COURSE OUTLINE

Course Number	Course Title	Credits
AUT 113	Suspension, Steering, and Alignment	4
Hours: Lecture/Lab/Other	**Co- or Pre-requisite**	**Implementation Semester & Year**
2 / 4	AUT 110 and AUT 111	Spring 2022

Catalog description: Theory of operation and service of vehicular suspension and steering systems, with emphasis on component inspection and replacement. Addresses four-wheel alignment with lab activities using a drive-on alignment rack and computer alignment machine.

General Education Category: **Non Ged Ed**

Course coordinator: Jason Evans, Ext. 3776, evansj@mccc.edu

Required texts & Other materials: Halderman, James D., Automotive Steering, Suspension, and Alignment, 8th Edition, Pearson Education, 2021. ISBN-13: 9780135674642

A basic calculator capable of adding, subtracting, multiplying, and dividing numbers. Cell phone calculators are not allowed during quizzes and exams.

Access to a personal laptop computer, tablet, or Chromebook is strongly recommended during class and lab.

Students must purchase safety glasses, work boots, and appropriate clothing to work in the automotive lab. This requirement is reviewed with the students on the first day of class. These items are not needed for the first class meeting of the term.

The following is provided at no charge to the students:
Vehicle service information provided though Stellantis, Subaru of America, Audi of America, or ALLDATA.

Accreditation Statement:
The Automotive Technology, Mopar CAP, Program is Master Automotive Service Technology (MAST) accredited by Automotive Service Excellence Education Foundation.
https://www.aseeducationfoundation.org/

Course Student Learning Outcomes (SLO):

Upon successful completion of this course, the student will be able to:

1. Demonstrate his or her knowledge of principles, terminology, theories of operation, and service procedures regarding automotive steering and suspension systems. [Supports ILG # 1, 2, 4, 10, 11; PLO # 1, 2, 3, 4]
2. Determine proper component replacement and adjustment to restore system operation and ensure customer safety. [Supports ILG # 1, 4, 10, 11; PLO # 1, 2, 3, 4]
3. Demonstrate the proper procedure to mount tires, balance tires, and program tire pressure monitoring system. [Supports ILG # 4, 10, 11; PLO # 1, 2, 3, 4]
4. Analyze and diagnose tire related failures. [Supports ILG # 4, 10, 11; PLO # 1, 2, 3, 4]
5. Demonstrate the process to remove, disassemble, assemble, and install McPherson struts. [Supports ILG # 4, 10, 11; PLO # 1, 2, 3]
6. Demonstrate the process to remove, disassemble, clean, and assemble wheel bearings and CV axles. [Supports ILG # 4, 10, 11; PLO # 1, 2, 3]
7. Explain the operation power steering pumps and different steering gear designs and demonstrate ability to remove and install components. [Supports ILG # 1, 4, 10, 11; PLO # 1, 2, 3, 4]
8. Show the proper procedure to diagnose customer concerns related to steering, suspension, and wheel alignment. [Supports ILG # 1, 4, 10, 11; PLO # 1, 2, 3, 4]
9. Compare similarities and differences between different steering and suspension designs, including advantages and disadvantages of each. [Supports ILG # 1, 10, 11; PLO # 1, 2, 3, 4]
10. Demonstrate the process to perform a 4-wheel alignment on a passenger vehicle using a computerized alignment machine. [Supports ILG # 1, 2, 4, 10, 11; PLO # 1, 2, 3, 4]

Course-specific Institutional Learning Goals (ILG):

Institutional Learning Goal 1. Written and Oral Communication in English. Students will communicate effectively in both speech and writing.
Institutional Learning Goal 2. Mathematics. Students will use appropriate mathematical and statistical concepts and operations to interpret data and to solve problems.
Institutional Learning Goal 4. Technology. Students will use computer systems or other appropriate forms of technology to achieve educational and personal goals.
Institutional Learning Goal 10. Information Literacy: Students will recognize when information is needed and have the knowledge and skills to locate, evaluate, and effectively use information for college level work.
Institutional Learning Goal 11. Critical Thinking: Students will use critical thinking skills understand, analyze, or apply information or solve problems.

Program Learning Outcomes for

1. Diagnose, service, and repair current automotive technologies.
2. Demonstrate desirable attitudes and work habits while working individually or with others.
3. Obtain service repair information and procedures from online websites and electronic databases.
4. Communicate effectively and professionally with customers and fellow technicians.

Units of study in detail – Unit Student Learning Outcomes:

Unit I **Introduction to Steering, Suspension, and Alignment [Supports Course SLO # 1]**

Learning Objectives

The student will be able to…

- Demonstrate basic identification of steering and suspension components.
- Explain how steering and suspension systems work together.
- Identify steering and suspension components that are worn or damaged.

