

RARITAN VALLEY COMMUNITY COLLEGE ACADEMIC COURSE OUTLINE

AUTC 109 –Brake Systems

I. Basic Course Information

- A. Course Number and Title: AUTC 109 –Brake Systems
- B. New or Modified Course: Modified
- C. Date of Proposal: Fall 2022
- D. Effective Term: Fall 2023**
- E. Sponsoring Departments: *Science and Engineering Department*
- F. Semester Credit Hours: 4
- G. Weekly Contact Hours: 6 Lecture: 3
Laboratory: 3
Out of class student work per week: 7.5
- H. Prerequisite (s) ☒ Corequisite (s) ☐ **OR** Prerequisite (s) and Corequisite (s) ☐Corequisites: AUTC 101 – Automotive Introduction, Fundamentals, and Safety
AUTC 104 – Automotive Electrical Systems I
AUTC 201 – Engine Systems & Emissions Control I
(Students must be registered in the same section for each course)
- I. Additional Fees: None
- J. Name and Telephone Number or Email Address of Department Chair and Divisional Dean at time of approval:
Department Chair: Marianne Baricevic, Marianne.baricevic@raritanval.edu
Divisional Dean: Sarah Imbriglio, sarah.imbriglio@raritanval.edu

II. Catalog Description

Corequisites: AUTC 101 – Automotive Introduction, Fundamentals, and Safety
AUTC 104 – Automotive Electrical Systems I
AUTC 201 – Engine Systems & Emissions Control I
(Students must be registered in the same section for each course)

This course provides an overview of the brake system. Training will cover the brake system fundamentals, principles, and complete brake servicing to the mechanical and hydraulic braking system. Inspection diagnosis, adjustment, and repair of drum, disc, hydraulics, and anti-lock brake systems will be performed. This course will also cover the theory involved in advanced suspension and steering diagnosis and Anti-Lock Brake systems. These two systems work in conjunction with each other for advanced safety systems including traction control and anti-roll stability controls. Practice is provided in diagnosing and servicing the automotive brakes systems.

In the lab, students will learn a hands-on strategy to perform diagnosis, maintenance, and repair of braking systems and learn how to use a variety of hand tools and diagnostic tools and processes. Students will be required to wear clothing appropriate for auto shop safety at all classes. Safety glasses will also be required at all classes.

III. Statement of Course Need

- A. Automotive technicians are vital to our mobile and transport-dependent community. Understanding the proper maintenance, service, and repair of brake system in automobiles are integral elements for the education of well-trained technicians in the field. Efficiency, performance and compliance with EPA regulations (State and Federal) are mandatory in this field as well as customer satisfaction. This course covers the maintenance, diagnosis, and repair of automotive brake systems and is intended to enhance the student's knowledge beyond understanding.
- B. Lab assignments for the course will introduce students to the maintenance, diagnosis, and repair of automotive brake systems while maintaining instruction that reinforces safety practices in a demonstrative environment.
- C. Course transferability: The course transfers as one of the core fundamental courses for the Automotive Technology major and includes a laboratory component; for New Jersey schools go to the NJ Transfer website, www.njtransfer.org. For all other colleges and universities, go to their individual websites.

IV. Place of Course in College Curriculum

- A. Free Elective
- B. This course meets the program requirement for the Automotive Technology Certificate and the Associate of Applied Science in Automotive Technology.
- C. Course transferability; for New Jersey schools go to the NJ Transfer website, www.njtransfer.org. For all other colleges and universities go to their individual sites.

V. Outline of Course Content

- A. Braking system components and performance standards
- B. Braking system principles
- C. Brake hydraulic systems
- D. Hydraulic valves & switches
- E. Brake fluid and lines
- F. Brake bleeding methods and procedures
- G. Wheel bearings and service
- H. Drum brakes
- I. Drum brakes diagnosis and service
- J. Disc brakes
- K. Disc brakes diagnosis and service
- L. Parking brake operation, diagnosis and service
- M. Machining brake drums and rotors
- N. Power brake unit operation, diagnosis, and service
- O. ABS components and operation
- P. ABS diagnosis and service
- Q. Electronic stability control systems
- R. ABS Components and Operation

VI. A. Course Learning Outcomes

At the completion of the course, students will be able to:

