Introduction to Automotive Service
Chapter 39 Automatic Transmissions/Transaxles
Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This course or class serves as an introduction to the world of automotive service. It correlates material to task lists specified by ASE and NATEF.
Motivate Learners	Explain how the knowledge of how something works translates into the ability to use that knowledge to figure why the engine does not work correctly and how this saves diagnosis time, which translates into more money.
State the learning objectives for the chapter or course you are about to cover and explain this is what they should be able to do as a result of attending this session or class.	Explain learning objectives to students. 1. Prepare for the ASE Automatic Transmission/Transaxle (A2) certification test content area "A" (General Transmission/Transaxle Diagnosis). 2. Describe the purpose of a torque converter can transmit and multiply engine torque. 3. Explain the shift modes and when each is used. 4. Describe the operation of a planetary gear set. 5. Discuss how to replace the automatic transmission filter and pan gasket
Establish the Mood or Climate	Provide a ***WELCOME,*** Avoid put downs and bad jokes.
Complete Essentials	Restrooms, breaks, registration, tests, etc.
Clarify and Establish Knowledge Base	Do a round robin of the class by going around the room and having each student give their backgrounds, years of experience, family, hobbies, career goals, or anything they want to share.

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	1. SLIDE 1 Ch39 AUTOMATIC TRANSMISSIONS /TRANSAXLES
	**Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/ WEB SITE IS UPDATED REGULARLY**
	**VIDEOS** General Automatic Transmission Diagnosis (31 Links) In Vehicle Repair - Automatic Transmission (45 Links) Off Vehicle Repair - Automatic Transmission (79 Links) http://www.jameshalderman.com/
	**DISCUSSION: Refer to Chart 127–1 to talk about changes in transmissions through the years. What are the major changes that have occurred? Ask the students to find the date closest to when they were born and discuss what major change was introduced at that time.**
	2. **SLIDE 2 EXPLAIN CHART 39–1** Automatic transmission use, while available in some models much sooner, increased in great numbers in the 1950s 3. **SLIDE 3 EXPLAIN Figure 39-1** cutaway of Chrysler PowerFlite 2-speed automatic transmission used in 1950s
	**VIDEOS Torque Converter** Torque Converter Operation 1 Torque Converter Operation 2 Torque Converter Operation 3 Torque Converter Operation 4 http://www.jameshalderman.com/
	4. **SLIDE 4 EXPLAIN Torque Converters** 5. **SLIDE 5 EXPLAIN FIGURE 39-2** torque converter looks like a metal doughnut and takes the place of a clutch in an automatic transmission or transaxle 6. **SLIDE 6 EXPLAIN FIGURE 39-3** A torque converter is made from 3 parts: **Impeller** is located at transmission end, attached to housing, and is driven by engine. **Turbine**

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	is located at engine side and is driven by fluid flow from impeller & drives input shaft of transmission. **Stator** redirects flow to improve efficiency and multiply torque
	**ANIMATIONS:** **1-2 Upshift, Minimum Throttle** **2-3 Shift Valve, Coast Downshift** **2-3 Shift Valve, Full Throttle Downshift** **2-3 Shift Valve, Light Throttle Downshift** **2-3 Shift Valve, Light Throttle Upshift** **2-3 Shift Valve, Wide Open Throttle Upshift** **2-3 Shift Valve** **Accumulator** **Auto Transmission Band & Servo Operation** **Auto Transmission Clutch Operation** **Basic Hydraulic System** **http://www.jameshalderman.com/**
	**DEMONSTRATION: Using a converter that has been cut open, show various parts inside a torque converter, including the impeller, turbine, stator, one-way clutch, and converter clutch (if present)**
	**DISCUSSION: Have the students talk about the purposes a torque converter plays in an automatic transmission. What is the reason for allowing slippage?**
	**DISCUSSION: Have the students talk about couplings. What is difference between a fluid coupling and a mechanical coupling?**
	**DISCUSSION: Have the students discuss how the torque converter drives the transmission oil pump. How does the inner portion of front pump couple to the torque converter hub? FIGURE 39-3**
	7. **SLIDE 7 EXPLAIN FIGURE 39-4** Two fans can be used to show how fluid, or air in the case of fans instead of automatic transmission fluid, can be used to transfer energy. If one fan is operating, the blades of a second fan will be rotated by the flow of air past the fan that is unplugged, causing the blades to rotate
	**DEMONSTRATION: To demonstrate how fluid coupling in converter works, use 2 fans facing each other. Turn one fan on & have the students observe**

