AUTO G141: AUTOMOTIVE CHASSIS: STEERING & SUSPENSION

Item	Value
Curriculum Committee Approval Date	10/17/2023
Top Code	094800 - Automotive Technology
Units	4.5 Total Units
Hours	117 Total Hours (Lecture Hours 63; Lab Hours 54)
Total Outside of Class Hours	0
Course Credit Status	Credit: Degree Applicable (D)
Material Fee	No
Basic Skills	Not Basic Skills (N)
Repeatable	No
Grading Policy	Standard Letter (S), • Pass/No Pass (B)

Course Description

This course covers the theory, knowledge, and skills necessary to understand automotive steering and suspension systems and related components. The lecture and lab instruction will enable students to successfully perform related diagnostics and repairs. The course material is based on the Automotive Service Excellence (ASE) Tasks and Standards intended to prepare students for the ASE A-4 Suspension & Steering Certification examination. Transfer Credit: CSU. C-ID: AUTO 140X. **C-ID:** AUTO 140X.

Course Level Student Learning Outcome(s)

1. Course Outcomes
2. Diagnose automotive steering and suspension systems and related components for correct system operation.
3. Analyze automotive suspension, steering, and alignment concerns using diagnostic tools and equipment.
4. Measure vehicle suspension and alignment angles using an automotive alignment machine.

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 steering and suspension system-related wiring diagrams.
- 6. Identify component failures using analytical skills, systematic diagnostic processes, and industry-accepted procedures.
- 7. Perform steering and suspension-related alignment, services, and repairs.

Lecture Content

Safety Basic Auto Technology shop safety instruction and demonstrations SP-2 Mechanical Safety and Mechanical Pollution Prevention tests Technical service and repair information Acquiring vehicle service and repair information online, hard-copy Vehicle service history, service precautions, and Technical Service Bulletins (TSBs) Vehicle and major component identification numbers (VIN, vehicle certification labels, calibration decals) Steering systems concepts, diagnosis, and repair Supplemental Restraint Systems (SRS) Steering wheel SRS coil Power-steering (P/S) systems Rack-and-pinion bearing sector lash Tie rod ends Collapsible steering columns P/S pumps P/S fluids, correct application, and maintenance Computer-controlled electronic steering Suspension systems concepts, diagnosis, and repair Control arms, short- and long-arm designs Standard and electronic strut assemblies Suspension bushings, noise, and wear diagnostics Ball joint inspection and replacement Stabilizer bars and bushings Torsion bar inspection and replacement Ride-height control Stability control Wheel alignment: measuring, evaluating, and adjusting the following angles and readings Basic camber, caster, toe angles, toe-out on turns Steering Axis Inclination (SAI) reading Included Angle (IA) readings Scrub radius Thrust angle Ride height Steering center Wheels and tires Design theory, concepts, and Tire Pressure Monitoring System (TPMS) Tire wear patterns Acquiring correct tire air pressure information Evaluating tire noise, vibration, harshness (NVH) issues Rotation, directional tire precautions Tire removal, repair, replacement, and installation precautions Tire/wheel balance

Lab Content

General steering and suspension diagnosis Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction Identify and interpret suspension and steering system concerns; determine necessary action Research applicable vehicle and service information, such as suspension and steering system operation, vehicle service history, service precautions, and technical service bulletins Locate and interpret vehicle and major component identification numbers Steering systems diagnosis and repair Disable and enable supplemental restraint system (SRS) Remove and replace steering wheel; center/time supplemental restraint system (SRS) coil (clock spring) Diagnose steering column noises, looseness, and binding concerns (including tilt mechanisms); determine necessary action Diagnose power steering gear (non-rack and pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine necessary action Diagnose power steering gear (rack and pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine necessary action Inspect steering shaft universal-joint(s), flexible coupling(s), collapsible column, lock cylinder mechanism, and steering wheel; perform necessary action Adjust non-rack and pinion worm bearing preload and sector lash Remove and replace rack and pinion steering gear; inspect mounting bushings and brackets Inspect and replace rack and pinion steering gear inner tie rod ends (sockets) and bellows boots Determine proper power steering fluid type; inspect fluid level and condition Flush, fill, and bleed power steering system Diagnose power steering fluid leakage; determine necessary action Remove, inspect, replace, and adju st power steering pump belt Remove and reinstall power steering pump Remove and reinstall press fit power steering pump pulley; check pulley and belt alignment Inspect and replace power steering hoses and fittings Inspect and replace pitman arm, relay (center link/intermediate) rod, idler arm and mountings, and steering linkage damper Inspect, replace, and adjust tie rod ends (sockets), tie rod sleeves, and clamps Test and diagnose components of electronically controlled steering systems using a scan

