

COURSE PREFIX /NO: **AUT 115**
COURSE TITLE: **MANUAL DRIVE TRAIN/AXLE**
LEC HRS/WEEK: **1.0**
LAB HRS/WEEK: **6.0**
CREDIT HRS/SEMESTER: **3.0**

[Distance Learning Attendance/VA Statement](#)
[Textbook Information](#)

COURSE DESCRIPTION

This course is a basic study of clutches, gearing, and manual transmission operation, including the basic study of rear axles and rear axle set up.

COURSE COMPETENCIES

Upon successful completion of this course, the student should be competent to perform the following tasks:

Module 1. General Drive Train Diagnosis

1. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. (P-1)
2. Identify and interpret drive train concerns; determine necessary action. (P-1)
3. Research applicable vehicle and service information, such as drive train system operation, fluid type, vehicle service history, service precautions, and technical service bulletins. (P-1)
4. Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, calibration decals). (P-1)
5. Diagnose fluid loss, level, and condition concerns; determine necessary action. (P-1)
6. Drain and fill manual transmission/transaxle and final drive unit. (P-1)

Module 2. Clutch Diagnosis and Repair

1. Diagnose clutch noise, binding, slippage, pulsation, and chatter; determine necessary action. (P-1)
2. Inspect clutch pedal linkage, cables, cables, automatic adjuster mechanisms, brackets, bushings, pivots, and springs; perform necessary action. (P-1)
3. Inspect hydraulic clutch slave and master cylinders, lines, and hoses; perform necessary action. (P-1)
4. Inspect release (throw-out) bearing, lever, and pivot; perform necessary action. (P-1)

5. Inspect and replace clutch pressure plate assembly and clutch disc. (P-1)
6. Inspect, remove, or replace pilot bearing or bushing (as applicable). (P-1)
7. Inspect flywheel and ring gear for wear and cracks; determine necessary action. (P-1)
8. Inspect engine block, clutch (bell) housing, and transmission/transaxle case mating surfaces, and alignment dowels; determine necessary action. (P-3)
9. Measure flywheel runout and crankshaft endplay; determine necessary action. (P-2)
10. Bleed clutch hydraulic system. (P-1)

Module 3. Transmission/Transaxle Diagnosis and Repair

1. Remove and reinstall transmission/transaxle. (P-1)
2. Disassemble, clean, and reassemble transmission/transaxle components. (P-1)
3. Inspect transmission/transaxle case, extension housing, case mating surfaces, bores, bushings, and vents; perform necessary action. (P-3)
4. Diagnose noise, hard shifting, jumping out of gear, and fluid leakage concerns; determine necessary action. (P-2)
5. Inspect, adjust, and reinstall shift linkages, brackets, bushings, cables, pivots, and levers. (P-2)
6. Inspect and reinstall powertrain mounts. (P-2)
7. Inspect and replace gaskets, seals, and sealants; inspect sealing surfaces. (P-2)
8. Remove and replace transaxle final drive. (P-3)
9. Inspect, adjust, and reinstall shift cover, forks, levers, grommets, shafts, sleeves, detent mechanism, interlocks, and springs. (P-2)
10. Measure endplay or preload (shim or spacer selection procedure) on transmission/transaxle shafts; perform necessary action. (P-1)
11. Inspect and reinstall synchronizer hub, sleeve, keys (inserts), springs, and blocking rings. (P-1)
12. Inspect and reinstall speedometer drive gear, driven gear, vehicle speed sensor (VSS), and retainers. (P-2)
13. Diagnose transaxle final drive assembly noise and vibration concerns; determine necessary action. (P-3)

14. Remove, inspect, measure, adjust, and reinstall transaxle final drive pinion gears (spiders), shaft, side gears, side bearings, thrust washers, and case assembly. (P-2)
15. Inspect lubrication devices (oil pump or slingers); perform necessary action. (P-3)
16. Inspect, test, and replace transmission/transaxle sensors and switches. (P-1)

Module 4. Drive Shaft and Half Shaft, Universal and Constant-Velocity (CV) Joint Diagnosis and Repair

1. Diagnose constant-velocity (CV) joint noise and vibration concerns; determine necessary action. (P-1)
2. Diagnose universal joint noise and vibration concerns; perform necessary action. (P-1)
3. Remove and replace front wheel drive (FWD) front wheel bearing. (P-1)
4. Inspect, service, and replace shafts, yokes, boots, and CV joints. (P-1)
5. Inspect, service, and replace shaft center support bearings. (P-3)

Module 5. Drive Axle Diagnosis and Repair

1. Diagnose noise and vibration concerns; determine necessary action. (P-2)
2. Diagnose fluid leakage concerns; determine necessary action. (P-1)
3. Inspect and replace companion flange and pinion seal; measure companion flange runout. (P-2)
4. Inspect ring gear and measure runout; determine necessary action. (P-2)
5. Remove, inspect, and reinstall drive pinion and ring gear, spacers, sleeves, and bearings. (P-2)
6. Measure and adjust drive pinion depth. (P-2)
7. Measure and adjust drive pinion bearing preload. (P-2)
8. 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-2)
9. Check ring and pinion tooth contact patterns; perform necessary action. (P-2)
10. Disassemble, inspect, measure, and adjust or replace differential pinion gears (spiders), shaft, side gears, side bearings, thrust washers, and case. (P-2)
11. Diagnose noise, slippage, and chatter concerns, determine necessary action. (P-3)

