

Course Outline for NAUT A3
MANUAL DRIVE TRAIN AND AXLES
Effective: Fall 2021

I. CATALOG DESCRIPTION:
 NAUT A3 — Noncredit

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.

Prerequisite

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

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

AUTO INTL - Automotive Service and Introduction Hands-On Lab
 with a minimum grade of C
 (May be taken concurrently)
 and

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

Grading Methods:

Pass/No Pass

Discipline:

- Automotive Technology

Noncredit Category

J - Workforce Preparation

	MIN
Total Noncredit Hours:	144.00

II. 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. Discuss braking systems, perform a brake inspection, identify parts;
4. Differentiate between suspension and steering system types, inspect and qualify components;
5. Identify different transmissions, understand theory of operation of both manual and automatic transmissions and fluid requirements;

B. NAUTINTR

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III. 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 front 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 transfer case components.
 - R. Properly rebuild transfer case to manufacturer specifications;
 - S. Maintain a clean and professional environment.

IV. 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
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- N. Transfer Case theory
 - 1. Gear Design
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 - 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
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 - 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

V. LAB CONTENT:

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 - 1. Tool usage and nomenclature
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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:

Methods/Frequency

- A. Exams/Tests
 - monthly
- B. Quizzes
 - weekly
- C. Lab Activities
 - weekly

IX. TYPICAL TEXTS:

- 1. Johanson, Chris. *Manual Drivetrans and Axles*. 5 ed., Goodheart Wilcox, 2021.
- 2. Duffy, James. *Modern Automotive Technology*. 9 ed., Goodheart Wilcox, 2020.

X. OTHER MATERIALS REQUIRED OF STUDENTS:

- A. Safety glasses