AUTO G151: AUTOMATIC TRANSMISSIONS AND TRANSAXLES

Item	Value
Curriculum Committee Approval Date	11/16/2021
Top Code	094800 - Automotive Technology
Units	4 Total Units
Hours	126 Total Hours (Lecture Hours 45; Lab Hours 81)
Total Outside of Class Hours	0
Course Credit Status	Credit: Degree Applicable (D)
Material Fee	No
Basic Skills	Not Basic Skills (N)
Repeatable	No
Grading Policy	Standard Letter (S), • Pass/No Pass (B)

Course Description

This course provides the students with theory, knowledge, and skills necessary to understand automotive automatic transmission and transaxle concepts. Instruction is given and lab experience provided in diagnosis, removal, disassembly, inspection, precision measurements, re-assembly and installation. The coursework is based on the Automotive Service Excellence (ASE) Tasks and Standards intended to prepare students for the ASE A-2 Automatic Transmission and Transaxle Certification examination. Transfer Credit: CSU.

Course Level Student Learning Outcome(s)

1. Course Outcomes
2. Analyze automatic transmissions, transaxles and related components for correct system operation.
3. Utilize diagnostic tools and equipment for automatic transmission and transaxle disagnosis and repair.
4. Solve power flow concerns within automatic transmission and transaxles through systematic analysis.

Course Objectives

- 1. Demonstrate shop safety regarding working procedures and hazardous materials and waste handling.
- 2. Explain the function of automatic transmission and transaxle components.
- 3. Utilize the correct procedures and specifications for maintenance and repair of automatic transmissions and transaxle systems.
- 4. Analyze automatic transmission and transaxle system-related wiring diagrams.
- 5. Perform systematic analysis on automatic transmission and transaxle drive train systems using industry-accepted testing procedures, and diagnostic tools and equipment such as micrometers, depth gauges, dial indicators, and electronic scan tools as needed.
- 6. Perform diagnosis, service and maintenance procedures in a timely manner to industry standards.
- 7. Apply learned safety concepts when servicing HEVs, identifying the location of high voltage service disconnect switches, warning devices, and following proper safeguards and correct set-up procedures.

Lecture Content

Safety Basic auto technology shop safety instruction and demonstrations Pass instructor provided safety test(s) Automatic transmissions and transaxles: Basic theory and concepts Drivetrain layout Rear-wheel drivetrain components Front-wheel drivetrain components Powerflow through the transmission and transaxles Transmission basic construction and components Transmission design variations by manufacturer Internal construction and components, basic powerflow Hydraulic operation: concepts and applied theory Frictional members and theory of operation Torque converts and oil pumps Purpose, basic designs, theory of operation Torque multiplication theory Lockup systems and design Gear assemblies and shafts Planetary gears Theory of operation Powerflow, reverse, gear reduction, and overdrive concepts Final drives and differentials Four wheel drive variations Drive chains Four wheel drive transfer concepts Reaction and friction units Basic purpose and function Frictional characteristics, concepts, and related purpose Brake bands, servos and accumulators One-way clutches and brakes Multiple-friction disc clutch and brake assemblies Transmission oil coolers Electrical and electronic controls Electro-mechanical theory and concepts On-board diagnostics System testing Hybrid vehicle drivetrain basic layout and concepts General transmission and transaxle diagnosis Acquiring maintenance, service, and repair information Electronic and hard-copy sources Factory vs. a ftermarket technical information Vehicle Identification Numbers (VIN) Vehicle certification labels and calibration decals Vehicle service history and service precautions Technical Service Bulletins (TSB) Transmission and transaxle maintenance Basic transmission service: visual inspection, fluid and filter replacement Basic adjustments: throttle valve (TV) linkages or cables; manual shift linkages or cables, transmission range sensor; gear select indicator Electronic, mechanical, hydraulic, and vacuum control systems Transmission and transaxle basic diagnostics and trouble analysis Engine condition and operation and its effect on transmission operation Transmission and transaxle fluid leaks, usage, level and condition concerns Pressure test Stall test Lock-up converter system tests Noise, vibration, harshness (NVH) concerns In-vehicle tranmission and transaxle service and repair Seals and gaskets Extension housing, bushings and seals Transmission fluid cooler, cooler lines, and fittings Speedometer drive gear, driven gear, vehicle speed sensor (VSS), and retainers Govenor assembly Electronic transmission control systems Alignment of powertrain mounts Off-vehicle transmission and transaxle repair Torque converters Transmission and transaxles disassembly, cleaning, measurement, analysis, reassembly Valve bodies Internal passages and bores Servo bores, pistons, seals, pins, springs, and retainers Accumulator bores, pistons, seals, springs, and retainers Oil pump and torque converter Torque converter flex plate, attaching parts, pilot, pump drive, and seal contact areas T orque converter endplay and interference, stator clutch Oil pump assembly and componenents Gear train, shafts, bushings and case Endplay or preload Thrust washers and bearings Oil delivery seal rings, ring grooves, and sealing surface areas Bushings Planetary gear assembly Sun, ring, planetary gears Carrier assembly Thrust washers Case bores, passages, vents, bushings, and mating surfaces Transaxle drive, link chains, sprockets, gears, bearings, and bushings Transaxle final drive and differnetial components Parking pawl shaft spring and retainer Reaction and friction units and members Bands and drums Clutch drum, piston, check balls, springs, retainers, and seals Roller and

sprag clutches, races, rollers, sprags, springs, cages, and retainers Clutch pack Friction disks and steel disks Clutch pack clearance Air test of clutch and servo assemblies

