

Course Outline for AUTO A3

MANUAL DRIVE TRAIN AND AXLES

Effective: Fall 2016

I. CATALOG DESCRIPTION:

AUTO A3 — MANUAL DRIVE TRAIN AND AXLES — 4.00 units

An in-depth study of rear axle, front axle, and transfer cases: mechanical, measurement, and assembly. Including theory, teardown, qualifying, and rebuilding. Students are encouraged to enroll in Automotive Lab concurrently.

2.00 Units Lecture 2.00 Units Lab

Prerequisite

AUTO INTR - Automotive Service and Introduction
 with a minimum grade of C
 (May be taken concurrently)

Grading Methods:

Letter or P/NP

Discipline:

	<u>MIN</u>
Lecture Hours:	36.00
Lab Hours:	108.00
Total Hours:	144.00

II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: 1

III. PREREQUISITE AND/OR ADVISORY SKILLS:

Before entering the course a student should be able to:

A. AUTOINTR

1. utilize and apply hazardous waste handling;
2. identify and describe uses of automotive related tools;
3. perform basic engine teardown and reassembly;
4. apply Ohm's law, read basic schematics, test automotive electrical systems;
5. differentiate between suspension and steering system types, inspect and qualify components;
6. identify different transmissions, understand theory of operation of both manual and automatic transmissions and fluid requirements;

IV. MEASURABLE OBJECTIVES:

Upon completion of this course, the student should be able to:

- A. Demonstrate the basic safety procedures of handling hazardous waste materials.
- B. Explain the history of powertrain evolution.
- C. Operate a wide variety of precision measurement equipment
- D. Explain rear axle gear theory;
- E. Teardown typical rear axle assembly;
- F. Make measurements of rear axle components and compare to specifications;
- G. Qualify new and used rear axle components.
- H. Properly rebuild rear axle to manufacturer specifications;
- I. Explain front axle gear theory;
- J. Teardown typical front axle assembly;
- K. . Make measurements of front axle components and compare to specifications;
- L. Qualify new and used rear axle components.
- M. Properly rebuild front axle to manufacturer specifications;
- N. Explain transfer case gear and power flow theory;
- O. Tear down typical transfer case assembly;
- P. Make measurements of transfer case components and compare to specifications;
- Q. Qualify new and used rear axle components.
- R. Properly rebuild transfer case to manufacturer specifications;
- S. Maintain a clean and professional environment.

V. CONTENT:

- A. Safety
 - 1. Tool usage and nomenclature
 - 2. Proper disposal procedures
 - 3. Environmentally conscious decisions
- B. Powertrain evolution
 - 1. The first axle assemblies
 - 2. Current axle assemblies
 - a. Internal design improvements
 - 3. Environmental decisions driving design
- C. Measurement tools
 - 1. Micrometer
 - a. Vernier
 - b. Caliper
 - 2. Dial bore gauge
 - 3. Snap gauges
 - 4. Straight edge
 - 5. Feeler gauges
 - 6. Hole gauges
- D. Rear Axle theory
 - 1. Gear Design
 - a. Straight Cut
 - b. Hypoid Cut
 - c. Diagonal Cut
 - d. Street vs. racing
 - 2. Pinion Design
 - 3. Ring Gear Design
 - 4. Locking/Non-Locking Design
 - 5. Full/Free Floating Design
- E. Rear Axle Teardown
 - 1. Removal and identification of external components
 - a. Special procedures
 - 1. Loosening sequence
 - 2. Removal and identification of internal components
 - a. Special Procedures
 - 1. Loosening sequence
- F. Component measurement
 - 1. Specification lookup
 - 2. Comparison
 - a. Component diagnosis
 - 1. Failure analysis
- G. Evaluation of replacement components
 - 1. Correct component?
 - 2. New and used part comparison
- H. Rear Axle rebuilding
 - 1. Manufacturer Procedures
 - a. Component sequence
 - b. Torque specifications
 - c. Tightening sequences
 - d. Special concerns
 - a.
 - 1. Assembly lube
 - 2. Gaskets and sealers
 - 2. Pinion Depth setting
 - 3. Backlash setting
 - 4. Rotational torque
- I. Front Axle theory
 - 1. Gear Design
 - a. Straight Cut
 - b. Hypoid Cut
 - c. Diagonal Cut
 - d. Street vs. racing
 - 2. Pinion Design
 - 3. Ring Gear Design
 - 4. Locking/Non-Locking Design
- J. Front Axle Teardown
 - 1. Removal and identification of external components
 - a. Special procedures
 - 1. Loosening sequence
 - 2. Removal and identification of internal components
 - a. Special Procedures
 - 1. Loosening sequence
- K. Component measurement
 - 1. Specification lookup
 - 2. Comparison
 - a. Component diagnosis
 - 1. Failure analysis
- L. Evaluation of replacement components
 - 1. Correct component?
 - 2. New and used part comparison
- M. Front Axle rebuilding
 - 1. Manufacturer Procedures
 - a. Component sequence
 - b. Torque specifications
 - c. Tightening sequences
 - d. Special concerns
 - 1. Assembly lube
 - 2. Gaskets and sealers
 - 2. Pinion Depth setting
 - 3. Backlash setting
 - 4. Rotational torque

- N. Transfer Case theory
 - 1. Gear Design
 - a. Straight Cut
 - b. Hypoid Cut
 - c. Diagonal Cut
 - d. Street vs. Off Road
 - 2. Drive Chain Design
 - 3. Active/Passive Design
 - 4. 4wd Hi/4WD Lo Design and usage
- O. Transfer case Teardown
 - 1. Removal and identification of external components
 - a. Special procedures
 - 1. Loosening sequence
 - 2. Removal and identification of internal components
 - a. Special Procedures
 - 1. Loosening sequence
- P. Component measurement
 - 1. Specification lookup
 - 2. Comparison
 - a. Component diagnosis
 - 1. Failure analysis
- Q. Evaluation of replacement components
 - 1. Correct component?
 - 2. New and used part comparison
- R. Transfer case rebuilding
 - 1. Manufacturer Procedures
 - a. Component sequence
 - b. Torque specifications
 - c. Tightening sequences
 - d. Special concerns
 - 1. Assembly lube
 - 2. Gaskets and sealers
- S. Two speed axles
- T. Electrical theory and application to axles
- U. Professionalism
 - 1. Safety glasses
 - 2. Working shop expectations
 - 3. Attitude
 - 4. Cleanliness
 - 5. Maintenance of work areas and tools

VI. METHODS OF INSTRUCTION:

- A. **Lab** - Group and individual laboratory activities
- B. **Lecture** -

VII. TYPICAL ASSIGNMENTS:

- A. Lecture based assignments
 - 1. Lecture on pinion depth measurements
- B. Lab based assignments
 - 1. Measure pinion depth
- C. Text based assignments
 - 1. Read Chapter One

VIII. EVALUATION:

- A. **Methods**
 - 1. Exams/Tests
 - 2. Quizzes
 - 3. Lab Activities
- B. **Frequency**
 - 1. Minimum two tests
 - a. Midterm
 - b. Final
 - 2. Weekly Quizzes
 - 3. Biweekly Lab assignments
 - 4. Weekly homework

IX. TYPICAL TEXTS:

- 1. Birch, Tom. *Manual Drivetrains and Axles*, ., Prentice Hall, 2014.
- 2. Kershaw, John. *Manual Drivetrains and Axles.*, Prentice Hall, 2014.
- 3. Halderman, James. *Automotive Maintenance and Light Repair*. 6 ed., Pearson, 2014.

X. OTHER MATERIALS REQUIRED OF STUDENTS:

- A. Safety glasses