

**JEFFERSON COLLEGE**

**COURSE SYLLABUS**

**AUT141**

**AUTOMOTIVE STEERING AND SUSPENSION SYSTEMS**

3 Credit Hours

Prepared by: Gerard Uhls  
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Revised by: Gerard Uhls  
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## AUT141 Automotive Steering and Suspension Systems

### I. CATALOGUE DESCRIPTION

- A. Pre-requisite: AUT100 Automotive Shop Safety; AUT131 Automotive Brake Systems; AUT132 Automotive Brake Systems Lab  
Co-requisite: AUT142 Automotive Steering and Suspension Systems Lab
- B. 3 Credit Hours
- C. Steering and Suspension Systems involves the study of various common suspension systems including: Short/Long Arm, McPherson strut, Modified strut, and electronic suspension systems. Individual components and inspection/replacement will be covered. Steering systems types covered will include: parallelogram steering, rack and pinion, and power assist systems. Two and four wheel alignment, tire wear, and vehicle handling issues will be addressed. Completion of this course will help prepare the student for entry level employment and the National Institute for Automotive Service Excellence (ASE) test (A-4). (F)

### II. EXPECTED LEARNING OUTCOMES/CORRESPONDING ASSESSMENT MEASURES

<b>A. General Suspension and Steering Systems Diagnosis</b>		
Demonstrate knowledge of completing work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction	P-1	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of identifying and interpreting suspension and steering system concerns	P-1	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of researching applicable vehicle and service information, such as suspension and steering system operation, vehicle service history, service precautions, and technical service bulletins	P-1	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of locating and interpreting vehicle and major component identification numbers	P-1	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests

<b>B. Steering Systems Diagnosis and Repair</b>		
Demonstrate understanding of disabling and enabling supplemental restraint system (SRS)	P-1	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of removing and replacing steering wheel, centering/timing supplemental restraint system (SRS), coil (clock spring)	P-1	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of diagnosing steering column noises, looseness, and binding concerns (including tilt mechanisms); determine necessary action	P-2	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of diagnosing power steering gear (non-rack and pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns	P-2	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of diagnosing power steering gear (rack and pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns	P-2	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of inspecting steering shaft universal-joint(s), flexible coupling(s), collapsible column, lock cylinder mechanism, and steering wheel	P-2	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of removing and replacing rack and pinion steering gear, inspect mounting bushings and brackets	P-2	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of inspecting and replacing rack and pinion steering gear inner tie rod ends (sockets) and bellows boots	P-2	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of determining proper power steering fluid type, inspecting fluid level and condition	P-1	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of determining proper power steering fluid type, inspect fluid level and condition	P-1	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests

Demonstrate understanding of flushing, filling, and bleeding power steering system	P-2	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of diagnosing power steering fluid leakage	P-2	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of removing, inspecting, replacing, and adjusting power steering pump belt	P-1	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of removing and reinstalling power steering pump	P-2	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of removing and reinstalling press fit power steering pump pulley, checking pulley and belt alignment	P-2	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of inspecting and replacing power steering hoses and fittings	P-2	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of inspecting and replacing pitman arm, relay (centerlink/intermediate) rod, idler arm and mountings, and steering linkage damper	P-2	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of inspecting, replacing, and adjusting tie rod ends (sockets), tie rod sleeves, and clamps	P-1	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of identifying hybrid vehicle power steering electrical circuits and safety precautions	P-2	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Inspect and test electric power assist steering	P-3	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests

### **C. Suspension Systems Diagnosis and Repair**

Demonstrate understanding of diagnosing short and long arm suspension system noises, body sway, and uneven ride height concerns	P-1	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
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Demonstrate understanding of diagnosing strut suspension system noises, body sway, and uneven ride height concerns	P-1	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of removing, inspecting, and installing upper and lower control arms, bushings, shafts, and rebound bumpers	P-3	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of inspecting, removing, and installing upper and/or lower ball joints	P-2	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of Inspecting, removing and installing steering knuckle assemblies	P-3	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of removing, inspecting, and installing short and long arm suspension system coil springs and spring insulators	P-3	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of removing, inspecting, and installing front stabilizer bar (sway bar) bushings, brackets, and links	P-2	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of removing, inspecting, and installing strut cartridge or assembly, strut coil spring, insulators (silencers), and upper strut bearing mount	P-3	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of inspection, removal and installation of track bar, strut rods/radius arms, and related mounts and bushings	P-3	Participate in Classroom Discussion, Lecture, Classroom
Demonstrate an understanding of inspecting leaf spring(s), bushings, center pins/bolts, and mounts	P-1	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests

#### **D. Related Suspension and Steering Service**

Demonstrate understanding of inspecting, removing, and replacing shock absorbers	P-1	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
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Demonstrate understanding of removing, inspecting, and servicing or replacing front and rear wheel bearings	P-1	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of diagnosing, inspecting, adjusting, repairing or replacing components of electronically controlled steering systems (including sensors, switches, and actuators), initialize system as required	P-3	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of the function of the power steering switch by description	P-3	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of lubricating suspension and steering systems		Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests

### **E. Wheel Alignment Diagnosis, Adjustment, and Repair**

Demonstrate understanding of diagnosing vehicle wander, drift, pull, hard steering, bump steer, memory steer, torque steer, and steering return concerns	P-1	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of performing pre-alignment inspection and measure vehicle ride height; perform necessary action	P-1	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of preparing vehicle for wheel alignment on the alignment machine, performing four wheel alignment by checking and adjusting front and rear wheel caster, camber, and toe as required, center steering wheel	P-1	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of checking toe-out-on-turns (turning radius)	P-2	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of checking SAI (steering axis inclination) and included angle	P-2	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests

