



South Portland, Maine 04106

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Title: **Brakes 2**

Catalog Number: **AUTO-117**

Credit Hours: **2**

Credit hours: **1 hour lecture / 1 hour lab**

Semester: **Spring 2018**

Total Contact Hours: **15 / 30**

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## Course Syllabus

### Course Description

This is the second class in a 2 part study of brake systems. Tasks from the NATEF Master Automobile Service Technology list will be performed. Students will diagnose and repair hydraulic systems, power assist units, wheel bearings, parking brakes, and electronic brake systems.

Co-requisite: AUTO 116 Brakes 1

Co-requisite: AUTO 205 Electrical/Electronics 2

### Course Objectives

As a result of this particular course, the student will be familiar with the tasks from the NATEF MASTER AUTOMOBILE SERVICE TECHNOLOGY task list minus the MAINTENANCE AND LIGHT REPAIR tasks that were previously studied in Brakes 1. The MAST task list is below with the previously studied MLR tasks crossed out. The student must perform all high priority tasks to manufacturer's specifications and document the completion of each task.

### NATEF 2017 Standards TASKS FOR THIS COURSE:

**V. BRAKES MASTER AUTOMOBILE SERVICE TECHNOLOGY tasks minus the MAINTENANCE AND LIGHT REPAIR tasks (MLR tasks are in AUTO 116)**

**For every task in Brakes, the following safety requirement must be strictly enforced:**

**Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.**

A. General: Brake Systems Diagnosis

1. Identify and interpret brake system concerns; determine needed action. P-1

~~2. Research vehicle service information including fluid type, vehicle service history, service precautions, and technical service bulletins. P-1~~

3. Describe procedure for performing a road test to check brake system operation including an anti lock brake system (ABS). P-1

4. Install wheel and torque lug nuts. P-1

#### B. Hydraulic System Diagnosis and Repair

1. Diagnose pressure concerns in the brake system using hydraulic principles (Pascal's Law). P-1

2. Measure brake pedal height, travel, and free play (as applicable); determine needed action. P-1

3. Check master cylinder for internal/external leaks and proper operation; determine needed action. P-1

4. Remove, bench bleed, and reinstall master cylinder. P-1

5. Diagnose poor stopping, pulling or dragging concerns caused by malfunctions in the hydraulic system; determine needed action. P-1

6. Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging, wear; and loose fittings/supports; determine needed action. P-1

7. Replace brake lines, hoses, fittings, and supports. P-2

8. Fabricate brake lines using proper material and flaring procedures (double flare and ISO types). P-2

9. Select, handle, store, and fill brake fluids to proper level; use proper fluid type per manufacturer specification. P-1

10. Inspect, test, and/or replace components of brake warning light system. P-3

11. Identify components of hydraulic brake warning light system. P-2

12. Bleed and/or flush brake system. P-1

13. Test brake fluid for contamination. P-1

#### C. Drum Brake Diagnosis and Repair

1. Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging or pedal pulsation concerns; determine needed action. P-1

2. Remove, clean, and inspect brake drum; measure brake drum diameter; determine serviceability. P-1

3. Refinish brake drum and measure final drum diameter; compare with specification. P-1

4. 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

5. Inspect wheel cylinders for leaks and proper operation; remove and replace as needed. P-2

6. 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

1. Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging, or pulsation concerns; determine needed action. P-1

2. Remove and clean caliper assembly; inspect for leaks, damage, and wear; determine needed action. P-1

3. Inspect caliper mounting and slides/pins for proper operation, wear, and damage; determine needed action. P-1

4. Remove, inspect, and/or replace brake pads and retaining hardware; determine needed action. P-1

5. Lubricate and reinstall caliper, brake pads, and related hardware; seat brake pads; inspect for leaks. P-1

6. Clean and inspect rotor and mounting surface; measure rotor thickness, thickness variation, and lateral runout; determine needed action. P-1

