



CENTRAL PIEDMONT COMMUNITY COLLEGE

Course Syllabus Manual Drive Trains/Axles AUT-231-05 TOYOTA T-10

Syllabus Contents:

- Course Description
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- Student Evaluation
- Safety Regulations
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Time Requirements:

- 8 Weeks
- 4 Class Hours/Week
- 6 Lab Hours/Week
- 3 Semester Hours Credit

Instructor: James Viehmann

E-Mail: jim.viehmann@cpcc.edu

Office: TS 138

Phone: (704) 330-4159

Office hours: By appointment

**AUT 231-05
MANUAL DRIVE TRAINS/ AXLES
TOYOTA T-10**

Prerequisites: None

Course Description:

This course covers the operation, diagnosis, and repair of manual transmissions/transaxles, clutches, driveshafts, axles, and final drives. Topics include theory of torque, power flow, and manual drive train service and repair using appropriate service information, tools, and equipment. Upon completion, students should be able to explain operational theory and diagnose and repair drive trains.

AUT 231-05
MANUAL DRIVE TRAINS/ AXLES
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COURSE OBJECTIVES

For every task in Manual Drive Train and Axles, 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.

A. General Drive Train Diagnosis

1. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. P-1
2. Identify and interpret drive train concern; determine necessary action. P-1
3. Research applicable vehicle and service information, such as drive train system operation, fluid type, vehicle service history, service precautions, and technical service bulletins. P-1
4. Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, calibration decals). P-1
5. Diagnose fluid loss, level, and condition concerns; determine necessary action. P-1
6. Drain and fill manual transmission/transaxle and final drive unit. P-1

B. Clutch Diagnosis and Repair

1. Diagnose clutch noise, binding, slippage, pulsation, and chatter; determine necessary action.
2. Inspect clutch pedal linkage, cables, automatic adjuster mechanisms, brackets, bushings, pivots, and springs; perform necessary action.
3. Inspect hydraulic clutch slave and master cylinders, lines, and hoses; determine necessary action. P-1
4. Inspect release (throw-out) bearing, lever, and pivot; determine necessary action. P-1
5. Inspect and replace clutch pressure plate assembly and clutch disc. P-1
6. Bleed clutch hydraulic system. P-1
7. Inspect, remove or replace pilot bearing or bushing (as applicable). P-1
8. Inspect flywheel and ring gear for wear and cracks, determine necessary action. P-1
9. Inspect engine block, clutch (bell) housing, transmission/transaxle case mating surfaces, and alignment dowels; determine necessary action. P-3
10. Measure flywheel runout and crankshaft endplay; determine necessary action. P-2

C. Transmission/Transaxle Diagnosis and Repair

1. Remove and reinstall transmission/transaxle. P-1
2. Disassemble, clean, and reassemble transmission/transaxle components. P-1
3. Inspect transmission/transaxle case, extension housing, case mating surfaces, bores, bushings, and vents; perform necessary action. P-3
4. Diagnose noise, hard shifting, jumping out of gear, and fluid leakage concerns; determine necessary action. P-2
5. Inspect, adjust, and reinstall shift linkages, brackets, bushings, cables, pivots, and levers. P-2
6. Inspect and reinstall powertrain mounts. P-2
7. Inspect and replace gaskets, seals, and sealants; inspect sealing surfaces. P-2
8. Remove and replace transaxle final drive. P-3
9. Inspect, adjust, and reinstall shift cover, forks, levers, grommets, shafts, sleeves, detent mechanism, interlocks, and springs. P-2
10. Measure endplay or preload (shim or spacer selection procedure) on transmission/transaxle shafts; perform necessary action. P-1
11. Inspect and reinstall synchronizer hub, sleeve, keys (inserts), springs, and blocking rings. P-1
12. Inspect and reinstall speedometer drive gear, driven gear, vehicle speed sensor (VSS), and retainers. P-2
13. Diagnose transaxle final drive assembly noise and vibration concerns; determine necessary action. P-3
14. Remove, inspect measure, adjust, and reinstall transaxle final drive pinion gears (spiders), shaft, side gears, side bearings, thrust washers, and case assembly. P-2
15. Inspect lubrication devices (oil pump or slingers); perform necessary action. P-3
16. Inspect, test, and replace transmission/transaxle sensors and switches. P-1

