This is an introductory course that 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.

JUSTIFICATION FOR COURSE:

PREREQUISITES:

COREQUISITES:

ADVISORIES:

ASSIGNED DISCIPLINES:

Automotive technology

MATERIAL FEE: Yes [ ] No [X] Amount: $0.00

CREDIT STATUS: Noncredit [ ] Credit - Degree Applicable [X] Credit - Not Degree Applicable [ ]

GRADING POLICY: Pass/No Pass [X] Standard Letter [X] Not Graded [ ] Satisfactory Progress [ ]

OPEN ENTRY/OPEN EXIT: Yes [ ] No [X]

TRANSFER STATUS: CSU Transferable[X] UC/CSU Transferable[ ] Not Transferable[ ]

BASIC SKILLS STATUS: Yes [ ] No [X] LEVELS BELOW TRANSFER: Not Applicable

CALIFORNIA CLASSIFICATION CODES: Y - Not Applicable

NON CREDIT COURSE CATEGORY: Y - Not applicable, Credit Course

OCCUPATIONAL (SAM) CODE: C

REPEATABLE ACCORDING TO STATE GUIDELINES: No [X] Yes [ ] NUMBER REPEATS:

REQUIRED FOR DEGREE OR CERTIFICATE: No [ ] Yes [X]

Chassis and Drivetrain Specialist(Associate in Arts)
Chassis and Drivetrain Specialist(Certificate of Achievement)

GE AND TRANSFER REQUIREMENTS MET:

COURSE LEVEL STUDENT LEARNING OUTCOME(S) Supported by this course:
1. Analyze and diagnose automotive engines and related components for correct system operation.

2. Demonstrate an ability to self-assess progress and development in a specific area and to further design and pursue a course of action based on the self-assessment.

3. Demonstrate mastery of diagnostic tools and equipment used for automotive repair.

4. Perform precision measurement to solve power flow concerns through systematic analysis.

COURSE OBJECTIVES:
1. Pass the SP-2 Mechanical Safety and Mechanical Pollution Prevention Test.
2. Explain the function of automatic transmission and transaxle components.
3. Retrieve and interpret service and repair information.
4. Analyze and interpret 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 precision measurements and compare against factory specifications.
7. Apply learned safety concepts when servicing HEV’s, identifying the location of high voltage service disconnect switches, warning devices, and following proper safeguards and correct set-up procedures.

COURSE CONTENT:

LECTURE CONTENT:

A. Safety
   1. Basic auto technology shop safety instruction and demonstrations
   2. SP-2 Mechanical Safety and Mechanical Pollution Prevention tests

B. Automatic transmissions and transaxles: Basic theory and concepts
   1. Drive train layout
      a. Rear-wheel drive train components
      b. Front-wheel drive train components
      c. Power flow through the transmission and transaxle
   2. Transmission basic construction and components
   3. Transmission design variations: Chrysler, Ford, General Motors, Nissan and Toyota
   4. Internal construction and components, basic power flow
   5. Hydraulic operation: concepts and applied theory
   6. Frictional members and theory of operation
   7. Torque converters and oil Pumps
      a. Purpose, basic designs, theory of operation
      b. Torque multiplication theory
      c. Lockup systems and design
   8. Gear assemblies and shafts
      a. Planetary gears
         1). Theory of operation
         2). Power flow, reverse, gear reduction and overdrive concepts
      b. Final drives and differentials
      c. Four wheel drive variations
      d. Drive chains
      e. 4-wheel drive transfer concepts
   9. Reaction and friction units
      a. Basic purpose and function
      b. Frictional characteristics, concepts, and related purpose
c. Brake bands, servos and accumulators
d. One-way clutches and brakes
e. Multiple-friction disc clutch and brake assemblies
10. Transmission oil coolers
11. Electrical and electronic controls
   a. Electro-mechanical theory and concepts
   b. On-board diagnostics
   c. System testing
12. Hybrid vehicle drive train basic layout and concepts

C. General transmission and transaxle diagnosis
1. Acquiring maintenance, service and repair information
   a. Electronic and hard-copy sources
   b. Factory vs. aftermarket technical information
   c. Vehicle Identification Number (VIN)
   d. Vehicle certification labels and calibration decals
   e. Vehicle service history, service precautions
   f. Technical Service Bulletins (TSB’s)
2. Transmission and transaxle maintenance
   a. Basic transmission service: visual inspection, fluid and filter replacement
   b. Basic adjustments: throttle valve (TV) linkages or cables; manual shift linkages
      or cables, transmission range sensor; gear select indicator
   c. Electronic, mechanical, hydraulic, and vacuum control systems
3. Transmission/transaxle basic diagnostics and trouble analysis
   a. Engine condition and operation and its effect on transmission operation
   b. Transmission and transaxle fluid leaks, usage, level and condition concerns
   c. Pressure test
   d. Stall test
   e. Lock-up converter system tests
   f. Noise, vibration, harshness (NVH) concerns

D. In-vehicle transmission and transaxle service and repair
1. Seals and gaskets
2. Extension housing, bushings and seals
3. Transmission fluid cooler, lines, and fittings
4. Speedometer drive gear, driven gear, vehicle speed sensor (VSS), and retainers
5. Governor assembly
6. Electronic transmission control systems
7. Alignment of power train mounts