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	other fan's blades turning. **FIGURE 39-4** **HANDS-ON TASK:** Have the students DOWNLOAD a transmission schematic for specific transmission or transaxle and explain powerflow for that schematic to the class.
	8. **SLIDE 8** EXPLAIN **Figure 39-5** torque converter bolts to the flexplate which is attached to the engine crankshaft and rotates at engine speed.
	**DEMONSTRATION:** Show examples of a **Flexplate & Flywheel**. Have them talk about differences between the two. Why do the flexplate and flywheel need to be different?
	**DISCUSSION:** While showing the students examples of flexplates & discuss the external gear welded to the flexplate. What is purpose of this gear? What will happen if the gear goes bad?
	**ON-VEHICLE NATEF TASK (A2-C-7)** Inspect converter flex plate **(P-2)**
	**DISCUSSION:** Discuss how the fluid pump in an automatic transmission is driven by the converter. If possible, show them the flat sections machined in the torque converter hub that are used to drive the pump. What ensures that the fluid pump spins only when the engine spins?
	**DISCUSSION:** Have students talk about the different converter phases of torque converter operation. What are rotary flow, vortex flow, & torque multiplication?
	**DISCUSSION:** Have the students talk about the coupling phase. How will the coupling phase be affected if the one-way clutch (Stator) fails
	**Show VIDEO: 2 MINUTES TCC OPERATION www.myautomotivelab.com** http://media.pearsoncmg.com/ph/chet/chet_mylabs/akamai/template/video640x480.php?title=Checking%20Torque%20Converter%20Clutch%20(TCC)&clip=pandc/chet/2012/automotive/Transmission/Checking_Torque%20Converter_Clutch.mov&caption=chet/chet_mylabs/akamai/2012/automotive/Transmission/xml/Checking_Torque%20Converter_Clutch.xml

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	**Torque Converter Power Flows** **TCC Operation** **http://www.jameshalderman.com/**
	**9. SLIDE 9 EXPLAIN FIGURE 39-6** expanded view of a typical torque converter assembly showing the torque converter clutch (TCC)
	**DISCUSSION: Have the students talk about the purpose and function of a lockup torque converter. What are the advantages of having a lockup or torque converter clutch? FIGURE 39-6**
	**DEMONSTRATION: Using cut-open converters for examples, show students different types of converter clutch material. Why would *Kevlar* and carbon fiber be needed in some applications?**
	**DISCUSSION: Discuss how engine computer controls are used to control converter lockup. How do engine performance issues affect transmission operation?**
	**DISCUSSION: Discuss converter clutch control. What regulates the timing and application of the clutch? Have the students talk about importance of using the correct fluid in a transmission with a lockup torque converter. What are possible customer complaints if wrong type of fluid is used?**
	**DEMONSTRATION: Show how to use a Scan Tool to check & Diagnose a TCC**
	**DISCUSSION: Discuss what stall speed is. How do different stall speeds affect the performance & emissions of an engine?**
	**DISCUSSION: Discuss torque multiplication qualities of a torque converter. Why do high-performance vehicles use a small diameter converter? (ANS. Small diameter results in higher stall speeds)**

