COURSE OUTLINE

Course Number	Course Title	Credits
AUT 115	Automotive Brake Systems	4
Hours: Lecture/Lab/Other	**Co- or Pre-requisite**	**Implementation Semester & Year**
2/4	AUT 110 and AUT 111	Spring 2022

Catalog description: The purpose, function, repair and diagnosis of disc and drum brake systems used on today's automobiles, including computer-controlled anti-lock braking systems. Emphasis on malfunction diagnosis, use of scan tool testing procedures, brake system inspection and repair, hydraulic system principles and component machining operations.

General Education Category: Non GenEd

Course coordinator: Jason Evans, 609-570-3776, evansj@mccc.edu

Required texts & Other materials: Halderman, James D., Automotive Brake Systems, 7th Edition, Pearson Education, 2017. ISBN-13: 9780134063126

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 brake systems. [Supports ILG # 1, 2, 3, 4, 10, 11 ; PLO # 1, 2, 3, 4]
2. Analyze automotive brake systems through visual inspection processes and scan tool procedures. [Supports ILG # 4, 10; PLO # 1, 3]
3. Demonstrate the process to perform component measuring and resurfacing procedures needed to comply with warranty requirements and ensure customer safety. [Supports ILG # 2, 4, 11 ; PLO # 1, 2, 3]
4. Explain the operation of anti-lock brake (ABS), electronic stability control, and traction control systems. [Supports ILG # 1, 10 ; PLO # 3, 4]
5. Demonstrate the process to diagnose customer concerns relating to base brake system, hydraulic and electronic brake systems. [Supports ILG # 4, 10, ; PLO # 1, 2, 3, 4]
6. Compare similarities and differences between brake fluid types used in automobiles and explain consequences of using the incorrect fluid type and causing brake fluid contamination. [Supports ILG # 1, 10 ; PLO # 3, 4]
7. Use the proper service procedure for the removal, replacement, and air bleed of brake system components. [Supports ILG # 1, 4, 10, 11 ; PLO # 1, 3]
8. Describe heat transfer principles and friction principles relating to the brake system. [Supports ILG # 1, 10, 11; PLO # 1, 3]
9. Explain and identify the operation and diagnosis of the hydraulic braking systems. [Supports ILG # 1, 10, 11; PLO # 1, 3]
10. Demonstrate his or her ability to communicate with automotive repair professionals in a manner that follows standards of the automotive repair industry. [Supports ILG # 1 ; PLO # 2, 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 3. Science. Students will use the scientific method of inquiry, through the acquisition of scientific knowledge.
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 Automotive Technology (PLO)

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 Automotive Brake Systems [Supports Course SLOs # 1]**

Learning Objectives

The student will be able to:

- Explain the purpose and function of the brake system.
- Identify brake system components.
- Understand the evolution of the brake system.
- Explain the safety requirements that manufactures have to follow when designing the brake system.
- Compare advantages and disadvantages of the disc brake and drum brake systems.

Unit II **Principles and Theories of Brake System Operation [Supports Course SLOs # 1, 8]**

Learning Objectives

The student will be able to:

- Describe how changes in a vehicles kinetic and potential energy effect brake system design.
- Explain how temperature effects the coefficient of friction and brake system performance.
- Analyze heat transfer principles and friction principles as they relate to the brake system.
- Classify differences in front-wheel drive (FWD) and rear-wheel drive (RWD) vehicles, and how weight transfer and inertia affect brake system performance.

Unit III **Hydraulic Brake System [Supports Course SLOs # 1, 9]**

Learning Objectives

The student will be able to:

- Summarize Pascal's Law.
- Analyze the properties of hydraulic fluid and how it is used in the brake system.
- Define the purpose and function of the hydraulic brake system.
- Demonstrate the process to calculate output piston force, distance of movement, and system pressure in hydraulic circuits.
- Demonstrate his or her ability to diagnose failures in hydraulic circuits.

Unit IV **Brake Fluid and Master Cylinder Operation and Service [Supports Course SLOs # 1, 2, 5, 6, 7, 10]**

Learning Objectives

The student will be able to:

- Explain the purpose and operation of a brake master cylinder.
- Classify differences between diagonal split and front/rear split brake master cylinders designs.
- Demonstrate his or her ability in diagnosing functionality concerns in hydraulic circuits.
- Compare and contrast the characteristics of different types of hydraulic brake fluids and their function.
- Demonstrate the process to overhaul and bench-bleed a brake master cylinder.
- Use the appropriate tools to flush and bleed air from the brake system using manual and electronic procedures.

Unit V **Drum Brake Theory, Operation, and Service [Supports Course SLOs # 1, 2, 3, 7, 10]**

Learning Objectives

The student will be able to:

- Explain the purpose and function of drum brake systems.
- Identify different types of drum brake systems.
- Demonstrate the process to remove and replace the drum brake shoes and hardware to restore the system to factory specification.
- Compare the advantages and disadvantages of drum brake systems.

- Demonstrate his or her ability to adhere to safety procedures while working with tools and equipment.
- Use the appropriate tools to measure and machine brake drums.

Unit VI **Disc Brake Theory, Operation, and Service [Supports Course SLOs # 1, 2, 3, 7, 10]**

Learning Objectives

The student will be able to:

- Explain the purpose and function of disc brake systems.
- Distinguish the differences in brake caliper design and service procedure.
- Demonstrate the process to remove and replace disc brake pads to restore the system to factory specification.
- Demonstrate his or her ability to adhere to safety procedures while working with tools and equipment.
- Demonstrate the process to use a bench lathe and an on-car brake lathe.
- Use the appropriate tools to measure and machine brake rotors.
- Demonstrate his or her ability to diagnose base brake system faults.

Unit VII **Brake Safety Switches, Valves, Brake Tubing, Hoses, and Fittings [Supports Course SLOs # 1, 2, 5]**

Learning Objectives

The student will be able to:

- Define the purpose and function of the hydraulic valves and switches used in the disc and drum brake systems.
- Identify the proper type of brake tubing that necessary to complete a hydraulic brake system repair.
- Use the appropriate tools to form an inverted double flare and ISO brake tubing flares.
- Use the appropriate tools to purge air from a hydraulic brake system.

Unit VIII **Power Assisted Brake Systems [Supports Course SLOs # 1, 2, 5, 7, 9]**

Learning Objectives

The student will be able to:

- Describe the purpose and function of brake power-assist systems.
- Explain the operation of the vacuum booster and causes of system failures.
- Explain the operation of Hydro-Boost and causes of system failures.
- Identify the need and application for different power assist systems.

Unit IX **Anti-Lock, Traction Control, Stability Control, and Regenerative Braking Systems [Supports Course SLOs # 1, 2, 4, 5]**

Learning Objectives

The student will be able to…

- Define the purpose and function of the anti-lock brake system (ABS), traction control, and electronic stability control systems.
- Express the safety features of each system.
- Restate how the system will not prevent an accident and cannot defy the laws of physics.
- Demonstrate the process to diagnose system faults with the scan tool.

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 beginning of 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 30%
Homework 15%

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.