7. Remove and reinstall/replace rotor. P-1

8. Refinish rotor on vehicle; measure final rotor thickness and compare with specification. P-1

9. Refinish rotor off vehicle; measure final rotor thickness and compare with specification. P-1

10. Retract and re-adjust caliper piston on an integrated parking brake system. P-2

11. Check brake pad wear indicator; determine needed action. P-1

12. 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

1. Check brake pedal travel with and without engine running to verify proper power booster operation. P-2

- ~~2. 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~~
3. Inspect vacuum-type power booster unit for leaks; inspect the check-valve for proper operation; determine needed action. P-1
4. Inspect and test hydraulically-assisted power brake system for leaks and proper operation; determine needed action. P-3
5. Measure and adjust master cylinder pushrod length. P-3
- F. Related Systems (i.e. Wheel Bearings, Parking Brakes, Electrical) Diagnosis and Repair
  1. Diagnose wheel bearing noises, wheel shimmy, and vibration concerns; determine needed action. P-1
  - ~~2. Remove, clean, inspect, repack, and install wheel bearings; replace seals; install hub and adjust bearings. P-2~~
  - ~~3. Check parking brake system and components for wear, binding, and corrosion; clean, lubricate, adjust and/or replace as needed. P-1~~
  - ~~4. Check parking brake operation and parking brake indicator light system operation; determine needed action. P-1~~
  - ~~5. Check operation of brake stop light system. P-1~~
  - ~~6. Replace wheel bearing and race. P-3~~
  7. Remove, reinstall, and/or replace sealed wheel bearing assembly. P-1
  - ~~8. 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
  1. Identify and inspect electronic brake control system components (ABS, TCS, ESC); determine needed action. P-1
  - ~~2. Describe the operation of a regenerative braking system. P-3~~
  3. 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
  4. 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
  5. Depressurize high-pressure components of an electronic brake control system. P-2
  6. Bleed the electronic brake control system hydraulic circuits. P-1
  7. 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
  8. Diagnose electronic brake control system braking concerns caused by vehicle modifications (tire size, curb height, final drive ratio, etc.). P-1

### **Topical Outline of Instruction**

1. Hydraulics
2. Brake diagnosis
3. Electronic brake systems

### **Course Requirements**

- Students will develop a three-ring binder / portfolio of all hand outs, quizzes and tests.
- Students will successfully complete homework, quizzes, and tests.
- Students will successfully complete shop projects as assigned and approved by instructor and maintain documentation of completion with lab sheets and NATEF scoring rubric.

## **Student Evaluation and Grading**

- 10%: Attendance and Participation
- 10%: Homework
- 20%: Quizzes
- 30%: Tests and Portfolio
- 30%: Practice of Safety and Shop Participation

## **Attendance Grade**

Out of 100 possible points, 10 points will be deducted for each class absence and 5 points will be deducted for each time tardy.

## **Department Attendance Policy**

**Students missing 15% of the total hours for the course, tardy or absent, will result in an administrative failure for the class. This equals 6.75 hours for this 2 credit course. This is a “no fault” policy, which means the reason(s) for absence are not considered in implementation of the policy.**

## **ASE Student Certification Test**

The final week of this course will consist of an ASE Student Certification Test. It will be administered at the Testing Center, located in the Campus Center building. Students will be responsible for taking the test at their convenience during the normal operating hours of the Testing Center. A photo ID is required. For information about the Testing Center, please see [www.smccme.edu/tests](http://www.smccme.edu/tests)

## **Texts, Tools, and/or Supplies**

- Automotive Technology with NATEF Correlated Task Sheets (5th Edition) by James D. Halderman (ISBN# 9780134209227).
- Electude Argo E Learning Software subscription
- Each student must supply and maintain his or her own set of tools as listed on the “SMCC Automotive Technology Required Student Tool List.”
- Personal protective equipment must be worn at all times in lab. Leather, steel-toe work boots; clear safety glasses with side shields; and a uniform are required for this course.

## **Telephones and Computers**

The use of computers, cell phones, smart phones, or other mobile communication devices is prohibited during lecture, unless the instructor indicates a special circumstance. In case of emergency, phones should be silenced, and answered outside the classroom. Special requests to use a computer for note taking will be considered by the instructor on a case by case basis. Violations of this policy will result in dismissal from the class period and an absence recorded. Repeat problems may result in a sanction from the Dean of Students.

## **Office Hours**

Appointments can be made to accommodate student needs. Please Call or Email for an appointment.

## **Learning Outcomes**

1. When necessary, utilize information-literacy skills, including evaluation of information from a variety of media and proper MLA and/or APA documentation.
2. Use critical thinking and listening skills in written and oral communication as a tool for learning.
3. Read and demonstrate understanding of complex ideas by identifying key concepts.
4. Apply theory to practice using problem solving techniques and data analysis.
5. Solve problems using algebraic techniques.
6. Interpret information presented in charts and graphs or illustrate a scenario using graphic techniques.
7. Utilize quantitative methods to solve and/or assess complex problems to support decision making, forecasting, and recommendations.
8. Participate in a direct experience of scientific inquiry of the natural world using the scientific method.
9. Find and evaluate credible sources of scientific information using a variety of media to support a research need.
10. Demonstrate the capacity to make informed and ethical judgments about the impact of science and technology on the self, the environment, and the practice of sustainability.

## **End-of-Course Evaluation**

In order to gain access to final course grades, students must complete evaluations for each course attended at SMCC. Evaluations are submitted online and can be accessed through the student portal site. Students can access the course evaluation report beginning two weeks before the end of classes. The deadline for submission of evaluations occurs 24 hours after the last day of classes each semester. Instructors will announce when the online course evaluation is available.

## **ADA Syllabus Statement**

Southern Maine Community College is an equal opportunity/affirmative action institution and employer. For more information, please call [207-741-5798](tel:207-741-5798). If you have a disabling condition and wish to request accommodations in order to have reasonable access to the programs and services offered by SMCC, you must register with the Disability Services Coordinator, Sandra Lynham, who can be reached at 741-5923. Further information about services for students with disabilities and the accommodation process is available upon request at this number. Course policies about online testing are modified to suit each individual's accommodations.

