

## **COURSE OUTLINE** **Mechanical & Electrical**

### **Course Description**

AB 241. Mechanical & Electrical. 3 hours credit. Prerequisite: AB 137 with a C or better. This course will enable the student to determine how to diagnose steering and suspension; diagnose electrical concerns; complete headlamp and fog/ driving lamp assemblies and repairs; demonstrate self-grounding procedures for handling electronic components; determine diagnosis, inspection, and service needed for brake system hydraulic components; examine components of heating and cooling system components; distinguish between the under car components and systems; and determine the diagnosis, inspection and service requirements of active and passive restraint systems.

### **Course Relevance**

The principles in this course will allow the student to diagnose mechanical and electrical components that have been damaged during an accident. This course will be taught according to National Automotive Technicians Education Foundation (NATEF)/Automotive Service Excellence (ASE) standards.

### **Required Materials**

I-CAR – CD DAM 03

### **Learning Outcomes**

The intention is for the student to be able to:

1. Determine how to diagnose steering and suspension.
2. Diagnose electrical concerns.
3. Complete headlamp and fog/driving lamp assemblies and repairs.
4. Demonstrate self-grounding procedures for handling electronic components.
5. Examine components of heating and air conditioning systems.
6. Demonstrate the inspection, service and repair needs for collision damage colling system components.
7. Distinguish between the under car components and systems.
8. Determine the diagnosis, inspection and service requirements of active and passive restraint systems.

### **Learning PACT Skills that will be developed and documented in this course**

Through involvement in this course, the student will develop ability in the following PACT skill area(s):

#### **Technology Skills**

1. Discipline-specific technology
  - Through in-class exercises, the student will be able to demonstrate an understanding of how to properly use repair equipment in a safe manner.

## Major Summative Assessment Task(s)

These learning outcome(s) and the Learning PACT skill(s) will be demonstrated by:

1. Completion of a hands-on repair project which incorporates the learning outcomes of the course.

## Course Content

I. Skills or Competencies – Actions that are essential to achieve the course outcomes: (The following competencies are taken from the National Automotive Technicians Education Foundation (NATEF) and incorporated into each specific course.)

### MECHANICAL AND ELECTRICAL

#### A. Frame Inspection and Repair

10. Analyze and identify misaligned or damaged steering, suspension, and powertrain components that can cause vibration, steering, and wheel alignment problems. HP-I

#### B. Unibody Inspection, Measurement, and Repair

01. Analyze and identify misaligned or damaged steering, suspension, and powertrain components that can cause vibration, steering, and chassis alignment problems. HP-I
04. Determine and inspect the locations of all suspension, steering, and powertrain component attaching points on the vehicle. HP-G

### NON-STRUCTURAL ANALYSIS AND DAMAGE REPAIR (BODY COMPONENTS)

#### A. Preparation

05. Inspect, remove, store, and replace all vehicle mechanical and electrical components that may interfere with or be damaged during repair. HP-G

### MECHANICAL AND ELECTRICAL COMPONENTS

#### A. Suspension and Steering

02. Remove, replace, inspect, or adjust power steering pump, pulleys, belts, hoses, fittings, and pump mounts. HP-G
04. Remove and replace power rack and pinion steering gear; inspect and replace mounting bushings, tie rod ends, bellow boots, and brackets; ensure proper mounting location. HP-G
05. Inspect and adjust (where applicable) steering linkage geometry (attitude/parallelism). HP-G
06. Inspect and replace pitman arm. HP-G
07. Inspect and replace relay (center link/intermediate) rod. HP-G
08. Inspect, remove, and replace idler arm and mountings. HP-G
09. Inspect, remove, and replace tie rod sleeves, clamps, and tie rod ends. HP-G
11. Inspect, remove, and replace upper and lower control arms. HP-G
12. Inspect, remove, and replace upper and lower control arm bushings, shafts, and rebound bumpers. HP-G
13. Inspect, remove, and replace upper and lower ball joints. HP-G
14. Inspect, remove, and replace steering knuckle/spindle/hub assemblies (including bearings, races, seals, etc.). HP-G
15. Inspect, remove, and replace front suspension system coil springs and spring insulators (silencers). HP-G

