AS – 214
Automatic Transmissions/Transaxles

COURSE INTRODUCTION

The automatic transmission is a device that eliminates the need for the driver to manually engage and disengage the engine from the driveline. More importantly it provides a means to adapt the power of the engine to meet changes in road and load conditions. The automatic transmission also allows the vehicle to move in reverse. The internal combustion engine has little power at low speeds, therefore, a means of torque multiplication must be provided to accelerate a vehicle from a standing start, negotiate a steep incline or pull a heavy load. As a vehicle’s speed increases, less torque is needed to keep the vehicle in motion, the transmission will up-shift automatically until the transmission output speed nearly matches engine speed.

In transmissions used today, the speed of the transmission output may be overdriven (faster than engine speed) for increased fuel economy and reduced engine wear. With fuel economy in mind, lighter weight vehicles have been developed with Front Wheel Drive. These vehicles eliminate heavy rear wheel drive components such as transmissions, drive shafts and rear axle differential housings in favor of lightweight combination transaxles using aluminum housings. The result is a good handling, fuel efficient, light weight vehicle.

Exhaust emission control has also found benefits in transmission operation. More consistent engine speeds help designers develop cleaner running engines. Acceleration, cruise and deceleration emissions have been lowered due to transmission design and gear ratios. One step further in this area includes electronic shift control transmissions with more closely controlled shift points. These transmissions shift due to engine torque demands and vehicle road speed which are monitored by computer controlled electronics. These new transmissions are computer controlled and solenoid activated to program up-shifts, overdrives and lock-up torque converters. Even to the point of being electronically adaptive some transmissions employ learning and compensating features by means of computer PWM shift solenoid control.

This course will include basic operating principles, service procedures, safety procedures, troubleshooting and diagnosis techniques of current transmissions and transaxles. Removal and replacement procedures will also be discussed.

1/10/05

Technical Department

COURSE SYLLABUS
Course Prefix and Number:       AS - 214

Course Title:       AUTOMATIC TRANSMISSION & TRANSAXLES

Curriculum:         AUTOMOTIVE SERVICE

Semester Hours:   3       Lecture Hours:  2       Lab Hours:  2

Prerequisites:      NONE

Catalog Description:

   Theory of operation of torque converters, planetary gear sets, and hydraulics as applied to
   the construction, diagnosis, service, and overhaul procedures for modern automatic
   transmissions and transaxles.

Course Objectives:

   This course will include basic operating principles, service procedures, safety procedures,
   troubleshooting and diagnosis techniques necessary to repair current automatic
   transmissions and front wheel drive transaxles. Transmission/transaxle removal and
   replacement procedures will also be included as well as drive shaft and CV-joint service.

Prepared by:       Reviewed by:

T. Airney          1/10/05
Instructor       Date

1/10/05

STUDENT MATERIALS
A. Textbooks:

<table>
<thead>
<tr>
<th>Author</th>
<th>Title</th>
<th>Publisher</th>
<th>Edition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thiessen/Davis</td>
<td>Automotive Drive Trains</td>
<td>Prentice Hall</td>
<td>2nd</td>
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</tbody>
</table>

B. Other Required Materials:

Safety glasses, protective clothing, leather hard soled shoes, calculator, and a notebook (3-ring binder type)

C. Other Course Requirements:

Students are not to leave Class until dismissed. Students are not to leave Lab until all projects and tools are put away, tools inventoried, area is cleaned up. If you are cleaned up and organized early assist other groups in putting things away and cleaning up. The instructor will dismiss student at the appropriate time.

It is the student’s responsibility to obtain a college catalog, read and understand the policies and regulations that concern students at Joliet Junior College and understand what requirements this course fulfills (if any) in your chosen course of study or selected career curriculum.

D. Student Evaluation: (Type of Grading)

- Performance (Lab grade)
- Mid-Term Exam
- Quiz, homework and notebook
- Attendance
- Final Exam

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GRADING

20%  Lab Grade
20%  Mid-Term
20%  Quizzes, Homework, and Notebook
20%  Attendance
20%  Final Exam

1. Attendance is very important in technical training courses, days missed are skills lost. If tardy, it is your responsibility to report to the instructor (that class) and see that the absence is changed. Points will be rewarded at 5 points per day in attendance, 2.5 points per day for tardy. Absentees can be made-up at partial points 2.5 as per directions of instructor. It is your responsibility to report to the instructor (the next class) and receive attendance make-up assignment.

2. Notebook includes:

   table of contents
   classroom notes
   handouts
   returned assignments
   lab sheets completed
   * all with dividers *

Quizzes and homework may be made-up on “your own time” as per directions of instructor for partial credit.