1. Analyze the structure and function of advanced brake systems.
2. Investigate complex maintenance and repair issues in advanced brake systems.
3. Compare and contrast the layout and types of advanced brake systems
4. Inspect, test, and replace advanced brake components with appropriate tools and instruments according to manufacturer's specifications.
5. Appraise tire pressure monitoring systems
6. Demonstrate skill required to diagnose stability control and ABS systems
7. Perform lab experiments and tasks to competent skill level as listed on the NATEF curriculum standards.
8. Identify techniques to troubleshoot, repair, maintain, and solve problems with various automotive brake systems (GE NJ 4)
9. Apply quantitative reasoning to problems with the maintenance of automotive brake systems (GE NJ 2)
10. Discuss issues of automotive brake systems (GE NJ 1)

NATEF Standards: AV Brakes

- a. General: Brake Systems Diagnosis
 - i. Identify and interpret brake system concerns; determine needed action. P-1
 - ii. Research vehicle service information including fluid type, vehicle service history, service precautions, and technical service bulletins. P-1
 - iii. Describe procedure for performing a road test to check brake system operation including an anti-lock brake system (ABS). P-1

- iv. Install wheel and torque lug nuts. P-1
- b. Hydraulic System Diagnosis and Repair
 - i. Diagnose pressure concerns in the brake system using hydraulic principles (Pascal's Law). P-1
 - ii. Measure brake pedal height, travel, and free play (as applicable); determine needed action. P-1
 - iii. Check master cylinder for internal/external leaks and proper operation; determine needed action. P-1
 - iv. Remove, bench bleed, and reinstall master cylinder. P-1
 - v. Diagnose poor stopping, pulling or dragging concerns caused by malfunctions in the hydraulic system; determine needed action. P-1
 - vi. Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging, wear; and loose fittings/supports; determine needed action. P-1
 - vii. Replace brake lines, hoses, fittings, and supports. P-2
 - viii. Fabricate brake lines using proper material and flaring procedures (double flare and ISO types). P-2
 - ix. Select, handle, store, and fill brake fluids to proper level; use proper fluid type per manufacturer specification. P-1
 - x. Inspect, test, and/or replace components of brake warning light system. P-3
 - xi. Identify components of hydraulic brake warning light system. P-2
 - xii. Bleed and/or flush brake system. P-1
 - xiii. Test brake fluid for contamination. P-1
- c. Drum Brake Diagnosis and Repair
 - i. Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging or pedal pulsation concerns; determine needed action. P-1
 - ii. Remove, clean, and inspect brake drum; measure brake drum diameter; determine serviceability. P-1
 - iii. Refinish brake drum and measure final drum diameter; compare with specification. P-1
 - iv. Remove, clean, inspect, and/or replace brake shoes, springs, pins, clips, levers, adjusters/self-adjusters, other related brake hardware, and backing support plates; lubricate and reassemble. P-1
 - v. Inspect wheel cylinders for leaks & proper operation; remove & replace as needed. P-2
 - vi. Pre-adjust brake shoes and parking brake; install brake drums or drum/hub assemblies and wheel bearings; perform final checks and adjustments. P-1
- d. Disc Brake Diagnosis and Repair
 - i. Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging, or pulsation concerns; determine needed action. P-1
 - ii. Remove and clean caliper assembly; inspect for leaks, damage, and wear; determine needed action. P-1
 - iii. Inspect caliper mounting and slides/pins for proper operation, wear, and damage; determine needed action. P-1
 - iv. Remove, inspect, and/or replace brake pads and retaining hardware; determine needed action. P-1
 - v. Lubricate and reinstall caliper, brake pads, and related hardware; seat brake pads; inspect for leaks. P-1
 - vi. Clean and inspect rotor and mounting surface; measure rotor thickness, thickness variation, and lateral runout; determine needed action. P-1