E. Off-vehicle transmission and transaxle repair
1. Torque converters
2. Transmission/transaxle disassembly, cleaning, measurements, analysis, reassembly
3. Valve bodies
4. Internal passages and bores
   a. Servo bore, piston, seals, pin, spring, and retainers
   b. Accumulator bore, piston, seals, spring, and retainers
5. Oil pump and converter
   a. Converter flex plate, attaching parts, pilot, pump drive, and seal contact areas
   b. Torque converter end-play and interference, stator clutch
   c. Oil pump assembly and components
6. Gear train, shafts, bushings and case
   a. End-play or preload
   b. Thrust washers and bearings
   c. Oil delivery seal rings, ring grooves, and sealing surface areas
d. Bushings 
e. Planetary gear assembly 
  1). Sun, ring, planetary gears  
  2). Carrier assembly  
  3). Thrust washers  
f. Case bores, passages, vents, bushings, and mating surfaces  
g. Transaxle drive, link chains, sprockets, gears, bearings, and bushings  
h. Transaxle final drive and differential components  
i. Parking pawl, shaft, spring, and retainer  

7. Reaction and friction units and members  
a. Bands and drums  
b. Clutch drum, piston, check-balls, springs, retainers, seals  
c. Roller and sprag clutch, races, rollers, sprags, springs, cages, and retainers  
d. Clutch pack  
  1). Friction disks and steel disks  
  2). Clutch pack clearance  
  3). Air test of clutch and servo assemblies  

LABORATORY CONTENT:  

For every task in Automatic Transmission and Transaxle, the following safety requirement must be strictly enforced: Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

Automatic Transmission and Transaxle  

A. General transmission and transaxle diagnosis  

1. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction  
2. Identify and interpret transmission/transaxle concern; differentiate between engine performance and transmission/transaxle concerns; determine necessary action  
3. Research applicable vehicle and service information, such as transmission/transaxle system operation, fluid type, vehicle service history, service precautions, and technical service bulletins  
4. Locate and interpret vehicle and major component identification numbers  
5. Diagnose fluid loss and condition concerns; check fluid level in transmissions with and without dip-stick; determine necessary action  
6. Perform pressure tests (including transmissions/transaxles equipped with electronic pressure control); determine necessary action  
7. Perform stall test; determine necessary action  
8. Perform lock-up converter system tests; determine necessary action  
9. Diagnose noise and vibration concerns; determine necessary action  
10. Diagnose transmission/transaxle gear reduction/multiplication concerns using driving, driven, and held member (power flow) principles  
11. (12). Diagnose pressure concerns in a transmission using hydraulic principles (Pascal’s Law)  
12. (13.) Diagnose electronic transmission/transaxle control systems using appropriate test equipment and service information  

B. In-vehicle transmission/transaxle maintenance and repair  

1. Inspect, adjust, and replace manual valve shift linkage, transmission range sensor/switch, and park/neutral position switch  
2. Inspect and replace external seals gaskets, and bushings  
3. Inspect, test, adjust, repair, or replace electrical/electronic components and circuits, including computers, solenoids, sensors, relays, terminals, connectors, switches,
and harnesses
4. Diagnose electronic transmission control systems using a scan tool; determine necessary action
5. Inspect, replace, and align powertrain mounts
6. Service transmission; perform visual inspection; replace fluid and filters

C. Off-vehicle transmission and transaxle repair

1. Remove and reinstall transmission/transaxle and torque converter; inspect engine core plugs, rear crankshaft seal, dowel pins, dowel pin holes, and mating surfaces
2. Disassemble, clean, and inspect transmission/transaxle
3. Inspect, measure, clean, and replace valve body (includes surfaces, bores, springs, valves, sleeves, retainers, brackets, check valves/balls, screens, spacers, and gaskets)
4. Inspect servo and accumulator bores, pistons, seals, pins, springs, and retainers; determine necessary action
5. Assemble transmission/transaxle
6. Inspect, leak test, and flush or replace transmission/transaxle oil cooler, lines, and fittings
7. Inspect converter flex (drive) plate, converter attaching bolts, converter pilot, converter pump drive surfaces, converter end play, and crankshaft pilot bore
8. Install and seat torque converter to engage drive/splines
9. Inspect, measure, and reseal oil pump assembly and components
10. Measure transmission/transaxle end play or preload; determine necessary action
11. Inspect, measure, and replace thrust washers and bearings
12. Inspect oil delivery circuits, including seal rings, ring grooves, and sealing surface areas, feed pipes, orifices, and check valves/balls
13. Inspect bushings; determine necessary action
14. Inspect and measure planetary gear assembly components; determine necessary action
15. Inspect case bores, passages, bushings, vents, and mating surfaces; determine necessary action
16. Inspect transaxle drive, link chains, sprockets, gears, bearings, and bushings; perform necessary action
17. Inspect, measure, repair, adjust or replace transaxle final drive components
18. Inspect clutch drum, piston, check-balls, springs, retainers, seals, and friction and pressure plates; determine necessary action
19. Measure clutch pack clearance; determine necessary action
20. Air test operation of clutch and servo assemblies
21. Inspect roller and sprag clutch, races, rollers, sprags, springs, cages, and retainers; determine necessary action
22. Inspect bands and drums; determine necessary action
23. Describe the operational characteristics of a continuously variable transmission (CVT)
24. Describe the operational characteristics of a hybrid vehicle drive train

D. Practice sample ASE (A2) automatic transmission and transaxle certification test

METHODS OF INSTRUCTION:
A. Lecture:
B. Lab:
C. Independent Study:

INSTRUCTIONAL TECHNIQUES:
COURSE ASSIGNMENTS:

Reading Assignments
Textbook
Websites - Autoshop101.com, CTEOnline.com other topic-specific websites as needed

Out-of-class Assignments

Writing Assignments
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.

METHODS OF STUDENT EVALUATION:
Midterm Exam
Final Exam
Short Quizzes
Written Assignments
Essay Examinations
Objective Examinations
Report
Projects (ind/group)
Problem Solving Exercises
Oral Presentations
Skills Demonstration

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.

TEXTS, READINGS, AND RESOURCES:
TextBooks: