



South Portland, Maine 04106

Title: **Manual Transmissions & Drivelines**

Catalog Number: **AUTO-215**

Credit Hours: **4**

Lecture (or Lab): **2 hour lecture / 2 hours lab**

Instructor: **Richard O'Brien**

Total Contact Hours: **30 / 60**

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Course Syllabus

Course Description

This course will cover manual drive train and axles theory, diagnosis and repair. Students will inspect, diagnose and repair manual transmission systems, clutches, drive shafts, axles, and four wheel drive systems. Students will apply critical thinking skills, utilizing service information, to diagnose problems with transmissions, transaxles, clutches, drive shafts, axles, transfer cases, and wheel hubs to determine necessary corrective action.

Prerequisite: AUTO-102.

Course Objectives

After completing this course, the student will be familiar with all tasks listed below. He or she must perform all high priority tasks to manufacturer's specifications and document the completion of each task.

NATEF 2017 MAST Standards TASKS FOR THIS COURSE:

III. MANUAL DRIVE TRAIN AND AXLES

For every task in Manual Drive Train and Axles, 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: Drive Train Diagnosis

1. Identify and interpret drive train 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. Check fluid condition; check for leaks; determine needed action. P-1

4. Drain and refill manual transmission/transaxle and final drive unit; use proper fluid type per manufacturer specification. P-1

B. Clutch Diagnosis and Repair

1. Diagnose clutch noise, binding, slippage, pulsation, and chatter; determine needed action. P-1
2. Inspect clutch pedal linkage, cables, automatic adjuster mechanisms, brackets, bushings, pivots, and springs; perform needed action. P-1
3. Inspect and/or replace clutch pressure plate assembly, clutch disc, release (throw-out) bearing, linkage, and pilot bearing/bushing (as applicable). P-1
4. Bleed clutch hydraulic system. P-1
5. Check and adjust clutch master cylinder fluid level; check for leaks; use proper fluid type per manufacturer specification. P-1
6. Inspect flywheel and ring gear for wear, cracks, and discoloration; determine needed action. P-1
7. Measure flywheel runout and crankshaft end play; determine needed action. P-2
8. Describe the operation and service of a system that uses a dual mass flywheel. P-3

C. Transmission/Transaxle Diagnosis and Repair

1. Inspect, adjust, lubricate, and/or replace shift linkages, brackets, bushings, cables, pivots, and levers. P-2
2. Describe the operational characteristics of an electronically-controlled manual transmission/transaxle. P-2
3. Diagnose noise concerns through the application of transmission/transaxle powerflow principles. P-2
4. Diagnose hard shifting and jumping out of gear concerns; determine needed action. P-2
5. Diagnose transaxle final drive assembly noise and vibration concerns; determine needed action. P-3
6. Disassemble, inspect clean, and reassemble internal transmission/transaxle components. P-2

D. Drive Shaft and Half Shaft, Universal and Constant-Velocity (CV) Joint Diagnosis and Repair (Front, Rear, All-wheel, and Four-wheel drive)

1. Diagnose constant-velocity (CV) joint noise and vibration concerns; determine needed action. P-1
2. Diagnose universal joint noise and vibration concerns; perform needed action. P-2
3. Inspect, remove, and/or replace bearings, hubs, and seals. P-1
4. Inspect, service, and/or replace shafts, yokes, boots, and universal/CV joints. P-1
5. Check shaft balance and phasing; measure shaft runout; measure and adjust driveline angles. P-2

E. Drive Axle Diagnosis and Repair

E.1 Ring and Pinion Gears and Differential Case Assembly

1. Clean and inspect differential case; check for leaks; inspect housing vent. P-1
2. Check and adjust differential case fluid level; use proper fluid type per manufacturer specification. P-1
3. Drain and refill differential case; use proper fluid type per manufacturer specification. P-1
4. Diagnose noise and vibration concerns; determine needed action. P-2
5. Inspect and replace companion flange and/or pinion seal; measure companion flange runout. P-2
6. Inspect ring gear and measure runout; determine needed action. P-3
7. Remove, inspect, reinstall and/or drive pinion and ring gear, spacers, sleeves, and bearings. P-3
8. Measure and adjust drive pinion depth. P-3
9. Measure and adjust drive pinion bearing preload. P-3
10. Measure and adjust side bearing preload and ring and pinion gear total backlash and backlash variation on a differential carrier assembly (threaded cup or shim types). P-3
11. Check ring and pinion tooth contact patterns; perform needed action. P-3
12. Disassemble, inspect, measure, adjust, and/or replace differential pinion gears (spiders), shaft, side gears, side bearings, thrust washers, and case. P-3

13. Reassemble and reinstall differential case assembly; measure runout; determine needed action. P-3

E.2 Limited Slip Differential

1. Diagnose noise, slippage, and chatter concerns; determine needed action. P-3
2. Measure rotating torque; determine needed action. P-3

E.3 Drive Axles

1. Inspect and replace drive axle wheel studs. P-1
2. Remove and replace drive axle shafts. P-1
3. Inspect and replace drive axle shaft seals, bearings, and retainers. P-2
4. Measure drive axle flange runout and shaft end play; determine needed action. P-2
5. Diagnose drive axle shafts, bearings, and seals for noise, vibration, and fluid leakage concerns; determine needed action. P-2

F. Four-wheel Drive/All-wheel Drive Component Diagnosis and Repair

1. Inspect, adjust, and repair shifting controls (mechanical, electrical, and vacuum), bushings, mounts, levers, and brackets. P-3
2. Inspect locking hubs; determine needed action. P-3
3. Check for leaks at drive assembly and transfer case seals; check vents; check fluid level; use proper fluid type per manufacturer specification. P-3
4. Identify concerns related to variations in tire circumference and/or final drive ratios. P-2
5. Diagnose noise, vibration, and unusual steering concerns; determine needed action. P-3
6. Diagnose, test, adjust, and/or replace electrical/electronic components of four-wheel drive/all-wheel drive systems.
P-2
7. Disassemble, service, and reassemble transfer case and components. P-2

Topical Outline of Instruction

- Drive train overview
- Clutch Systems
- Manual Transmissions
- Manual Transaxles
- Transfer cases
- Drive shafts/CV joints
- Differentials

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 instructors and maintain documentation of completion.

Student Evaluation and Grading

10%: Attendance and Participation

10%: Homework

20%: Quizzes

30%: Tests and Portfolio

30%: Practice of Safety and Shop Participation

ASE Student Certification Test

The final week of this course will consist of an ASE Student Certification Test. It will be administered by 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

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 13.5 hours for this 4 credit course.

Text, Tools, and/or Supplies

- Manual Drivetrains and Axles with NATEF Correlated Task Sheets (7th Edition) by James Halderman and Tom Birch (ISBN # 9781269941723).
- 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.

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. 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.

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 \$0.10 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.

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

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

Adherence to ethical academic standards is obligatory. Cheating is a serious offense, whether it consists of taking credit for work done by another person or doing work for which another person will receive credit. Taking and using the ideas or writings of another person without clearly and fully crediting the source is plagiarism and violates the academic code as well as the Student Code of Conduct. If it is suspected that a student in any course in which s/he is enrolled has knowingly committed such a violation, the faculty member should refer the matter to the College’s Disciplinary Officer and appropriate action will be taken under the Student Code of Conduct. Sanctions may include suspension from the course and a failing grade in the course. Students have the right to appeal these actions to the Disciplinary Committee under the terms outlined in the 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.