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	**DEMONSTRATION:** Demonstrate what "creep" is. Then show them how to check torque converter stall speed by power braking a vehicle & observing the tachometer. Make sure the students understand that a stall test should last for only 5 seconds so that the transmission or transaxle is not damaged. After a stall test is performed engine should be idled for a few minutes to let transmission cool down.
	**Tell students when stall speed is about 1/3 of specification, it is an indicator that one-way (Stator) clutch in converter is bad.**
	**ON-VEHICLE NATEF TASK (A2-A-7)** Perform stall test; determine necessary action (P-3)
	10. **SLIDE 10** EXPLAIN Shift Modes 11. **SLIDE 11** EXPLAIN **FIGURE 39-7** gear selector is often called the "PRNDL," pronounced "prindle," regardless of the actual letters or numbers used.
	**Show VIDEO: 2 MINUTES TRANSMISSION RANGE SWITCH (T/R) www.myautomotivelab.com** http://media.pearsoncmg.com/ph/chet/chet_mylabs/akamai/template/video640x480.php?title=Checking%20The%20T/R%20Switch&clip=pandc/chet/2012/automotive/Auto_Transmission/A2T5.mov&caption=chet/chet_mylabs/akamai/2012/automotive/Auto_Transmission/xml/A2T5.xml
	**DISCUSSION:** Have the students talk about the **SHIFT MODES** that most automatic transmissions & transaxles include. What is a common name for a gear selector? **FIGURE 39-7**
	**DISCUSSION:** Have the students talk about the importance of operating a vehicle in the proper **SHIFT MODE** at the proper time. Which gears are used on gentle, long, or steep grades?
	**HANDS-ON TASK:** Pulse width is measured in Hertz. Hertz are often displayed in milliseconds. How many milliseconds in a second? Have students determine speed of electricity. Understanding speed of electricity helps students understand how electronics can operate so fast.

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	12. **SLIDE 12** EXPLAIN Planetary Gear Sets 13. **SLIDE 13** EXPLAIN **FIGURE 39-8** typical planetary gear set showing terms used to describe each member. 14. **SLIDE 14** EXPLAIN Planetary Gear Sets
	**Planet Gears** **Planetary Gear Operation** **http://www.jameshalderman.com/**
	**DEMONSTRATION:** Show **planetary gear set**. Identify parts including **sun gear, planetary carrier, & ring (annulus) gear**
	**SAFETY** Caution parts on a **planetary gear set** can be very sharp and can cause personal injury. Also warn students that planetary gear sets have many pinch points that also can cause injury
	**HANDS-ON TASK:** Have the students identify parts on **planetary gear set**. Grade them on their ability to correctly identify parts including sun gear, planetary carrier, & ring (annulus) gear
	**DEMONSTRATION:** Using a planetary gear set, demonstrate for students when 3 gears are used and when 2ND gear moved in a driven gear becomes a drive gear to third gear
	**DISCUSSION:** Have the students talk about what an input member, a reaction member, and output member are. Are these members always the same in a planetary gear set?
	**HANDS-ON TASK:** Have students work in groups to experiment with a **planetary gear set.** Ask them to hold and drive different parts of the gear set to see what the results will be. Ask them to determine when a gear reduction, a 1:1 ratio, or an overdrive will occur.
	**HANDS-ON TASK:** Using **ON-LINE SERVICE INFORMATION**, have the students look up what the gear ratios for all forward gears are in an SUV, a pickup, and a compact. Are there any Similarities? Ask them to report their findings to class

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	**HANDS-ON TASK:** Have the students identify what model of transmission or transaxle (GM 4L80E) their own or their parents' vehicle has in it. Have the students determine what the numbers and letters mean for vehicle
	**DISCUSSION:** Have the students talk about automatic transaxles. What does an automatic transaxle include? In what applications can automatic transaxles be used?
	**DEMONSTRATION:** Show students how to disassemble a transaxle FINAL DRIVE unit and explain the parts.
	**DISCUSSION:** Have the students discuss final drive units. What does a final drive assembly include? O
	**HANDS-ON TASK:** Have the students locate in ON-LINE SERVICE INFORMATION, details about the operation of a Saturn or Honda NON-PLANETARY Transaxle and have them select a spokesperson who will explain the advantages and disadvantages of this design compared to a standard automatic transaxle using planetary gearsets.
	**Show ANIMATION: CVT OPERATION** **www.myautomotivelab.com** http://media.pearsoncmg.com/ph/chet/chet_myautomotivelab_2/animations/A14_Animation/Chapter100_Fig_100_21/index.htm
	**ON-VEHICLE NATEF TASK (A2-C-24)** Describe the operational characteristics of a hybrid vehicle drive train. **(P-3) Page 460**
	15. **SLIDE 15** EXPLAIN Automatic Transmission Fluid 16. **SLIDE 16** EXPLAIN **FIGURE 39-9** typical automatic transmission dipstick (fluid level indicator). Many use a clip to keep it from being forced upward due to pressure changes inside the automatic transmission. A firm seal also helps keep water from getting into the fluid, which can cause severe damage to the clutches and bands
	**DISCUSSION:** Have the students discuss how important proper fluid condition and level are for correct transmission operation. Can you diagnose