## **Add-Drop Policy**

Students who drop a course during the one-week "add/drop" period in the fall and spring semesters and the first three days of summer sessions receive a 100% refund of the tuition and associated fees for that course. Please note any course that meets for less than the traditional semester length, i.e., 15 weeks, has a pro-rated add/drop period. There is no refund for non-attendance.

## **Withdrawal Policy**

A student may withdraw from a course only during the semester in which s/he is registered for that course. The withdrawal period is the second through twelfth week of the fall and spring semesters and the second through ninth week of twelve-week summer courses. This period is pro-rated for shorter-length courses. To withdraw from a course, a student must complete and submit the appropriate course withdrawal form, available at the Enrollment Service Center (no phone calls, please). The designation “W” will appear on the transcript after a student has officially withdrawn. A course withdrawal is an uncompleted course and may adversely affect financial aid eligibility. Failure to attend or ceasing to attend class does not constitute withdrawal from the course. There is no refund associated with a withdrawal.

## **Plagiarism Statement**

If an instructor suspects that a student has knowingly committed a violation defined in the Maine Community College System Policy on Student Grade Appeals and Academic Misconduct, the instructor has the authority to review the alleged misconduct and determine the grade that the student should receive for the assignment and the course. The instructor may assign a failing grade for the assignment or course and may require the student to complete additional work for the course. The instructor may consult with the department chair and/or the College’s chief academic officer prior to making such decisions. If a student seeks to challenge an instructor’s determination, the student should submit a grade appeal. Grade appeal forms are available in the Advising Office on the South Portland Campus or in the administrative offices in the Learning Commons on the Midcoast Campus. An instructor may also refer the matter to the College’s disciplinary officer for review under the procedures of the MCCS Student Code of Conduct.

## **Cancellations**

When weather conditions require the College to close, we will:

- Notify you through your SMCC email account and send a text alert
- Post a storm message on the SMCC Storm Line (741-5900)
- Post the closure on a banner at the top of the SMCC website
- Post a message on the SMCC Facebook page
- Notify local media outlets
- Post a message on Twitter

When the weather forces the College to close altogether, open late or close early, the following guidelines are in place:

- When the College closes altogether for the day, all classes are canceled and all offices are closed.
- When the College closes early at a specific time, all classes beginning at that time and later are canceled. All classes beginning before the closure time will be held as scheduled. All offices will close at the closing time.
- When the College opens late, all classes beginning before the specified scheduled opening time are canceled. Classes beginning at the opening time and later will be held as scheduled. All offices will open at the opening time.

## **Student Printing Policy**

This policy identifies the cost per page for black and white as well as color printing in varying page sizes. Specifics of the policy are outlined below:

### **Per Page Costs**

Each semester students receive a \$20 printing credit. The balance resets at the end of the semester and any remaining credits are removed. The cost varies depending upon page size and whether printing is done in black and white or color.

- a. There is a \$.10 per page fee for standard 8.5" by 11" black and white documents.
- b. The reverse sides of duplex (double-sided) documents are free.
- c. There is a \$.50 per page fee for standard 8.5" by 11" color documents.
- d. There is a \$.20 per page fee for 8.5" by 14" (legal) or 11" by 17" (tabloid) black and white documents.
- e. There is a \$1.00 per page fee for 8.5" by 14" (legal) or 11" by 17" (tabloid) color documents.

**Duplex charges** (printing on both sides of a page) work in the following fashion: One page is \$0.10, two pages are \$0.10, three pages are \$0.20, and four pages are \$0.20, *etc.* The flipsides are free, but another sheet of paper is \$0.10. Please be aware that a document with any color at all (when printed to a color printer) will by default be printed in color. You are responsible for setting the print job to print black and white if you do not need color. For directions, please go to the IT Help tab in My SMCC.

### **How does it work?**

The College's pay-for-print system monitors printing on all printers (including those in general access labs, library printers, the Academic Achievement Center, Noisy Lounge and technology labs). Students can check the number of pages they have printed by using the Printing Balance tool available on SMCC computers (located in the lower right corner of the screen, near the clock). Departments with work study students who need to print documents for the department should contact the HelpDesk at 741-5696 to have a special account set up.

### **Refunds**

Print jobs are eligible for a refund in the event of mechanical or electronic error on the part of the printer, print server, or software used to submit the job. Jobs are not eligible for a refund in cases where the job was not set up correctly, was submitted multiple times, or the student is not satisfied with the result. To request a refund, please bring the offending print to the IT Department in the basement of the Ross Technology Center. Refunds will be granted in the form of a credit to the student's account.

### **Why is SMCC charging for printing?**

The pay-for-print system is an effort to control escalating printing costs. Charging for printing helps offset the increasing cost of supplies and encourages students to conserve resources. To find ways to reduce your printing charges, please go to the IT Help tab on My SMCC. If you have questions about the pay-for-printing policy or your printing charges, please contact the HelpDesk at 741-5696 or send an email to [helpdesk@smccme.edu](mailto:helpdesk@smccme.edu).

*Be sure to log OUT of the system when you've finished your printing, to prevent unauthorized access to your account.*