

I. COURSE DESCRIPTION:

- A. Department Information:
Division: Technical
Department: Automotive
Course ID: AUTO 077
Course Title: Manual Transmissions and Transaxles
Units: 4
Lecture: 3 hours
Laboratory: 3 Hours
Prerequisite: None
- B. Catalog and Schedule Description:
Theory and practical work on front wheel drive manual transaxles and rear wheel drive manual transmissions in automobile and light truck applications including transfer cases, axle assemblies, and clutches.

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

III. EXPECTED OUTCOMES FOR STUDENTS:

Upon completion of this course, students will be able to:

- A. Demonstrate appropriate shop and job safety techniques.
- B. Perform diagnostic and service procedures of the clutch system.
- C. Analyze the operation and service of the manual transmission.
- D. Perform diagnostic and service procedures on a manual transaxle.
- E. Perform general maintenance on drive shafts, half shafts, universal, and constant-velocity joint.
- F. Perform major and minor services on rear axles.
- G. Demonstrate diagnostic and service procedures on four-wheel drive components.
- H. Demonstrate job search and retention skills.

IV. COURSE CONTENT:

- A. Introduction to Manual Transmission Repair
- 1. Course overview
 - 2. Assessment and certification
 - 3. Class rules
 - 4. Career opportunities and continuing education
 - 5. Industry ethics
- B. Safety Practices Review
- 1. Shop specific procedures
 - 2. Hazardous materials
 - a. Types
 - b. Storage
 - c. MSDS
 - d. Handling
 - e. Emergency procedures
 - 3. Vehicle specific procedures
 - 4. Power tools and hand tools
 - 5. Personal safety
- C. Clutch System
- 1. Course overview clutch systems
 - 2. Proper safety procedures
 - 3. Diagnostic equipment and special tools
 - 4. Inspect, analyze symptoms, diagnose, and service sub-components and assemblies
 - a. Clutch systems components
 - b. Hydraulic system

- c. Flywheel
 - d. Engine block
 - e. Crankshaft
 - f. Torque Specifications
- D. Manual Transmission**
- 1. Course overview manual transmission systems
 - 2. Proper safety procedures
 - 3. Diagnostic equipment and special tools
 - 4. Inspect, analyze symptoms, diagnose, and service sub-components and assemblies
 - a. Transaxle shift problems
 - b. Transaxle and components
 - c. Noise and vibration
 - d. Fluid leakage
 - e. Shift linkage
 - f. Bushings
 - g. Brackets
 - h. Cables
 - i. Pivots
 - j. Levers
 - k. Power-train mounts
 - l. Gaskets, seals, surfaces, and sealants
 - m. R & R manual transmission
 - n. Disassemble, inspect, and reassemble manual transmission
 - o. R & R speedometer/VSS
 - p. Extension housing
 - q. Bores
 - r. Vents
 - s. Lubrication system
 - t. Torque specifications
- E. Manual Transaxle**
- 1. Overview of manual transaxles
 - 2. Proper safety procedures
 - 3. Diagnostic equipment and special tools
 - 4. Inspect, analyze symptoms, diagnose, and service sub-components and assemblies
 - a. Transaxle shift problems
 - b. Transaxle and components
 - c. Fluid leaks
 - d. Noise and vibration
 - e. Linkage
 - f. Brackets
 - g. Bushings
 - h. Cables
 - i. Pivots
 - j. Levers
 - k. Mounts
 - l. Gaskets
 - m. Seals
 - n. Sealants
 - o. Sealing surface
 - p. R & R transaxle
 - q. Disassemble, inspect, and reassemble transaxle
 - r. Speedometer/VSS
 - s. Extension housing
 - t. Bores
 - u. Vents