Lab Content

General Transmission and Transaxle Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction Identify and interpret transmission/transaxle concerns; differentiate between engine performance and transmission/transaxle concerns; determine necessary action Research applicable vehicle and service information, such as transmission/transaxle system operation, fluid type, vehicle service history, service precautions, and technical service bulletins. Locate and interpret vehicle and major component identification numbers Diagnose fluid loss and condition concerns; check fluid level in transmissions with and without dip-stick; determine necessary action Perform pressure tests (including transmissions/transaxles equipped with electronic pressure control); determine necessary action Perform stall test; determine necessary action Perform lock-up converter system tests; determine necessary action Diagnose noise and vibration concerns; determine necessary action Diagnose transmission/transaxle gear reduction/multiplication concern using driving, driven, and held member (powerflow) principles Diagnose pressure concerns in a transmission using hydraulic principles (Pascals Law) Diagnose electronic transmission/transaxle control systems using appropriate test equipment and service information. Diagnose transmsission/transaxle control systems using appropriate test equipment and service information In-vehicle Transmission/Transaxle maintenance and repair Inspect, adjust, and replace manual valve shift linkage, transmission range sensor/switch, and park/neutral position switch Inspect and replace external seals gaskets, and bushings Inspect, test adjust, repair, or replace electrical/electr onic components and circuits, including computers, solenoids, sensors, relays, terminals, connectors, switches. and harnesses Diagnose electronic transmission control systems using a scan tool; determine necessary action Inspect, replace, and align powertrain mounts Service transmission; perform visual inspection; replace fluid and filters Off-vehicle transmission and transaxle repair Remove and reinstall transmission/transaxle and torque converter; inspect engine core plugs, rear crankshaft seal, dowel pins, dowel pin holes, and mating surfaces Disassemble, clean, and inspect transmission/transaxle Inspect, measure, clean, and replace valve body (includes surfaces, bores, springs, valves, sleeves, retainers, brackets, check valves/balls, screens, spacers, and gaskets) Inspect servo and accumulator bores, pistons, seals, pins, springs, and retainers; determine necessary action Assemble transmission/transaxle Inspect, leak test, and flush or replace transmission/transaxle oil cooler, lines, and fittings Inspect converter flex (drive) plate, converter attaching bolts, converter pilot, converter pump drive surfaces, converter endplay, and crankshaft pilot bore Install and seat torque converter to engage drive/splines Inspect, measure, and reseal oil pump assembly and components Measure transmission/transaxle endplay or preload; determine necessary action Inspect, measure, and replace thrust washers and bearings Inspect oil delivery circuits, including seal rings, ring grooves, and sealing surfaces areas, feed pipes, orifices, and check valves/balls Inspect bushings; determine necessary action Inspect and measure planetary gear assembly components; determine necessary action Inspect case bores, passages, bushings, vents, and mating surfaces; determine necessay act ion Inspect transaxle drive, link chains, sprockets, gears, bearings, and bushings; perform necessary action Inspect, measure, repair, adjust or replace transaxle final drive components Inspect clutch drum, piston, check-balls, springs, retainers, seals, and friction and pressure plates; determine necessary action Measure clutch pack clearance; determine necessary action Air test operation of clutch and servo assemblies Inspect roller and sprag clutch, races, rollers, sprags, springs, cages, and retainers: determine necessary action Inspect bands and drums; determine necessary action Describe the operational characteristics of a continuously variable transmission (CVT) Describe the operational characteristics of a hybrid vehicle drivetrain Practice sample Automotive Service Excellence (ASE), A2 Automatic Transmission and Transaxle Certification Test.

Method(s) of Instruction

- Lecture (02)
- DE Live Online Lecture (02S)
- DE Online Lecture (02X)
- Lab (04)
- DE Live Online Lab (04S)
- DE Online Lab (04X)

Reading Assignments

Textbook reading assignment

Writing Assignments

Create vehicle repair orders which include industry accepted documentation of repairs (Complaint, Cause and Correction). Repair should also include mathmatical computations of part cost and labor totals.

Out-of-class Assignments

Interactive web-based training modules

Demonstration of Critical Thinking

1. Analyze and troubleshoot automatic transmission and transaxle components and restore them to 100% proper service.2. Analyze, confirm, and diagnose automatic transmission and transaxle faults based on symptoms indicated on repair orders.3. Diagnose and confirm automatic transmission and transaxle component failures by comparing actual readings or measurements with factory specifications.4. Analyze wiring diagrams to determine integrity of circuits which support vehicle automatic transmission and transaxle systems.

Required Writing, Problem Solving, Skills Demonstration

1. Create vehicle repair orders, perform math exercises for flat rate labor, parts and materials totals.2. Demonstrate an understanding of gear ratio theory and concepts by performing related math exercises.3. Successfully pass a written test or practicum examination using information and concepts learned in class.4.Use on-line service and repair information to compare factory specifications with actual readings and measurements acquired during automatic transmission and transaxle diagnostic activities.

Eligible Disciplines

Automotive technology: Any bachelors degree and two years of professional experience, or any associate degree and six years of professional experience.

Textbooks Resources

1. Required James D Halderman. Automatic Transmissions and Transaxles, Seventh ed. New Jersey: Pearson Education, 2018

Other Resources

1. GWC automotive uniform and safety glasses