D. Drive Shaft and Half Shaft, Universal and Constant-Velocity (CV) Joint Diagnosis and Repair

1. Diagnose constant-velocity (CV) joint noise and vibration concerns; determine necessary action. P-1
2. Diagnose universal joint noise and vibration concerns; perform necessary action. P-1
3. Remove and replace front wheel drive (FWD) front wheel bearing. P-1
4. Inspect, service, and replace shafts, yokes, boots, and CV joints. P-1
5. Inspect, service, and replace shaft center support bearings. P-3
6. Check shaft balance and phasing; measure shaft runout; measure and adjust driveline angles. P-2

E. Drive Axle Diagnosis and Repair

1. Ring and Pinion Gears and Differential Case Assembly

1. Diagnose noise and vibration concerns; determine necessary action. P-2
2. Diagnose fluid leakage concerns; determine necessary action. P-1
3. Inspect and replace companion flange and pinion seal; measure companion flange runout. P-2

4. Inspect ring gear and measure runout; determine necessary action. P-2
5. Remove, inspect, and reinstall drive pinion and ring gear, spacers, sleeves, and bearings. P-2
6. Measure and adjust drive pinion depth. P-2
7. Measure and adjust drive pinion bearing preload. P-2
8. Measure and adjust side bearing preload and ring and pinion gear total backlash and backlash variation on a differential carrier assembly (threaded cup or shim types). P-2
9. Check ring and pinion tooth contact patterns; perform necessary action. P-2
10. Disassemble, inspect, measure, and adjust or replace differential pinion gears (spiders), shaft, side gears, side bearings, thrust washers, and case. P-2
11. Reassemble and reinstall differential case assembly; measure runout; determine necessary action.

2. Limited Slip Differential

1. Diagnose noise, slippage, and chatter concerns; determine necessary action. P-3
2. Clean and inspect differential housing; refill with correct lubricant. P-2
3. Inspect and reinstall clutch (cone or plate) components. P-3
4. Measure rotating torque; determine necessary action. P-3

3. Drive Axle Shaft

1. Diagnose drive axle shafts, bearings, and seals for noise, vibration, and fluid leakage concerns; determine necessary action. P-2
2. Inspect and replace drive axle shaft wheel studs. P-1
3. Remove and replace drive axle shafts. P-1
4. Inspect and replace drive axle shaft seals, bearings, and retainers. P-2
5. Measure drive axle flange runout and shaft endplay; determine necessary action. P-2

F. Four-wheel Drive/All-wheel Drive Component Diagnosis and Repair

1. Diagnose noise, vibration, and unusual steering concerns; determine necessary action. P-3
2. Inspect, adjust, and repair shifting controls (mechanical, electrical, and vacuum), bushings, mounts, levers, and brackets. P-3
3. Remove and reinstall transfer case. P-3
4. Disassemble, service, and reassemble transfer case and components. P-3
5. Inspect front-wheel bearings and locking hubs; perform necessary action. P-3
6. Check drive assembly seals and vents; check lube level. P-3
7. Diagnose, test, adjust, and replace electrical/electronic components of four-wheel drive systems. P-3

WEEKLY OUTLINE
AUT 231-05
MANUAL DRIVE TRAINS/AXLES
TOYOTA T-10

REQUIRED TEXT: *Manual Drive Trains and Axles*

BY: ***JEFFREY REHKOPF***

WEEK 1

Day 1:

Orientation, Shop Practices, and Safety

- Reading Assignment: Chapter 1, 2

Day 2:

Introduction to Automotive Drive Trains
Gears, Bearings and Bearing Service

- Reading Assignment: Chapter 4,5

Test- Safety

WEEK 2

Day 1:

Clutches

- Reading Assignment: Chapter 8,9

Test-Chapters 4&5

Day 2:

Clutch Diagnosis and Repair

WEEK 3

Day 1:

Manual Transmissions Fundamentals

Worksheets in Lab (Hand-out)

- Reading Assignment: Chapter 10 Pgs 170-182, 196-201
- Reading Assignment: Chapter 11

Test-Chapter 8&9

Day 2:

Manual Transaxles Fundamentals

Worksheets in Lab (Handout)

- Reading Assignment Chapter 10 Pgs 182-196,
- Reading Assignment Chapter 11

WEEK 4

Day 1:

Manual Transmission & Transaxles Diagnosis / Repair
Worksheets in Lab (Handout)

Day 2:

Driveshaft and U-Joint Operation, Diagnosis, and Repair

- Reading Assignment: Chapter 15

Test-Chapter 10&11

WEEK 5

Day 1:

Half shaft and CV Joint Operation, Diagnosis and Repair
Worksheets (Handout)

