rod ends
   6. Collapsible steering columns
   7. P/S pumps
   8. P/S fluids, correct application and maintenance

D. Suspension systems concepts, diagnosis and repair
   1. Control arms, short- and long-arm designs
   2. Strut assemblies
   3. Suspension bushings, noise and wear diagnostics
   4. Ball joint inspection and replacement
   5. Stabilizer bars and bushings
   6. Torsion bar inspection and replacement
   7. Ride-height control
   8. Stability control

E. Wheel alignment: Measuring, evaluating, and adjusting the following angles and readings
1. Basic camber, caster, toe angles, toe-out on turns
2. Steering Axis Inclination (SAI) reading
3. Included Angle (IA) readings
4. Scrub radius
5. Thrust angle
6. Ride height.
7. Steering center

F. Wheels and tires
   1. Design theory and concepts
   2. Tire wear patterns
   3. Acquiring correct tire air pressure information
   4. Evaluating tire noise, vibration, harshness (NVH) issues
   5. Rotation, directional tire precautions
   6. Tire removal, repair, replacement, and installation precautions
   7. Tire/wheel balance

LABORATORY CONTENT:

After acquiring the appropriate lecture information, the successful student will demonstrate skill accomplishment by completing worksheet-driven NATEF-approved tasks. NATEF (National Automotive Technicians Education Foundation) is a non-profit agency that evaluates technician training programs against standards developed by the automotive industry. All of the current NATEF approved tasks for this class are listed below, and are also contained in a separate document that is handed out on the first day of class.

Steering and suspension

A. General steering and suspension diagnosis
   1. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction
   2. Identify and interpret suspension and steering system concerns; determine necessary action
   3. Research applicable vehicle and service information, such as suspension and steering system operation, vehicle service history, service precautions, and technical service bulletins
   4. Locate and interpret vehicle and major component identification numbers

B. Steering systems diagnosis and repair
   1. Disable and enable supplemental restraint system (SRS)
   2. Remove and replace steering wheel; center/time supplemental restraint system (SRS) coil (clock spring)
   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 noise concerns; determine necessary action
   5. Diagnose power steering gear (rack and pinion) binding, uneven turning effort, looseness, hard steering, and noise 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 non-rack and pinion worm bearing preload and sector lash
   8. Remove and replace rack and pinion steering gear; inspect mounting bushings and brackets
   9. Inspect and replace rack and pinion steering gear inner tie rod ends (sockets) and bellows boots
   10. Determine proper power steering fluid type; inspect fluid level and condition
11. Flush, fill, and bleed power steering system
12. Diagnose power steering fluid leakage; determine necessary action
13. Remove, inspect, replace, and adjust power steering pump belt
14. Remove and reinstall power steering pump
15. Remove and reinstall press fit power steering pump pulley; check pulley and belt alignment
16. Inspect and replace power steering hoses and fittings
17. Inspect and replace pitman arm, relay (center link/intermediate) rod, idler arm and mountings, and steering linkage damper
18. Inspect, replace, and adjust tie rod ends (sockets), tie rod sleeves, and clamps
19. Test and diagnose components of electronically controlled steering systems using a scan tool; determine necessary action
20. Inspect and test electric power assist steering
21. Identify hybrid vehicle power steering system electrical circuits, service and safety precautions

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
2. Diagnose strut suspension system noises, body sway, and uneven ride height concerns; determine necessary action
3. Remove, inspect, and install upper and lower control arms, bushings, shafts, and rebound bumpers
4. Remove, inspect and install strut rods and bushings
5. Remove, inspect, and install upper and/or lower ball joints
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 strut cartridge or assembly, strut coil spring, insulators (silencers), and upper strut bearing mount
11. Remove, inspect, and install leaf springs, leaf spring insulators (silencers), shackles, brackets, bushings, and mounts