- v. Lubrication system
- w. Torque specifications
- F. Drive and Half Shaft Universal and Constant-Velocity Joints**
 - 1. Overview of drive and half shaft and constant-velocity joint systems
 - 2. Proper safety procedures
 - 3. Diagnostic equipment and special tools
 - 4. Inspect, analyze symptoms, diagnose, and service sub-components and assemblies
 - a. Noise and vibrations
 - b. Wheel bearing
 - c. Yokes
 - d. Boots
 - e. Joints
 - f. Center support bearing
 - g. Run out
 - h. Balance
 - i. Angles
 - j. Torque specifications
- G. Rear Axle**
 - 1. Overview of rear axle operation
 - 2. Proper safety procedures
 - 3. Diagnostic equipment and special tools
 - 4. Inspect, analyze symptoms, diagnose, and service sub-components and assemblies
 - a. Noise and vibrations
 - b. Fluid leaks
 - c. Companion flange
 - d. Seals
 - e. Run out
 - f. Drive pinion dept
 - g. Pinion bearing preload
 - h. Side bearing preload
 - i. Backlash
 - j. Tooth contact pattern
 - k. Pinion side gears and shaft
 - l. Side bearings, thrust washers, and case
 - m. Limited slip
 - n. Housing
 - o. Cone
 - p. Axles
 - q. Retainers
 - r. Endplay
 - s. Torque specifications
- H. Four-Wheel Drive Train and Axles**
 - 1. Overview of four-wheel drive systems
 - 2. Proper safety procedures
 - 3. Diagnostic equipment and special tools
 - 4. Inspect, analyze symptoms, diagnose, and service sub-components and assemblies
 - a. Noise and vibrations
 - b. Shifting controls (mechanical, electrical, and vacuum)
 - c. Bushings
 - d. Mounts
 - e. Levers and brackets
 - f. R & R transfer case
 - g. Disassemble and reassemble transfer case
 - h. Front-wheel bearings and locking hubs

- i. Seals and vents
- j. Fluid
- k. Viscous coupling assembly
- l. Torque specifications

V. METHODS OF INSTRUCTION:

Methods of instruction will vary from instructor to instructor but may include:

- A. Lecture:
Instructional lecture will emphasize safety aspects in an automotive repair environment, theory and operation of the automotive power train, and the use of special automotive tools and equipment.
- B. Discussion:
Topics of discussion will be related to the automotive manual transmission and power train.
Typical Topic:
What are the advantages of a manual transmission opposed to an automatic transmission?
- C. Large and small group projects
- D. Individualized instruction where appropriate
- B. Computer based training
- C. Lab assignments:
Instructor will demonstrate task set forth by the NATEF standards and outlined in workbook.

VI. TYPICAL ASSIGNMENTS:

- A. Read textbook and answer questions at the end of each chapter.
Typical Question: Describe the operation of the clutch system.
- B. Critical thinking and problem solving
 - 1. Review a manufacturer's procedures and write an overview of the instructions.
 - 2. Inspect and evaluate failed parts and complete a report on findings.
 - 3. Compare the cost of a major overhaul of a manual transmission to a replacement with manufacturer rebuilt transmission and document the pro's and con's.
- C. Lab assignments
Complete task sheets as per NATEF standards from shop workbook.
Typical Assignment:
Perform a visual inspection of a manual transmission.

VII. EVALUATION(S):

- A. Methods of evaluation will vary from instructor to instructor but may include:
 - 1. Written and oral tests
 - 2. Quizzes covering reading assignments
 - 3. Lab assignments progress review
 - 4. Comprehensive mid-term and final examsTypical Questions:
 - a. Describe the operation of a constant velocity u-joint.
 - b. Compare and contrast two common four-wheel drive power trains.
- B. Frequency of evaluation will vary from instructor to instructor but may include:
 - 1. Unit tests covering reading assignments
 - 2. Weekly review of lab project progress
 - 3. One mid-term exam
 - 4. One final exam

VIII. TYPICAL TEXT(S):

Jack Erjavec, Manual Transmissions and Transaxles, Delmar, 1997
Chris Johanson and Jame E. Duffy, Manual Drive Trains & Axles, Goodheart-Wilcox, Tinley Park, Illinois, 2002

IX. OTHER SUPPLIES REQUIRED OF STUDENTS:

Safety glasses are to be worn in lab at all times.