12. Clean and inspect differential housing, refill with correct lubricant. (P-2)
13. Inspect and reinstall clutch (cone or plate) components. (P-3)
14. Measure rotating torque, determine necessary action. (P-3)
15. Diagnose drive axle shafts, bearings, and seals for noise, vibration, and fluid leakage concerns, determine necessary action. (P-2)
16. Inspect and replace drive axle shaft wheel studs. (P-1)
17. Remove and replace drive axle shafts. (P-1)
18. Inspect and replace drive axle shaft seals, bearings, and retainers. (P-2)
19. Measure drive axle flange runout and shaft endplay, determine necessary action. (P-2)

COURSE REQUIREMENTS

Students are responsible for attaining competencies through completion of the following course requirements:

ATTENDANCE

Students will be bound by the policies stated in the York Technical College Student Handbook. Students must attend 80% of the hours assigned the class for a semester to receive credit for the course. In case a student does miss a class, the student is responsible for obtaining the material that was covered during the absence. If a student is aware that a class will be missed, then the student should notify the instructor at the earliest possible date. Students with unexcused absences during tests will be allowed to make up tests at the discretion of the instructor. The student has the burden to be sure that some arrangement has been made with the instructor for taking a make-up test.

ACADEMIC HONESTY

York Technical College adheres to the South Carolina Tech Student code, approved by the State Board for Technical and Comprehensive Education on March 13, 1974 (revised last April 25, 1984). Copies of this code are available in the Library and from Student Services. Any student involved in cheating or any other academic dishonesty will be given a grade of zero and will be subject to further disciplinary action. See the student handbook section "Student Life" subheading "Student Conduct" for further details.

PARTICIPATION IN CLASS

Students will be expected to participate in class discussions, to demonstrate problem-solving techniques, and to complete tests, homework, lab experiments, lab reports and other assigned work.

EVALUATION STRATEGIES / GRADING

The grading scale will be as follows:

Grade Points

A	90-100
B	80-89
C	70-79
D	60-69
F	00-59

Evaluation Method

Tests may be written or oral and may contain questions that are true or false, short answer, multiple choice, fill in the blank and/or problems. Students should refer to the instructor for the number of tests to be given and the material to be covered on each test. Each test will be of equal weight unless otherwise indicated by the instructor. Lab grades will be based on the completion of the course competencies, teamwork, safety, class participation, and housekeeping.

Final Grades will be determined as follows:

Module 1	Tests	10.0%
Module 1	Lab	10.0%
Module 2	Tests	10.0%
Module 2	Lab	10.0%
Module 3	Tests	10.0%
Module 3	Lab	10.0%
Module 4	Tests	10.0%
Module 4	Lab	10.0%
Module 5	Tests	10.0%
Module 5	Lab	<u>10.0%</u>
Total grade		100%

ENTRY LEVEL SKILLS

Students should demonstrate hand-eye coordination, manual dexterity, and be able to work in an industrial environment.

PREREQUISITES – None

CO-REQUISITES – RDG 100

TOPIC/CONTENT OUTLINE

Module 1. Clutch Diagnosis and Repair

1. noise
2. linkage
3. hydraulics
4. release bearing
5. pressure plate
6. pilot bearing
7. flywheel
8. bell housing
9. runout

Module 2. Transmission/Transaxle Diagnosis and Repair

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|-------------------|----------------------|
| 1. remove/replace | 9. shift cover |
| 2. disassembly | 10. end play |
| 3. inspection | 11. synchronizer |
| 4. diagnosis | 12. speedometer |
| 5. shift linkages | 13. noise/vibration |
| 6. mounts | 14. pinion gears |
| 7. gaskets, seals | 15. lubrication |
| 8. final drive | 16. sensors/switches |

Module 3. Drive Shaft and Half Shaft, Universal and Constant Velocity Joint Diagnosis and Repair

1. joint noise
2. vibration
3. wheel bearing
4. inspection
5. center support bearings
6. balance

Module 4. Drive Axle Diagnosis and Repair

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|---------------------|-------------------|---------------------|
| 1. noise | 8. side bearing | 15. rotating torque |
| 2. leakage | 9. tooth contact | 16. shaft bearings |
| 3. companion flange | 10. pinion gears | 17. drive axle |
| 4. ring gear | 11. case | 18. shafts |
| 5. drive pinion | 12. slippage | 19. seals |
| 6. pinion depth | 13. flush | 20. runout |
| 7. preload | 14. clutch plates | |

METHODS OF INSTRUCTION

This course consists of one hour of classroom instruction and six hours of lab instruction. The classroom instruction includes lectures, discussions, problem solving sessions, and tests. The lectures are given while drawing on the blackboard, using overhead projections, videotapes, demonstrations, and other multimedia methods. The laboratory instruction includes proper safety procedures, instructions on the proper use of lab equipment, proper diagnosis of manual transmission /transaxle and differential related problems, and hands-on experience with live repair projects.

EFFECTIVE:FA2006