

Automatic Transmissions and Transaxles, 7e












Chapter 1 Introduction to Drivetrains









Opening Your Class











KEY ELEMENT	EXAMPLES
Introduce Content	This course or class covers Automatic Transmissions and Transaxles 7th Edition . It correlates material to task lists specified by ASE and ASE Education (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 the chapter learning objectives to the students. <ol style="list-style-type: none">1. Define torque, and explain the relationship between torque and horsepower.2. Describe the various gear types and their effect on speed, torque, and direction of rotation.3. Explain gear ratios and their effect on vehicle operation.4. Discuss the types of manual transmissions and transaxles that are currently in use.5. Discuss automatic transmissions and the planetary gear sets used for automatic transmissions.6. Compare rear wheel drive, front wheel drive, four wheel drive, and all wheel drive.7. Explain the characteristics of driveshafts and drive axle assembly.
Establish the Mood or Climate	Provide a <i>WELCOME</i> , 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.









NOTE: This lesson plan is based on automatic Transmissions & Transaxle 7th Edition Chapter Images found on Jim's web site @ www.jameshalderman.com











DOWNLOAD CHP 1: Chapter Images

ICONS	Ch01 Introduction to Drivetrains
          	<p>1. SLIDE 1 INTRODUCTION TO DRIVETRAINS</p> <p>Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/ WEB SITE IS CONSTANTLY UPDATED</p> <p><u>Videos</u></p> <p>At the beginning of this class, you can download the crossword puzzle & Word Search from http://www.jameshalderman.com/books_a2.html to familiarize your class with the terms in this chapter & then discuss them</p> <p>DOWNLOAD Crossword Puzzle DOWNLOAD Word Search Puzzle</p> <p>2. SLIDE 2 EXPLAIN FIGURE 1–1 Torque, a twisting force, is produced when you pull on a wrench. An engine produces torque at the crankshaft as combustion pressure pushes the piston downward.</p> <p>DEMONSTRATION: SHOW HOW A FULCRUM AND LEVER CAN REDUCE LIFTING EFFORT. SET A LONG LEVER ON FULCRUM ¼ OF WAY TO THE LOAD YOU WANT TO LIFT. MOVE FULCRUM TO ¼ OF DISTANCE FROM THE INPUT POINT. SHOW STUDENTS HOW DECREASED LIFT EFFORT INCREASES THE LENGTH OF MOVEMENT AND THEN OPPOSITE HAPPENS FOR OTHER SETUP. EXPLAIN FREQUENTLY ASKED QUESTION</p> <p>3. SLIDE 3 EXPLAIN FIGURE 1–2 The torque produced by a 5.7 L engine as plotted on a graph. Note that the engine begins producing usable torque at 1000 to 1200 RPM and a maximum torque (381 ft-lb) at 3500 RPM. The torque produced by the decreases at higher RPM due to a decrease in volumetric efficiency.</p>

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	<p>4. SLIDE 4 EXPLAIN Gear ratio is determined by dividing the number of teeth of the driven (output) gear (24 teeth) by the number of teeth on the driving (input) gear (12 teeth). The ratio illustrated is 2:1.</p>
	<p>DISCUSSION: DISCUSS OTHER PLACES ON THE VEHICLE WHERE LEVERAGE IS USED TO REDUCE INPUT EFFORT</p>
	<p>HANDS-ON TASK: USE SEVERAL COMBINATIONS OF FULCRUMS AND LEVERS TO LIFT OBJECTS SO THEY CAN EXPERIENCE INPUT FORCE REQUIRED TO LIFT HEAVIER OBJECTS OR TO MOVE OBJECTS LONGER DISTANCE.</p>
	<p>5. SLIDE 5 EXPLAIN FIGURE 1-4 Work is calculated by multiplying force times distance. If you push 100 pounds 10 feet, you have done 1,000 foot-pounds of work.</p>
	<p>6. SLIDE 6 EXPLAIN FIGURE 1-5 One horsepower is equal to 33,000 foot-pounds (200 lbs × 165 ft) of work per minute</p>
	<p>7. SLIDE 7 EXPLAIN FIGURE 1-6 The pitch diameter is the effective diameter of the gear. Note how the contact points slide on the gear teeth as they move in and out of contact.</p>
	<p>EXPLAIN TECH TIP How to Explain the Difference between Horsepower & Torque</p>
	<p>8. SLIDE 8 EXPLAIN FIGURE 1-7 (a) When one external gear drives another, the direction of rotation is always reversed. (b) When an external gear drives an internal gear, the two gears will rotate in the same direction.</p>
	<p>9. SLIDE 9 EXPLAIN FIGURE 1-8 An idler gear reverses the direction of rotation so that the driving and driven gears rotate in the same direction.</p>
	<p>GOOD EXAMPLE OF AN IDLER GEAR USED IN INBLOCK CAM SYSTEM IS A GEAR CALLED A "BONE," WHICH TAKES PLACE OF A TIMING CHAIN</p>
	<p>10. SLIDE 10 EXPLAIN FIGURE 1-9 The teeth of a spur gear are cut parallel to shaft, and this produces a straight pressure between the driving and the driven gear teeth.</p>