- vii. Remove and reinstall/replace rotor. P-1
- viii. Refinish rotor on vehicle; measure final rotor thickness & compare w/ specification. P-1
- ix. Refinish rotor off vehicle; measure final rotor thickness & compare w/ specification. P-1
- x. Retract and re-adjust caliper piston on an integrated parking brake system. P-2
- xi. Check brake pad wear indicator; determine needed action. P-1
- xii. Describe importance of operating vehicle to burnish/break-in replacement brake pads according to manufacturer's recommendations. P-1
- e. Power-Assist Units Diagnosis and Repair
 - i. Check brake pedal travel with and without engine running to verify proper power booster operation. P-2
 - ii. Identify components of the brake power assist system (vacuum and hydraulic); check vacuum supply (manifold or auxiliary pump) to vacuum- type power booster. P-1
 - iii. Inspect vacuum-type power booster unit for leaks; inspect the check-valve for proper operation; determine needed action. P-1
 - iv. Inspect and test hydraulically-assisted power brake system for leaks and proper operation; determine needed action. P-3
 - v. Measure and adjust master cylinder pushrod length. P-3
- f. Related Systems (i.e. Wheel Bearings, Parking Brakes, Electrical) Diagnosis and Repair
 - i. Diagnose wheel bearing noises, wheel shimmy, and vibration concerns; determine needed action. P-1
 - ii. Remove, clean, inspect, repack, and install wheel bearings; replace seals; install hub and adjust bearings. P-2
 - iii. Check parking brake system and components for wear, binding, and corrosion; clean, lubricate, adjust and/or replace as needed. P-1
 - iv. Check parking brake operation and parking brake indicator light system operation; determine needed action. P-1
 - v. Check operation of brake stop light system. P-1
 - vi. Replace wheel bearing and race. P-3
 - vii. Remove, reinstall, and/or replace sealed wheel bearing assembly. P-1
 - viii. Inspect and replace wheel studs. P-1
- g. Electronic Brake Control Systems: Antilock Brake (ABS), Traction Control (TCS), and Electronic Stability Control (ESC) Systems Diagnosis and Repair
 - i. Identify and inspect electronic brake control system components (ABS, TCS, ESC); determine needed action. P-1
 - ii. Describe the operation of a regenerative braking system. P-3
 - iii. Diagnose poor stopping, wheel lock-up, abnormal pedal feel, unwanted application, and noise concerns associated with the electronic brake control system; determine needed action. P-2
 - iv. Diagnose electronic brake control system electronic control(s) and components by retrieving diagnostic trouble codes, and/or using recommended test equipment; determine needed action. P-2
 - v. Depressurize high-pressure components of an electronic brake control system. P-2
 - vi. Bleed the electronic brake control system hydraulic circuits. P-1
 - vii. Test, diagnose, and service electronic brake control system speed sensors (digital and analog), toothed ring (tone wheel), and circuits using a graphing multimeter (GMM)/digital storage oscilloscope (DSO) (includes output signal, resistance, shorts to voltage/ground, and frequency data). P-2

- viii. Diagnose electronic brake control system braking concerns caused by vehicle modifications (tire size, curb height, final drive ratio, etc.).

P-1

B. Assessment Instruments

1. Lectures
2. Demonstrations
3. Laboratory work
4. Instructional videos/DVDs
5. Laboratory performance
6. Examinations
7. NATEF task list
8. Online modules
9. Manufacturer programs
10. Pro-Cut Certification

VII. Grade Determinants

- A. Lab performance
- B. Examinations
- C. Class participation
- D. Technical writing
- E. Interactive simulations
- F. Module completion
- G. Homework assignments
- H. Pro-Cut Certification

Primary formats, modes, and methods for teaching and learning that may be used in the course:

- A. Lecture/discussion
- B. Small-group work
- C. Group discussion
- D. Computer-assisted instruction
- E. Laboratory
- F. Simulation/role playing
- G. Demonstration
- H. Student collaboration
- I. Individual assignments
- J. Electude
- K. Manufacturer training

VIII. Text and Materials

- A. Suggested Text: Automotive Technology: Principles, Diagnosis, and Service Plus MyAutomotiveLab with Pearson eText -- Access Card Package / Edition 5 by James D. Halderman (Author), Prentice Hall Publishing ISBN-10: 0134009088 / ISBN-13: 9780134009087
- B. Students will be required to wear clothing appropriate for auto shop safety at all classes. Student are required to wear a standard industry uniform. Safety glasses will also be required at all classes.
- C. The Automotive Program utilizes online curriculum and online industry service and repair information from the following sources:
 - I. AllData
 - II. Snap On Industries
 - III. Shop Key Pro.
 - IV. Electude
 - V. Manufacturer Training
- D. Various Automotive Magazines
- E. Students are provided the use of RVCC technology during the course

Please note: The course outline is intended only as a guide to course content and resources. Do not purchase textbooks based on this outline. The RVCC Bookstore is the sole resource for the most up-to-date information about textbooks.

IX. Resources

- A. Reference books
- B. Text Book
- C. AllData
- D. Shop Key Pro
- E. Snap On Industries
- F. NAPA Pro-Link
- G. Published Automotive Magazines
- H. Lab/Shop Tools and Equipment
- I. Electude Interactive Courseware
- J. Safety equipment
- K. Lubricants and various automotive fluids
- L. Sample Steering and Suspension system components
- M. Instructional videos/DVDs
- N. Auto mechanics shop facility at RVCC workforce building
- O. Electude
- P. Manufacturer Training
- Q. Pro-Cut Certification