tool; determine necessary action Inspect and test electric power assist steering Identify hybrid vehicle power steering system electrical circuits, service and safety precautions Suspension systems diagnosis and repair Diagnose short and long arm suspension system noises, body sway, and uneven ride height concerns; determine necessary action Diagnose strut suspension system noises, body sway, and uneven ride height concerns; determine necessary action Remove, inspect, and install upper and lower control arms, bushings, shafts, and rebound bumpers Remove, inspect and install strut rods and bushings Remove, inspect, and install upper and/or lower ball joints Remove, inspect, and install steering knuckle assemblies Remove, inspect, and install short and long arm suspension system coil springs and spring insulators Remove, inspect, install, and adjust suspension system torsion bars; inspect mounts Remove, inspect, and install stabilizer bar bushings, brackets, and links Remove, inspect, and install strut cartridge or assembly, strut coil spring, insulators (silencers), and upper strut bearing mount Remove, inspect, and install leaf springs, leaf spring insulators (silencers), shackles, brackets, bushings, and mounts Related steering and suspension service Inspect, remove, and replace shock absorbers Remove, inspect, and service or replace front and rear wheel bearings Test and diagnose components of electronically controlled suspension systems using a scan tool; determine necessary action Diagnose, inspect, adjust, repair or replace components of electronically controlled steering systems (including sensors, switches, and actuators); initialize system as required Describe the function of the idle speed compensation switch Lubricate suspension and steering systems Diagnose and Repair automotive active suspension systems and related components (Electronically Controlled Suspension) Wheel alignment diagnosis, adjustment, and repair Diagnose vehicle wander, drift, pull, hard steering, bump steer, memory steer, torque steer, and steering return concerns; determine necessary action. Perform pre-alignment inspection and measure vehicle ride height; perform necessary action 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 Check toe-out-on-turns (turning radius); determine necessary action Check SAI (steering axis inclination) and included angle; determine necessary action Check rear wheel thrust angle; determine necessary action Check for front wheel setback; determine necessary action Check front and/or rear cradle (sub frame) alignment; determine necessary action Wheel and tire diagnosis and repair Inspect tire condition; identify tire wear patterns; check and adjust air pressure; determine necessary action Diagnose wheel/tire vibration, shimmy, and noise; determine necessary action Rotate tires according to manufacturers recommenda tions Measure wheel, tire, axle flange, and hub run out; determine necessary action Diagnose tire pull problems; determine necessary action Dismount, inspect, and remount tire on wheel; balance wheel and tire assembly (static and dynamic) Dismount, inspect, and remount tire on wheel equipped with tire pressure monitoring system sensor Reinstall wheel; torque lug nuts Inspect tire and wheel assembly for air loss; perform necessary action Repair tire using internal patch Inspect, diagnose, and calibrate tire pressure monitoring system Practice sample ASE (A4) Steering Suspension test

Method(s) of Instruction

- Lecture (02)
- DE Live Online Lecture (02S)
- Lab (04)
- DE Live Online Lab (04S)

Reading Assignments

Textbook reading of assigned chapters.

Writing Assignments

1. Create vehicle repair orders, perform math exercises for flat rate labor times, parts, and materials totals.2. Use wheel alignment concepts to perform related math exercises to validate proper angles and settings.3. Use online service and repair information to compare factory specifications with actual readings and measurements acquired during steering and suspension

Out-of-class Assignments

Interactive manufacture training modules.

Demonstration of Critical Thinking

After acquiring the appropriate lecture information, the successful student will demonstrate skill accomplishment by completing worksheet-driven Automotive Service Excellence Education Foundation (ASEEF)-approved tasks. ASEEF is a non-profit agency that evaluates technician training programs against standards developed by the automotive industry. 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. Use wheel alignment concepts to perform 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 online service and repair information to compare factory specifications with actual readings and measurements acquired during steering and suspension.

Eligible Disciplines

Automotive technology: Any bachelors degree and two years of professional experience, or any associate degree and six years of professional experience.

Textbooks Resources

1. Required Johnansen, C., Duffy, J., Stockel, M. ASE Automotive Suite, ed. Goodheart Wilcox, 2021

Other Resources

1. GWC work uniform and safety glasses.