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	<p>DEMONSTRATION: SHOW SPUR GEAR & EXAMPLES OF WHERE YOU WOULD FIND SPUR GEARS IN NON-AUTOMOTIVE APPLICATIONS. (EG: BOAT WINCHES, GEAR REDUCTION UNITS ON MACHINERY, AND ANALOG CLOCKS.</p>
	<p>11. SLIDE 11 EXPLAIN FIGURE 1–10 The teeth of a helical gear are cut on a slant, and this produces an axial or side thrust.</p>
	<p>External Gears, 2:1 (View) (Download) External Gears With Idler (View) (Download) INTERNAL & EXTERNAL GEAR (VIEW) (DOWNLOAD)</p>
	<p>DISCUSSION: DISCUSS DIFFERENCE BETWEEN SPUR AND HELICAL GEARS AND OTHER PLACES IN VEHICLE WHERE YOU MAY FIND EACH.</p>
	<p>HELICAL GEARS ARE USED BECAUSE THEY ARE MUCH MORE QUIET THAN SPUR GEARS BUT DUE TO THEIR ANGLE, THEY WILL THRUST FORWARD LIKE A SCREW, SO ENDPLAY IS IMPORTANT. YET, DUE TO THEIR INCREASED SURFACE AREA THEY CAN CARY A LARGER LOAD.</p>
	<p>12. SLIDE 12 EXPLAIN FIGURE 1–11 Bevel gears are commonly used in differentials.</p> <p>13. SLIDE 13 EXPLAIN FIGURE 1–12 hypoid gear set uses a pinion gear that is located below the centerline of the ring gear and is commonly used in drive axles.</p>
	<p>EXPLAIN FREQUENTLY ASKED QUESTION What Is a “Rock Crusher” Transmission?</p>
	<p>HYPOID RING & PINION GEAR SET (VIEW) (DOWNLOAD)</p>
	<p>DEMONSTRATION: SHOW EXAMPLE OF A HYPOID GEAR IN DIFFERENTIAL. POINT OUT HOW THE PINION GEAR IS OFFSET FROM RING GEAR</p>
	<p>14. SLIDE 14 EXPLAIN FIGURE 1–13 worm gear set is also used to transmit power between angled shafts.</p> <p>15. SLIDE 15 EXPLAIN FIGURE 1–14 gear ratio is determined by dividing number of teeth on the driven</p>

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       	<p>(output) gear by the number of teeth on the driving (input) gear.</p> <p>DEMONSTRATION: HOW USING DIFFERENT SIZE COMBINATIONS OF GEARS CHANGES ROTATION SPEED</p> <p>EXPLAIN FREQUENTLY ASKED QUESTION: What Is the Relationship between Speed and Gear Ratio?</p> <p>DISCUSS HOW GEAR RATIOS HELP WHEN PEDALING MULTI-SPEED BIKE</p> <p>16. SLIDE 16 EXPLAIN FIGURE 1–15 Backlash is the clearance between the teeth of two meshing gears. There has to be some clearance (backlash) to prevent the gears from getting into a bind condition when they are transmitting torque.</p> <p>DEMONSTRATION: USING A REAR AXLE SETUP SHOW THE STUDENTS THE TYPICAL BACKLASH CHECKING PROCEDURE OR SHOW A YOUTUBE VIDEO</p> <p>17. SLIDE 17 EXPLAIN FIGURE 1–16 A manual transmission provides several gear ratios and a method to shift them.</p> <p>18. SLIDE 18 EXPLAIN FIGURE 1–17 GM Muncie four-speed manual transmission on a restored muscle car (Used in Corvettes and Muscle cars of the 60s & 70s)</p> <p>19. SLIDE 19 EXPLAIN FIGURE 1–18 (a) A clutch cover (pressure plate assembly) is bolted onto flywheel with the clutch disc between them. The release bearing and fork provide a method to release (disengage) clutch. (b) When the clutch is engaged, the disc is squeezed against flywheel by pressure plate. Releasing the clutch separates the disc from flywheel and pressure plate.</p> <p>EXPLAIN FREQUENTLY ASKED QUESTION: What Is a “Close-Ratio” Transmission?</p>