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	**transmission condition based on fluid condition?** 17. **SLIDE 17** EXPLAIN **FIGURE 39-10** "add" mark on most automatic transmission dipsticks indicates the level is down 0.5 quart (0.5 liter). Always follow the instructions stamped or printed on the dipstick 18. **SLIDE 18** EXPLAIN Automatic Transmission Fluid 19. **SLIDE 19** EXPLAIN **Fluid Leak Check**
	**HANDS-ON TASK: FIGURE 39-10: Have students check fluid level in an automatic transmission or transaxle. Have them read the information on dipstick & follow any directions stamped there. Make sure they identify correct fluid for transmission.**
	**DISCUSSION: Have the students talk about things that contaminate fluid. How could water or coolant get into the transmission? What would this do to an automatic transmission?**
	**HANDS-ON TASK: Using the correct service information or owner's manual, have students find the proper procedure for checking fluid level in a specific vehicle. Is there a dipstick?**
	**DEMONSTRATION: Demonstrate how a scan tool can be used to command shifts in an electronically controlled transmission.**
	**HANDS-ON TASK: Have the students hook up a scan tool to a 1996, or newer, vehicle and scan for engine/transmission DTCs. Note any codes present. Talk about DTCs. Just because a code is set does not mean that component is bad. Correct diagnosis after a code is set is important.**
	20. **SLIDE 20** EXPLAIN **FIGURE 39-11** Sometimes the location of a transmission fluid leak is easy to see, but with others it can be difficult to find exact location. Look closely at places where O-rings seals or gaskets are used, as these are most common areas where fluid leaks occur 21. **SLIDE 21** EXPLAIN **FIGURE 39-12** black light being used to locate the source of an automatic transmission fluid leak

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	**DEMONSTRATION:** Show how to add dye to transmission and use a black light to diagnose source of a fluid leak. Warn students that engine coolant will often glow like dye, which could result in misdiagnosis. **FIGURE 39-12**
	**HANDS-ON TASK:** Have the students raise vehicle on a lift using all safety procedures. Have the students inspect the automatic transmission or transaxle for any fluid leaks. Have them report their findings, along with recommended service.
	**22. SLIDE 22** EXPLAIN In-Vehicle Service
	**DISCUSSION:** Have the students discuss need to watch for falling parts when replacing a transmission filter. Some models use check valve that will fall when the filter is removed. What could happen if this check valve is not installed correctly?
	**DISCUSSION:** Have the students talk about the importance of correctly installing filter in an automatic transmission. What will happen if filter sucks air?
	**HANDS-ON TASK:** Have the students identify the transmission or transaxle in a specific vehicle. Using a service manual or an oil-pan shape chart may be helpful for their identification process.
	**23. SLIDE 23** EXPLAIN **FIGURE 39-13** Draining the fluid from an automatic transaxle by allowing the fluid to flow into a container after most of the retaining bolts have been removed **24. SLIDE 24** EXPLAIN **FIGURE 39-14** This is a normal amount of wear material in the bottom of an automatic transmission pan. Use a magnet and check for any steel particles which could indicate serious transmission wear or damage. **25. SLIDE 25** EXPLAIN In-Vehicle Service

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	**26. SLIDE 26 EXPLAIN FIGURE 39-15** Always check that the filter is secured by a clip or other fastener to keep it from dropping out of location **27. SLIDE 27 EXPLAIN FIGURE 39-16** In this case, cork-rubber gasket is glued to pan and is ready to be installed. Retaining bolts need to be tightened in sequence, but be aware that overtightening will cause a leak. Also, some manufacturers recommend using only RTV sealer, but never use an RTV sealer & gasket together
	**DEMONSTRATION: Show the students how to cut open a filter that has been removed from an automatic transmission/transaxle. Often, broken internal parts will get caught in the filter and you may not see them in the of the pan.**
	**HANDS-ON TASK: Have students remove oil pan from an automatic transmission and change filter. Remind the students that the old oil can be very hot and cause burns. Make sure students have the correct type and amount of ATF before they begin.**
	**Homework: complete Ch39 crossword puzzle: http://www.jameshalderman.com/links/book_intro/cw/crossword_ch_39.pdf**