17. Inspect, remove, and replace stabilizer bar bushings, brackets, and links. HP-G
  18. Inspect, remove, and replace MacPherson strut cartridge or assembly, upper bearing, and mount. HP-G
  19. Inspect, remove, and replace rear suspension system transverse links, control arms, stabilizer bars, bushings, and mounts. HP-G
  20. Inspect, remove, and replace suspension system leaf spring(s), leaf spring insulators (silencers), shackles, brackets, bushings, and mounts. HP-G
  21. Inspect axle assembly for damage and misalignment. HP-G
  22. Inspect, remove, and replace shock absorbers. HP-G
  24. Measure vehicle ride height; determine needed repairs. HP-I
  25. Inspect, remove, replace, and align front and rear frame (cradles/stub). HP-G
  26. Diagnose steering column damage, looseness, and binding problems (including tilt mechanisms); determine needed repairs. HP-G
  27. Inspect, remove, and replace steering shaft U-joint(s), flexible coupling(s), collapsible columns, and steering wheels. HP-G
  32. Diagnose vehicle wandering, pulling, hard steering, bump steer, memory steering, torque steering, and steering return problems; determine needed repairs. HP-G
  34. Check front and rear wheel camber on adjustable and non-adjustable suspension systems; determine needed repairs. HP-I
  36. Check caster on adjustable and non-adjustable suspension systems; determine needed repairs. HP-I
  37. Check and adjust wheel toe including centering steering wheel; determine needed adjustment or repairs. HP-I
  38. Identify toe-out-on-turns (turning radius) related problems; determine needed repairs. HP-I
  39. Identify SAI (steering axis inclination), included angle, and KPI (king pin inclination) related problems; determine needed repairs. HP-I
  40. Identify thrust angle related problems; determine needed repairs. HP-I
  41. Check for front wheel setback; determine needed repairs. HP-I
  42. Diagnose tire wear patterns; determine needed repairs. HP-I
  43. Inspect tires, identify direction of rotation and location; check and adjust air pressure. HP-I
  45. Measure wheel, tire, axle, and hub run out; determine needed repairs. HP-I
  46. Diagnose tire pull (lead) problems; determine corrective actions. HP-G
- B. Electrical
04. Inspect, test, and replace fusible links, circuit breakers, and fuses. HP-I
  06. Inspect, clean, and replace battery. HP-I
  12. Check operation of exterior lighting; determine needed repairs. HP-I
  14. Inspect, test, and repair or replace switches, relays, bulbs, sockets, connectors, and wires of interior and exterior light circuits. HP-I
  20. Inspect, remove, and replace components of keyless lock/unlock devices and alarm systems. HP-G
- C. Brakes

- 01. Inspect brake lines and fittings for leaks, dents, kinks, rust, cracks or wear; tighten loose fittings and supports; replace brake lines (double flare and ISO types), fittings, and supports. HP-I
- 02. Inspect flexible brake hoses for leaks, kinks, cracks, bulging or wear; remove and replace hoses; tighten loose fittings and supports. HP-I
- 11. Identify and replace ABS wheel speed sensor components. HP-G
- 14. Check for bent or damaged brake system components. HP-G
- D. Heating and Air Conditioning
  - 03. Locate and identify A/C system service ports. HP-I
  - 04. Identify and recover refrigerant from A/C system. HP-G
  - 05. Recycle refrigerant in accordance with EPA regulations. HP-G
  - 06. Identify, label, and store refrigerant. HP-G
  - 11. Inspect, adjust, and replace A/C compressor drive belts; check pulley alignment. HP-G
  - 12. Remove and replace A/C compressor; inspect, repair, or replace A/C compressor mount. HP-G
  - 13. Inspect, repair, or replace A/C system mufflers, hoses, lines, fittings, orifice tube, expansion valve, and seals. HP-G
  - 14. Inspect, test, and replace A/C system condenser and mounts. HP-G
  - 15. Inspect and replace receiver/drier or accumulator/drier. HP-G
- E. Cooling Systems
  - 01. Check engine cooling and heater system hoses and belts; determine needed repairs. HP-I
  - 02. Inspect, test, remove, and replace radiator, pressure cap, coolant recovery system, and water pump. HP-G
  - 03. Recover, refill, and bleed system with proper coolant and check level of protection; leak test system and dispose of materials in accordance with EPA specifications. HP-I
- F. Drive Train
  - 04. Remove and replace powertrain assembly; inspect, replace, and align powertrain mounts. HP-G
  - 06. Inspect, remove and replace half shafts and axle constant velocity (CV) joints. HP-G
  - 07. Inspect, remove and replace drive shafts and universal joints. HP-G
- G. Fuel, Intake, and Exhaust Systems
  - 01. Inspect, remove and replace exhaust pipes, mufflers, converters, resonators, tail pipes, and heat shields. HP-G
  - 02. Inspect, remove and replace fuel tank, fuel tank filter, fuel cap, fuel filler hose, and inertia switch; inspect and replace fuel lines and hoses; check fuel for contaminants. HP-G

## Learning Units

- I. Cooling system
  - A. Operation
  - B. Damage location

- II. Air conditioning system
  - A. Operation
  - B. Repair
- III. Electrical system
  - A. Electrical circuit parts
  - B. Batteries
- IV. Gasoline electrical hybrid vehicles
  - A. Safety
  - B. Inspection
- V. Vehicle
  - A. Vehicle options
  - B. Electromechanical
- VI. Drive train
  - A. Engine damage
  - B. Shafts
  - C. Subframe
- VII. Brakes
  - A. Inspections
  - B. Replacement

### **Learning Activities**

Learning activities will include lectures, demonstrations, and performance.

### **Grade Determination**

The student will be graded on learning activities and assessment tasks, written assignments and examinations. Grade determinants may include the following: assessments, examinations, and other methods of evaluation at the discretion of the instructor.