- Reading Assignment: Chapter 16
Driveline Vibration Service

Day 2:

Drive Axle and Differential Operation

- Reading Assignment: Chapter 17

Test Chapter 15&16

WEEK 6

Day 1:

Drive Axle Diagnosis and Repair

- Reading Assignment: Chapter 18

Day 2:

Four Wheel Drive-All/Wheel Drive System Operation
Worksheets (Handout)

- Reading Assignment: Chapter 19
- Reading Assignment: Chapter 20

Test Chapter 17& 18

WEEK 7

Day 1:

Four Wheel Drive-All/Wheel Drive System Diagnosis & Repair

Day 2:

Lab Services - Clutches, Transmissions, Four Wheel Drive
On-Vehicle Diagnosis and Servicing

Test Chapter 19&20

WEEK 8

Day 1:

Lab Services - Clutches, Transmissions, Four Wheel Drive
On-Vehicle Diagnosis and Servicing Cont.

Day 2:

Lab Cleanup & Grades

STUDENT GRADE POINT AVERAGE

Students will be graded according to the following grade point system.

Grade	Point Value	Description
A	4	Excellent
B	3	Very Good
C	2	Satisfactory
D	1	Poor
F	0	Failing
The following grades will not be used in computing the grade point average.		
I = Incomplete		W = Withdrawal
S = Satisfactory		U = Unsatisfactory
AUD = Audit		N = Never Attended
X = Credit by Examination		

- **Since this course is preparatory to entering the automotive service industry, job attitude, neatness, promptness and care of equipment will be considered part of the final grade. The final grade on these items will be determined by the instructor and based upon accepted industry standards.**

GRADING

- 1. FOR A GRADE OF "A":**
 - a. Complete all written tests with an average of 93% to 100%.
 - b. Attend 90% of all scheduled class/lab hours.
 - c. Complete all lab/shop work in a manner as would be determined EXCELLENT in an actual shop.
- 2. FOR A GRADE OF "B":**
 - a. Complete all written test with an average of 85% to 92%.
 - b. Attend 85% of all scheduled class/lab hours.
 - c. Complete all lab/shop work in a manner as would be determined VERY GOOD in an actual shop.
- 3. FOR A GRADE OF "C":**
 - a. Complete all written tests with an average of 77% to 84%.
 - b. Attend 80% of scheduled class/lab hours.
 - c. Complete all lab/shop work in a manner as would be determined SATISFACTORY in an actual repair shop.
- 4. FOR A GRADE OF "D":**
 - a. Complete all written tests with an average of 70% to 76%.
 - b. Attend 80% of all scheduled class/lab hours.
 - c. Complete all lab/shop work in a manner as would be determined POOR in an actual repair shop.



CENTRAL PIEDMONT COMMUNITY COLLEGE

Automotive Department Student Dress Code Effective August 2005

All automotive students will have and wear safety glasses at all times in shop or lab areas. Failure to adhere to safety glasses rules may result in disciplinary action.

1. All students are required to wear their dealer sponsored uniform to school each day. If a student has not been sponsored by a dealer, the student may purchase approved CPCC shirts from the school store. All shirts must be clean and tucked in. Rips and tears must be mended in a timely manner.
2. Dark colored work-style pants are recommended or Proper fitting jeans that meet the following requirements (length above the shoes, jeans above the hip with belt). No oversized jeans will be permitted. **Shorts are not allowed.** Rips and tears must be mended in a timely manner.
3. Facial jewelry of any type is **NOT** permitted. This includes ear, nose, lip, eyebrow, and cheek rings and/or studs. We also suggest that you refrain from wearing necklaces, rings, or bracelets of any kind as these items may pose a safety hazard.
4. All belts will be of the type that does not have an exposed buckle. No keys, chains or wallets hanging out of pockets.
5. Hats are permitted in the shop area only! If a hat has a brim, it must be worn with it facing forward.
6. Students must wear leather work boots or shoes with steel toes. We highly recommend oil resistant soles. No sneakers, tennis shoes, open toed shoes, or dress shoes are permitted.
7. Other appearance issues not directly covered by these rules will be considered on a case-by-case basis. CPCC staff will decide what is professional in appearance and what is not.

Any Student Not Following These Guidelines Will Be Dismissed From Class And Attendance Credit For That Day Will Not Be Given. No Excuses Will Be Considered.