D. Related steering and suspension service

1. Inspect, remove, and replace shock absorbers
2. Remove, inspect, and service or replace front and rear wheel bearings
3. Test and diagnose components of electronically controlled suspension systems using a scan tool; determine necessary action
4. Diagnose, inspect, adjust, repair or replace components of electronically controlled steering systems (including sensors, switches, and actuators); initialize system as required
5. Describe the function of the idle speed compensation switch
6. Lubricate suspension and steering systems

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.
2. Perform pre-alignment inspection and measure vehicle ride height; perform necessary action
3. Prepare vehicle for wheel alignment on the alignment machine; perform four-wheel alignment by checking and adjusting front and rear wheel caster, camber;
and toe as required; center steering wheel
4. Check toe-out-on-turns (turning radius); determine necessary action
5. Check SAI (steering axis inclination) and included angle; determine necessary action
6. Check rear wheel thrust angle; determine necessary action
7. Check for front wheel setback; determine necessary action
8. Check front and/or rear cradle (sub frame) alignment; determine necessary action

F. Wheel and tire diagnosis and repair
1. Inspect tire condition; identify tire wear patterns; check and adjust air pressure; determine necessary action
2. Diagnose wheel/tire vibration, shimmy, and noise; determine necessary action
3. Rotate tires according to manufacturer’s recommendations
4. Measure wheel, tire, axle flange, and hub run out; determine necessary action
5. Diagnose tire pull problems; determine necessary action
6. Dismount, inspect, and remount tire on wheel; balance wheel and tire assembly (static and dynamic)
7. Dismount, inspect, and remount tire on wheel equipped with tire pressure monitoring system sensor
8. Reinstall wheel; torque lug nuts
9. Inspect tire and wheel assembly for air loss; perform necessary action
10. Repair tire using internal patch
11. Inspect, diagnose, and calibrate tire pressure monitoring system

G. Practice sample ASE (A4) Steering & Suspension test

METHODS OF INSTRUCTION:

A. Lecture:
B. Lab:

INSTRUCTIONAL TECHNIQUES:

COURSE ASSIGNMENTS:
Reading Assignments

Websites
Web-based assignments: autoshop101.com, CTEOnline.com, other topic-specific websites as needed

Out-of-class Assignments

Writing Assignments
1. Create vehicle repair orders, perform math exercises for flat rate labor times, parts and materials totals.
2. Demonstrate an understanding of wheel alignment concepts by performing related math exercises to validate proper angles and settings.
3. Use information and concepts learned in class to successfully pass a practicum exam or written test or assignment.
4. Use on-line service and repair information to compare factory specifications with actual readings and measurements acquired during steering and suspension
METHODS OF STUDENT EVALUATION:
Midterm Exam
Final Exam
Short Quizzes
Written Assignments
Essay Examinations
Objective Examinations
Report
Projects (ind/group)
Problem Solving Exercises
Oral Presentations
Skills Demonstration

Demonstration of Critical Thinking:
1. Demonstrate the ability to analyze and troubleshoot steering and suspension systems and restore them to proper service.
2. Analyze, confirm, and diagnose steering and suspension faults based on symptoms indicated on repair orders.
3. Diagnose and confirm steering and suspension system component failures by comparing actual readings or measurements with factory specifications.
4. Analyze wiring diagrams to determine integrity of circuits which support steering and suspension systems.

Required Writing, Problem Solving, Skills Demonstration:
1. Create vehicle repair orders, perform math exercises for flat rate labor times, parts and materials totals.
2. Demonstrate an understanding of wheel alignment concepts by performing related math exercises to validate proper angles and settings.
3. Use information and concepts learned in class to successfully pass a practicum exam or written test or assignment.
4. Use on-line service and repair information to compare factory specifications with actual readings and measurements acquired during steering and suspension

TEXTS, READINGS, AND RESOURCES:
TextBooks:

Other:
1. GWC Auto Tech work shirt
2. Basic hand tool set

LIBRARY:
Adequate library resources include:

Comments:

Attachments:
Attached Files