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	<p><u>Clutch Operation (View) (Download)</u></p>
	<p>20. SLIDE 20 EXPLAIN FIGURE 1–19 The gear selector is often called the “PRNDL,” pronounced “prindle,” regardless of the actual letters or numbers used.</p>
	<p>21. SLIDE 21 EXPLAIN FIGURE 1–20 A torque converter is attached to the engine crankshaft and the other end is splined to the input shaft of the automatic transmission. The torque converter is used to transmit engine torque to the transmission yet slip when the engine is at idle speed.</p>
	<p><u>Torque Converter Fluid Flows (View) (Download)</u></p>
	<p><u>Torque Converter Power Flows (View) (Download)</u></p>
	<p>22. SLIDE 22 EXPLAIN FIGURE 1–21 A typical planetary gear set showing the terms that are used to describe each member.</p>
	<p>23. SLIDE 23 EXPLAIN FIGURE 1–22 (a) If the planet carrier is held with the sun gear rotating, the planet gears simply rotate in the carrier and act as idler gears between the sun and ring gears. (b) If the sun or ring is held, the planet gears will walk around that stationary gear; they rotate on their shafts as the carrier rotates. (c) If two parts are driven and no parts are held, the planet gears are stationary on their shafts, and the whole assembly rotates as a unit.</p>
	<p><u>DISCUSSION:</u> DISCUSS THE DIFFERENT COBINATIONS OF THE SIMPSON AND COMPOUND GEAR TRAIN CONFIGURATIONS</p>
	<p><u>DEMONSTRATE</u> THE SIMPLE REDUCTION AND OVERDRIVE GEAR MOVEMENT USING AN OLD PLANETARY GEARSET OR PROFESSIONAL PROPS</p>
	<p><u>DISCUSSION:</u> DISCUSS “REDUCTION” & “OVERDRIVE.” IN EACH COMBINATION, SOMETHING IS GAINED/SOMETHING IS LOST (REDUCTION, # OF ROTATIONS IS LOST BUT TORQUE IS INCREASED</p>

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24. **SLIDE 24 EXPLAIN FIGURE 1–23** RWD drivetrain uses a transmission to provide the necessary gear ratio and a single driveshaft to transfer power to the rear axle (a). A FWD drivetrain uses a transaxle that combines the transmissions final drive, and differential (b). A driveshaft is used for each front drive wheel.

EXPLAIN 2 FREQUENTLY ASKED QUESTIONS: What Do All the Letters and Numbers Mean in Transmission Designations?

25. **SLIDE 25 EXPLAIN FIGURE 1–24** Transverse (a) and longitudinal (b) mounted front-wheel-drive (FWD) drivetrains.
26. **SLIDE 26 EXPLAIN FIGURE 1–25** (a) A rear-wheel-drive (RWD) driveshaft uses a pair of universal joints to allow the rear axle to move up and down. (b) A front-wheel-drive (FWD) driveshaft uses a pair of constant-velocity joints to allow the front wheels to move up and down and steer.
27. **SLIDE 27 EXPLAIN FIGURE 1–26** A drive axle includes a ring and pinion gear to produce a lower gear ratio as it turns the power flow 90° and a differential (differential pinion and side gears) to allow the drive wheels to rotate at different speeds.


[RWD DRIVETRAIN \(VIEW\) \(DOWNLOAD\)](#) [2WD DIFFERENTIALS \(VIEW\) \(DOWNLOAD\)](#) [DIFFERENTIAL ACTION \(VIEW\) \(DOWNLOAD\)](#)

DISCUSSION: DISCUSS ADVANTAGES & DISADVANTAGES OF THE TRANSAXLE DESIGN COMPARED TO TRANSMISSION DESIGN

DEMONSTRATION: SHOW VEHICLE WITH A TRANSMISSION AND ONE WITH A TRANSAXLE.

EXPLAIN FREQUENTLY ASKED QUESTION: What Must the Powertrain Overcome to Move the Vehicle?

28. **SLIDE 28 EXPLAIN FIGURE 1–27** Three major 4WD configurations. The traditional form (a) uses a transfer case to split the torque for the front and rear drive axles. Both (b) and (c) are typical AWD configurations.

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	ASE EDUCATION TASK: RESEARCH APPLICABLE VEHICLE AND SERVICE INFORMATION, VEHICLE SERVICE HISTORY, SERVICE PRECAUTIONS, AND TECHNICAL SERVICE BULLETINS.