Unit II **Tire and Wheel Service [Supports Course SLO # 1, 2, 3, 4, 6]**

Learning Objectives

The student will be able to:

- Demonstrate his or her ability to perform component replacement and adjustment procedures to restore system operation and ensure customer safety.
- Explain construction and design of tires including the safety involved with a tire's date of manufacture.
- Demonstrate the process to mount and balance tires and identify tire and wheel damage and failures.
- Compare different types of tire pressure monitoring systems.
- Demonstrate the process to program and relearn tire pressure-monitoring systems after a repair procedure.
- Analyze and diagnose tire wear patterns.
- Demonstrate the process to remove, disassemble, clean, and assemble wheel bearings and CV axles.

Unit III **Suspension Systems [Supports Course SLO # 1, 2, 5, 8, 9]**

Learning Objectives

The student will be able to:

- Describe the design differences between front and rear suspension systems.
- Explain the function and necessity of each suspension component including torsion bar, coil spring, MacPherson strut, anti-sway bar, leaf spring, and shocks.
- Demonstrate the process to remove, disassemble, assemble, and install McPherson struts.
- Demonstrate the process to remove, disassemble, clean, and assemble wheel bearings and CV axles.
- Evaluate wheel bearing condition to determine steering and suspension system failure.
- Identify, diagnose and repair air suspension systems including scan tool use.
- Express safety related concerns when servicing the air suspension system.
- Analyze symptoms related to suspension system malfunctions.
- Demonstrate the process to perform repair of suspension systems by following proper repair procedures.

Unit IV **Steering Systems [Supports Course SLO # 1, 2, 7, 8, 9]**

Learning Objectives

The student will be able to…

- Describe the design differences between steering systems, including linkage steering, rack and pinion and gearbox systems.
- Clarify the function and necessity of each steering system component.
- Analyze symptoms related to steering system malfunctions.
- Demonstrate the process to perform repair of steering systems by following proper repair procedures.
- Understand the hydraulic principles involving fluid dynamics related to the power steering system.

- Demonstrate the process to remove, disassemble, assemble, and install a power steering pump.
- Explain the purpose and function of electric power steering systems.

Unit V Wheel Alignment [Supports Course SLO # 1, 2, 10]

Learning Objectives

The student will be able to…

- Interpret the function of all wheel alignment angles including camber, caster, toe, steering axis inclination, turning radius and tracking.
- Analyze tire wear patterns to determine which wheel alignment angle is out of specification.
- Indicate the effects of improper alignment angle settings; pull, wander, vibration, wobble, shimmy, directional stability check.
- Distinguish symptoms related to wheel misalignment.
- Demonstrate the process to perform 4-wheel alignment on a passenger vehicle using a computerized alignment machine

Evaluation of student learning:

Students are evaluated using weekly quizzes, a mid-term exam, a final exam, graded homework assignments, and hands-on work assignments in the automotive laboratory. Students are expected to read the assigned textbook chapters, handouts, and complete vehicle manufacturers' training material (if applicable) outside of class and at appropriate times throughout the course.

Please note that:

- Any student who scores below a 60% (D) on the final exam must repeat the course.
- Students enrolled in the any automotive program option sponsored by a vehicle manufacturer (Mopar CAP, Subaru University, or Audi AEP) must complete all vehicle manufacturer web courses, post-tests, and proctored assessments assigned at the start of the semester. The assigned web courses, post-test, and proctored assessments are in addition to the standard course assignments shown below. Due dates for each assigned web course, post-test, and proctored assessment is discussed in class, but all of them must be finished and passed before the last week of the term.

Below is a list of the tools used for assessing student learning outcomes in this course. The percentages shown after each assessment tool refers to the weight each assessment has on a student's final course grade. Percentages are approximate.

Exams 35%
Quizzes 20%
Hands-On Lab Assignments 35%
Homework 10%

Policy Statement for Missed Lab Demonstrations:

Due to the concerns for student and staff safety, a student who does not attend tool, equipment, and procedure demonstrations performed by the course instructor, prior to a hands-on learning activity, may be excluded from participating in the hands-on activity. This occurs because the tools, equipment, and chemicals necessary to complete automotive diagnosis and service often present safety hazards for users and observers if the correct handling procedures are not followed.

Reasons for not attending demonstrations may include full or partial absence during the demonstration, or if a student does not give his or her full attention during the demonstration. Enforcement of this classroom policy is at the discretion of the course instructor, and is based largely on the dangers involved with the use of the necessary tools, equipment, and chemicals required to complete the hands-on activity, and the time necessary to complete a make-up demonstration.