Demonstrate understanding of checking rear wheel thrust angle	P-1	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of checking for front wheel setback	P-2	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of checking front and/or rear cradle (sub-frame) alignment	P-3	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of resetting steering angle sensor	P-2	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests

#### **F. Wheel and Tire Diagnosis and Repair**

Demonstrate understanding of inspecting tire condition, identifying tire wear patterns, checking for correct tire size and application (load and speed ratings) and adjust air pressure; determine necessary action	P-1	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of diagnosing wheel/tire vibration, shimmy, and noise; determine necessary action	P-2	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of rotating tires according to manufacturer's recommendations	P-1	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of measuring wheel, tire, axle flange, and hub run-out	P-2	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of diagnosing tire pull problems; determine necessary action	P-2	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of dismounting, inspecting, and remounting tire on wheel, balance wheel and tire assembly (static and dynamic)	P-1	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests

Demonstrate understanding of dismounting, inspecting, and remounting tire on wheel equipped with tire pressure monitoring system	P-2	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of inspecting tire and wheel assembly for air loss; perform necessary action	P-1	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of the steps required to remove and replace sensors in a tire pressure monitoring system	P-1	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of repairing tire using internal patch	P-1	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests
Demonstrate understanding of identifying and testing tire pressure monitoring system (indirect and direct) for operation, verify operation of instrument panel lamps	P-2	Participate in Classroom Discussion, Lecture, Classroom Exercises, Reading Assignments, Tests

### III. OUTLINE OF TOPICS

#### A. Locate Vehicle Information

1. Locate vehicle history in Mitchell Management system
2. Locate correct vehicle information using Mitchell Pro Demand or Alldata
3. Locate technical service bulletins using Mitchell Pro Demand or Alldata
4. Locate vehicle service precautions using Mitchell Pro Demand or Alldata

#### B. Explain Safety and Service for Steering Column Components

1. Explain procedures for disabling/enabling SRS
2. Identify steering column components
3. Explain the positions and functions of the lock cylinder
4. Explain the causes of looseness, binding, uneven steering effort, and hard steering effort



- C. Explain Steering System Types and Diagnosis
  - 1. Explain rack and non-rack and pinion steering component inspection
  - 2. Explain power steering pump, hose and belt inspection
  - 3. Identify electronic steering components
  
- D. Explain Related Steering and Suspension Components
  - 1. Explain front and rear wheel bearing service
  - 2. Explain front and rear suspension systems
  - 3. Identify and explain shock absorber and McPherson strut systems
  
- E. Explain Suspension System Types and Service
  - 1. Identify suspension types including frame types
  - 2. Identify spring types: (coil, leaf, torsion bar and air bag)
  - 3. Identify suspension components and inspection and service procedures
  
- F. Explain Wheel Alignment
  - 1. Explain vehicle drift, pull and wander
  - 2. Explain camber, caster and toe on front and camber and toe on rear of vehicle
  - 3. Explain diagnostic angles: steering axis inclination (SAI), included angle, toe out on turns (TOOT) and rear thrust angle
  
- G. Explain Tire and Wheel Service
  - 1. Explain tire wear problems and causes for vibrations and pulling
  - 2. Explain tire pressure, inflation requirements and TPMS systems
  - 3. Explain tire dismounting, mounting and balancing
  - 4. Identify tire pressure loss, locations and repair procedures
  - 5. Explain tire sidewall information

#### IV. METHOD(S) OF INSTRUCTION

- A. Lectures
- B. Textbook Exercises
- C. Classroom Exercises
- D. Classroom Discussion
- E. Small Group Projects

V. REQUIRED TEXTBOOK(S)

James D. Halderman, Chase D. Mitchell, *Automotive Chassis Systems*, (current edition), Prentice Hall

VI. REQUIRED MATERIALS

- A. Jefferson College Automotive Technology Shirt (2)
- B. Safety Glasses (Clear)
- C. Work Boots (Steel Toe Preferred)

VII. SUPPLEMENTAL REFERENCES

None

VIII. METHOD OF EVALUATION

- A. Tests 50%
- B. Homework 50%

IX. ADA AA STATEMENT

Any student requiring special accommodations should inform the instructor and the Coordinator of Disability Support Services (Technology Center 101; phone 636-481-3169).

X. ACADEMIC HONESTY STATEMENT

All students are responsible for complying with campus policies as stated in the Student Handbook (see College Website <http://www.jeffco.edu>).

XI. ATTENDANCE STATEMENT

Regular and punctual attendance is expected of all students. Any one of these four options may result in the student being removed from the class and an administrative withdrawal being processed: (1) Student fails to begin class; (2) Student ceases participation for at least two consecutive weeks; (3) Student misses 15 percent or more of the coursework; and/or (4) Student misses 15 percent or more of the course as defined by the instructor. Students earn their financial aid by regularly attending and actively participating in their coursework. If a student does not actively participate, he/she may have to return financial aid funds. Consult the College Catalog or a Student Financial Services representative for more details.

## XII. OUTSIDE OF CLASS ACADEMICALLY RELATED ACTIVITIES

The U.S. Department of Education mandates that students be made aware of expectations regarding coursework to be completed outside the classroom. Students are expected to spend substantial time outside of class meetings engaging in academically related activities such as reading, studying, and completing assignments. Specifically, time spent on academically related activities outside of class combined with time spent in class meetings is expected to be a minimum of 37.5 hours over the duration of the term for each credit hour.