- Students will bring tools required for class with them at class time.
 - **No Tools, No Lab Credit.**
- **Remember how you act and present yourself will reflect on the department and presentations to prospective employers.**



CENTRAL PIEDMONT COMMUNITY COLLEGE

Automotive Department Student Guidelines / Expectations

- No tobacco products usage is allowed inside any college building at any time.
- Eating or drinking in classrooms is with permission of instructor only; **there will be no eating or drinking in shop or lab or lab areas.**
- Students are expected to be in class on time and will be held responsible for any information covered by instructor, even if late or absent. Tests and quizzes missed may be made up only with instructor permission.
- Missed or late assignments will affect student's course grade.
- Tardiness is a problem; any student who is over 15 minutes late for a class will be counted as absent. CPCC attendance policy is in the on line student handbook.
- Students are expected to conduct themselves in a mature manner at all times. Students caught cheating, fighting, stealing, spinning tires, vandalizing or purposely damaging a vehicle or equipment will be **EXPELLED** from the automotive program. Care should be shown to college vehicles and property.
- Leaving class or shop/lab early without instructor permission will not be tolerated.
- Students are expected to come prepared for class. This means with paper, textbook, pens, pencils or other required material.
- Cell phones and pagers must be turned off during all class or lab times. Cell phones may only be used outside of the automotive buildings. Cell phones which ring during class will be subject to forfeiture or may result in student loss of privilege.
- The area in front of the main lab is not a parking area for students. The laneway must remain open for emergency vehicles. Vehicles inappropriately parked will be ticketed and towed. No parking means No Parking.
- All students are expected to clean up and put away all tools and equipment used during class or lab before leaving. Housekeeping is very important and will be part of your grade.
- Whenever you are unsure about anything ask your instructor! It is your responsibility to make sure that no physical damage occurs to any vehicle that you are working on or driving. Students are responsible for their actions!
- **Safety glasses** and student tools are mandatory in all shop/lab areas, no exceptions.
- All vehicles brought into the main lab will have a CPCC work order filled out and visible on windshield.



CENTRAL PIEDMONT COMMUNITY COLLEGE

Automotive Technology, Tool List

Safety Glasses or Goggles Mandatory in Labs

- Toolbox
- Common slotted screwdrivers, 4"x3/16, 6"x1/4, 8"x1/4
- Phillips screwdrivers number 1 and number 2
- Torx bit set T10 to T60
- Standard combination wrench set 5/16 to 1 1/4"
- Metric combination wrench set 6mm to 22mm
- 16 oz ball peen hammer
- 6" needle nose pliers
- Regular slip joint pliers
- 10 or 12" Channel Lock pliers
- 6 or 7" side cutting pliers
- Set of punches and chisels
- Feeler gauge set
- 3/8" drive socket set, including ratchet, extensions, standard and metric sockets,
 - 3/8 to 7/8 and 8mm to 17mm
- 3/8" to 1/2" socket adapter, 1/2" to 3/8" socket adapter
- 1/2" drive socket set with extensions and ratchet,
- 1/2" drive flex handle at least 18" long (breaker bar)
- 1/2" drive sockets, 7/16 to 1 1/4 and 10mm to 22mm
- 1/2" inch drive torque wrench
- Spark plug sockets 5/8" and 13/16" 3/8" drive
- Gasket scraper
- Set of Allen wrenches
- 12-volt test light
- 1/4" drive socket set, standard and metric sockets, including ratchet
- Non-sparking drift punch, brass or aluminum
- Digital Volt, Ohm and Ammeter DVOM, with Leads Example Fluke model 83

You may wish to purchase additional tools for the specific program you are enrolled in such as ASEP, BMW, T-TEN, CAP. Check with your instructor for a list.



CENTRAL PIEDMONT COMMUNITY COLLEGE

Automotive Technology Safety Regulations

- An Instructor must be present any time a class or session is working in the lab

Use of safety glasses is required/mandatory in lab areas.

- Any safety hazard will be reported to the instructor immediately. Floor will be kept clear of all liquids and tripping hazards.
- No equipment will be operated by students until they have received instruction on proper and safe operation of same equipment.
- Vehicle lifts must be secured with mechanical locks prior to working under vehicle
- Jack stands will be used when jacking up a vehicle for service.
- Brake asbestos "dust" will be controlled any time work is done which could lead to asbestos exposure.
- Floor exhaust system will be used anytime an engine is running in the lab.
- Use of tobacco is not permitted in any lab or classroom.
- Use of audio equipment is not permitted during class/lab hours.
- Students and faculty must follow OSHA rules concerning exposure to blood borne diseases.
- Proper disposal of automotive waste products, including hazardous wastes, is required.