Las Positas College
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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:

	MIN
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 toque
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. Minimun two tests
        a. Midterm
        b. Final
    2. Weekley 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