

COURSE OUTLINE **Automotive Brakes I**

Course Description:

AT103 Automotive Brakes 1. 3 Credit Hours. Prerequisite: AT 101. This course will enable the student to establish the hydraulic and mechanical principles utilized in automotive braking systems. Hydraulic system diagnosis, disc, drum, wheel bearing, and parking brake service procedures are established. The student will acquire disc and drum measuring and machining techniques.

Course Relevance:

The principles and techniques acquired in this course are common to the automotive industry and are the foundation for all braking systems. Comprehension of these principles allows the student to effectively diagnose and repair common automotive braking systems.

Required Materials:

Halderman, J. D. (1995). *Automotive Brake Systems*. Englewood, NJ: Prentice Hall Publishers.

Learning Outcomes: Comprehension of the principles and techniques presented in this course will allow the student to:

1. Diagnose and safely repair braking systems that are in current use with the industry
2. Apply the course principles to future developments in automotive braking systems

Learning PACT

Through the student involvement in this course, the student will develop and document his/her achievement of the following PACT skills:

Primary skills (developed and documented):

1. Problem solving
 - Through analyzing braking system problems and choosing the proper repair procedure, the student will develop problem-solving skills.
2. Critical Thinking
 - Through solving braking problems, employing an “outside –in” thinking process and examining the system as an interrelated entity functioning as a “whole” based upon the strength of its individual components, the student will develop critical thinking skills.
3. Listening

- Through working as a team and recognizing the need for clear, concise communication between the technician and the consumer to effectively analyze and repair the complaint, the student will develop listening skills.
4. Field related Technology
- Through researching specifications and service bulletins related to the repair procedure to select and use tools appropriate for the repair task, the student will develop field-related technology skills.

Secondary skills (developed but not documented):

Writing
 Reading
 Time management
 Ethical work practices

Assessment Tasks:

These learning outcomes and primary Learning PACT skills will be demonstrated by:

1. In a field related environment, listing, describing, and explaining the operation of the basic components for an automotive brake system.
2. Identifying, describing and explaining the components and operation of the master cylinder.
3. In a field related environment, identifying, describing, and explaining the operation of brake lines and valves.
4. In a field related environment, demonstrating an understanding of the disc brake caliper assembly.
5. In a field related environment, demonstrating an understanding of rear wheel caliper and parking brake operation.
6. Describing the function and operation of drum brake components.
7. In a field related environment, demonstrating the ability to diagnose and service parking brake related customer complaints.

Course Content:

- I. Themes - Key recurring concepts that run throughout this course:
 - A. Ethical work practices
 - B. Cost effectiveness
 - C. Safety in the work place
 - D. Time management
 - E. Communication
- II. Issues - Key issues that will be addressed in this course: areas of conflict that must be understood in order to achieve the intended outcome:
 - A. Effective relationships within a team environment
 - B. Responsibility
 - C. Dealing with diversity within the Lab/Classroom
 - D. Dealing with situations that limit individual performance
 - E. Coping with technological change
- III. Concepts – Key concepts that must be understood to address the issues:

- A. Hydraulic principles
 - B. Mechanical principles
 - C. Basic Laws of Physics
 - D. Basic Machining Practices
 - E. Mathematics
- IV. Skills / Competencies - Actions that are essential to achieve the course outcomes:
- A. Inspect brake lines and fittings for leaks, dents, kinks, rust, cracks or abrading; service and repair as necessary.
 - B. Inspect flexible brake hoses for the conditions above; correct as necessary.
 - C. Inspect, test and replace components of brake warning system.
 - D. Diagnose poor stopping, noise, pulling, grabbing, or pedal pulsation problems; service as required
 - E. Select, handle, store and install brake fluids to proper level.
 - F. Inspect, test, and replace metering (hold-off), proportioning (balance), and pressure differential and combination valves.
 - G. Measure and adjust pedal push rod length and pedal height
 - H. Check master cylinder for internal and external leaks, verify proper operation; service as required
 - I. Remove, bench bleed, and replace master cylinder
 - J. Fill master cylinder with recommended fluid level, seat pads and inspect for leakage
 - K. Diagnose poor stopping, pulling or dragging caused by fluid transfer system (lines); correct as required
 - L. Fabricate and install brake lines (double flair and I.S.O.); replace hoses, fittings and supports as needed
 - M. Inspect, test, replace and adjust height (load) sensing valves
 - N. Bleed and flush hydraulic brake system (Manual, Pressure and Vacuum methods)
 - O. Remove caliper assembly from mountings; clean and inspect
 - P. Clean and inspect caliper mounting and slides for wear and damage
 - Q. Remove, clean and inspect pads and retaining hardware; determine needed service
 - R. Disassemble, clean and inspect caliper assembly for: wear, rust scoring and pitting, other damage. Replace: seals, boots and damaged components as necessary
 - S. Clean, inspect, and measure rotor with dial indicator and micrometer; research specifications and service as needed
 - T. Refinish rotor according to manufacturers' specifications.
 - U. Adjust calipers with integrated parking brake systems
 - V. Remove, clean, inspect, re-pack, and install wheel bearings; replace seals, re-install hubs and adjust.
 - W. Replace wheel bearings and races
 - X. Remove, clean,(using O.S.H.A. approved methods) inspect, and measure brake drums; service or replace as needed

- Y. Mount brake drum on lathe; machine braking surface
- Z. Remove, clean, and inspect brake shoes, springs, clips, levers, adjusters, self adjusters, and other brake hardware; lubricate and re-assemble
- AA. Remove and install wheel cylinders
- BB. Pre-adjust brake shoes and parking brake prior to installation of drums
- CC. Install wheels, torque lug nuts, final inspection and adjustments
- DD. Diagnose wheel bearing noises, wheel shimmy and vibration problems; determine needed repairs
- EE. Check parking brake cables and components for wear, rusting, binding and corrosion; clean lubricate and replace as needed
- FF. Check parking brake operation; adjust as needed.
- GG. Check operation of parking brake indicator lamp system
- HH. Check operation of brake stop lamp system; adjust and service as needed

Learning Units:

- I. Demonstrate an analytical, systematic approach to brake system repairs.
- II. Demonstrate knowledge of the operation of fluid transfer systems and control valves
- III. Demonstrate proper measuring, inspection, and machining practices
- IV. Demonstrate comprehension of master cylinder, wheel cylinder and caliper function
- V. Demonstrate comprehension of the parking brake system
- VI. Demonstrate safe, ethical work practices

Learning Activities:

Independent and collaborative learning activities will be assigned within the classroom and lab environment to assist the student in achieving the desired outcomes. Class discussion, lecture, reading assignments and supportive lab activities will also contribute to the learning process.

Grade Determination:

Grade determination will be based on the student's performance of assigned tasks within the classroom/lab environment. Attendance, group participation, attitude towards fellow students and assigned tasks will be reflected in the final grade. Lab tasks (competencies) will be evaluated (rated) on the competency profile.