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<table>
<thead>
<tr>
<th>Week</th>
<th>Topic or Class Activity</th>
<th>Teaching Aids/Special Instructions</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>Hydraulic fundamentals and torque converters</td>
<td>Cutaway torque converter with torque converter clutch</td>
</tr>
<tr>
<td>2.</td>
<td>Planetary gear sets and holding devices</td>
<td>Planetary gear sets, bands, clutches, Sprags and roller clutches</td>
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<td>3.</td>
<td>Transmission power flow, case design and hydraulic controls</td>
<td>Transmission case, pump, valve body governor and modulator</td>
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<tr>
<td>4.</td>
<td>R &amp; R torque converter, pump, seal and bushing (RWD)</td>
<td>Rear wheel drive 3-spd automatic transmission</td>
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<tr>
<td>5.</td>
<td>R &amp; R components, clutches, shafts, gear sets and bushings</td>
<td>Rear wheel drive 4-spd automatic transmission</td>
</tr>
<tr>
<td>6.</td>
<td>FWD transaxle power flow and begin overhaul procedure</td>
<td>Front wheel drive 3-spd transaxle and/or 4-spd automatic transaxle</td>
</tr>
<tr>
<td>7.</td>
<td>Resume FWD transaxle overhaul procedure</td>
<td>Transmission benches and basic hand tools necessary to overhaul transaxle to be disassembled</td>
</tr>
<tr>
<td>8.</td>
<td>Review and Mid-term Exam</td>
<td>Special tools necessary to overhaul transaxles to be disassembled</td>
</tr>
<tr>
<td>9.</td>
<td>Resume FWD transaxle overhaul procedure</td>
<td>Circuit diagrams, charts, overhead transparencies and slides</td>
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<tr>
<td>10.</td>
<td>Transaxle hydraulics, valve body, TCC circuit operation</td>
<td>Manuals, workbooks, and lab sheets necessary to guide assembly</td>
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<td>11.</td>
<td>Complete FWD transaxle overhaul including valve body</td>
<td>Vehicles with adjustable bands, TV and modulator controlled shifting For demonstration of in-car services</td>
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<td>12.</td>
<td>In-car service, linkage, bands, TV adjust and modulator testing (Neutral start switch)</td>
<td>Vehicles for pressure testing, TCC checks and road testing</td>
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<td>13.</td>
<td>Diagnosis procedures, pressures testing, TCC checks and road tests</td>
<td>Service manuals, procedures and cooler line flushing equipment</td>
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<tr>
<td>14.</td>
<td>Transmission R&amp;R and cooler line service (repair and flushing)</td>
<td>Technical manuals, service bulletins, power flow charts, transmissions, transaxle/components demonstrations</td>
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<tr>
<td>15.</td>
<td>Other popular automatic transmission/transaxle power flow and operation</td>
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<tr>
<td>16.</td>
<td>Review and Final Exam</td>
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</tbody>
</table>
1. Identify and interpret transmission/transaxle concern; assure proper engine operation; determine necessary action. P-1
2. Perform pressure tests; determine necessary action. P-1
3. Perform stall test; determine necessary action. P-2
4. Perform lock-up converter system tests; determine necessary action. P-1
5. Diagnose electronic, mechanical, hydraulic, vacuum control system concerns; determine necessary action. P-1
6. Diagnose noise and vibration concerns; determine necessary action. P-2
7. Diagnose transmission/transaxle gear reduction/multiplication concerns using driving, driven, and held member (power flow) principles. P-1
8. Inspect and replace speedometer drive gear, driven gear, vehicle speed sensor (VSS), and retainers. P-2
9. Diagnose electronic transmission control systems using a scan tool; determine necessary action. P-1
10. Remove and reinstall transmission and torque converter (rear-wheel drive). P-2
11. Remove and reinstall transaxle and torque converter assembly. P-1
12. Disassemble, clean, and inspect transmission/transaxle. P-1
13. Inspect, measure, clean, and replace valve body (includes surfaces and bores, springs, valves, sleeves, retainers, brackets, check-balls, screens, spacers, and gaskets). P-2
14. Inspect servo bore, piston, seals, pin, spring, and retainers; determine necessary action. P-3
15. Inspect accumulator bore, piston, seals, spring, and retainer; determine necessary action. P-3
16. Assemble transmission/transaxle. P-1
   Inspect converter flex plate, pilot, pump drive, and seal areas. P-2
17. Measure torque converter end-play, check for interference in stator clutch. P-2
18. Inspect, measure, and reseal oil pump assembly and components. P-1
19. Measure endplay or preload; determine necessary action. P-1
20. Inspect, measure, and replace thrust washers and bearings. P-2
21. Inspect oil delivery seal rings, ring grooves, and sealing surface areas. P-2
22. Inspect bushings; determine necessary action. P-2
23. Inspect and measure planetary gear assembly includes sun, ring gear, planetary gears, and carrier assembly); determine necessary action. P-2
24. Inspect case bores, passages, bushings, vents, and mating surfaces; determine necessary action. P-2
25. Inspect transaxle drive, link chains, sprockets, gears, bearings, and bushings; perform necessary action. P-2
26. Inspect, measure, repair, adjust or replace transaxle final drive components. P-2
27. Inspect and reinstall parking pawl, shaft, spring, and retainer; determine necessary action. P-3
28. Inspect clutch drum, piston, check -balls, springs, retainers, seals, and friction and pressure plates; determine necessary action. P-2
29. Measure clutch pack clearance; determine necessary action. P-1
30. Air test operation of clutch and servo assemblies. P-1
31. Inspect roller and sprag clutch, races, rollers, sprags, springs, cages, and retainers; replace as needed. P-1
32. Inspect bands and drums; determine necessary action.

P-2

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