



# COURSE OUTLINE

## TCT816

Prepared: George Parsons    Approved: Corey Meunier

<b>Course Code: Title</b>	TCT816: DRIVE TRAIN
<b>Program Number: Name</b>	6082: T/C TECHN-LEVEL III
<b>Department:</b>	MOTIVE POWER APPRENTICESHIP
<b>Semester/Term:</b>	18W
<b>Course Description:</b>	Gear Train Systems is designed for the advanced level training in Heavy Duty Transmissions used in On Highway Commercial Vehicles commonly School City Buses, Highway Coach, and specialized delivery vehicles for city refuse vehicles. Students will be taught the purpose, construction and operation of the Automatic Transmissions and transmission control devices used for these applications. Students will learn the theory of operation of torque converters both single and double stage and how they develop the power and torque to power the automatic transmissions. Students will also learn the construction, and operation of the internal components and controls of the manual automatic transmissions and the newer electronically controlled transmission. They will be taught how to diagnose and test the external manual and electronic controls as well as the internal manual hydraulic and electronic hydraulically controlled systems.
<b>Total Credits:</b>	5
<b>Hours/Week:</b>	5
<b>Total Hours:</b>	40
<b>Essential Employability Skills (EES):</b>	<p>#1. Communicate clearly, concisely and correctly in the written, spoken, and visual form that fulfills the purpose and meets the needs of the audience.</p> <p>#2. Respond to written, spoken, or visual messages in a manner that ensures effective communication.</p> <p>#3. Execute mathematical operations accurately.</p> <p>#4. Apply a systematic approach to solve problems.</p> <p>#5. Use a variety of thinking skills to anticipate and solve problems.</p> <p>#6. Locate, select, organize, and document information using appropriate technology and information systems.</p> <p>#7. Analyze, evaluate, and apply relevant information from a variety of sources.</p> <p>#8. Show respect for the diverse opinions, values, belief systems, and contributions of others.</p> <p>#9. Interact with others in groups or teams that contribute to effective working relationships and the achievement of goals.</p> <p>#10. Manage the use of time and other resources to complete projects.</p> <p>#11. Take responsibility for ones own actions, decisions, and consequences.</p>

<b>Course Evaluation:</b>	Passing Grade: 50%, D								
<b>Other Course Evaluation &amp; Assessment Requirements:</b>	<p>Grade            Definition Grade Point Equivalent            A+ 90 - 100% 4.00            A 80 - 89%            B 70 - 79% 3.00            C 60 - 69% 2.00            D 50 - 59% 1.00            F (Fail)49% and below 0.00</p> <p>CR (Credit) Credit for diploma requirements has been awarded.            S Satisfactory achievement in field /clinical placement or non-graded subject area.            U Unsatisfactory achievement in field/clinical placement or non-graded subject area.            X A temporary grade limited to situations with extenuating circumstances giving a student additional time to complete the requirements for a course.            NR Grade not reported to Registrar's office.            W Student has withdrawn from the course without academic penalty.</p>								
<b>Evaluation Process and Grading System:</b>	<table border="1"> <thead> <tr> <th>Evaluation Type</th> <th>Evaluation Weight</th> </tr> </thead> <tbody> <tr> <td>Assignments/Theory</td> <td>20%</td> </tr> <tr> <td>Shop/Assigned/Tasks</td> <td>30%</td> </tr> <tr> <td>Tests/Theory</td> <td>50%</td> </tr> </tbody> </table>	Evaluation Type	Evaluation Weight	Assignments/Theory	20%	Shop/Assigned/Tasks	30%	Tests/Theory	50%
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<b>Books and Required Resources:</b>	Heavy Duty Truck Systems by Bennet Publisher: Cengage Learning								
<b>Course Outcomes and Learning Objectives:</b>	<p><b>Course Outcome 1.</b></p> <p>Upon successful completion, the apprentice is able to understand the principles of operation, diagnose and repair truck and coach torque converter units.</p> <p><b>Learning Objectives 1.</b></p> <p>Explain the history, purpose and fundamentals of torque converter assemblies:</p> <ul style="list-style-type: none"> <li>- torque converters</li> <li>- fluid clutch</li> <li>- hydraulic force</li> <li>- kinetic energy</li> <li>- centrifugal force</li> </ul> <p>Identify the functions, construction, composition, types, styles and application of torque converter assemblies.</p> <ul style="list-style-type: none"> <li>- torque converters</li> <li>- one-piece</li> <li>- multi-piece</li> <li>- impeller</li> <li>- turbine</li> <li>- stator</li> <li>- conventional</li> <li>- variable pitch</li> <li>- overrunning clutch</li> <li>- lockup clutch</li> </ul>								

- Describe the principle(s) of operation of torque converter assemblies.
- torque converters
  - one-piece
  - multi-piece
  - impeller
  - turbine
  - stator
  - conventional
  - variable pitch
  - overrunning clutch
  - lockup clutch
  - vortex flow
  - rotary flow
  - torque multiplication phase
  - coupling phase
  - converter lockup
  - coupling phase
- Perform inspection, testing and diagnostic procedures on torque converter assemblies.
  - fluid level check
  - fluid condition
  - visual inspection
  - converter endplay check
  - demonstration of stall test procedure
  - performance testing
- Recommend reconditioning or repairs following manufacturers' procedures on torque converter assemblies.
  - outline procedure for checking fluid levels
  - outline recommended fluid change intervals
  - verify fluid type and application
  - converter removal, disassembly, (multi-piece), reassemble (multi-piece) and replacement procedure

## Course Outcome 2.

Upon successful completion, the apprentice is able to understand the principles of operation, diagnose and repair automatic transmissions and vehicle retarders to manufacturer's standards.

## Learning Objectives 2.

Explain the purpose and fundamentals of automatic transmissions and vehicle retarders:

- mechanical advantage
- laws of Levers
- torque
- gear ratios
- shaft and splines
- planetary gearing
- gear train control devices
- hydraulic control systems
- power flows
- thrust loads
- lubrication system
- hydraulic fluid and principles
- retarders and controls

Identify the functions, construction, and application of automatic transmissions and vehicle retarders:

- planetary gear trains
- simple
- compound
- gear train control devices
- hydraulic clutches
- pumps, drives and controls
- valve bodies
- spool valves
- pressure regulating device
- flow control devices
- directional control devices
- shift cushioning devices
- throttle / modulator valves and circuits
- governor valves and circuits
- shift mechanisms
- automatic upshifting and downshifting
- lubrication system
- parking devices

Describe the principle(s) of operation of automatic transmissions and vehicle retarders.

planetary gear trains:

- simple
- compound
- gear train control devices
- one way clutched
- band and servo mechanisms
- hydraulic clutches
- pumps, drives ad controls
- valve bodies
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- pressure regulating devices
- flow control devices
- directional control devices
- shift cushioning devices
- throttle / modulation valves and circuits
- shift mechanisms
- automatic upshifting and downshifting
- lubrication system
- parking devices
- retarders and controls

Perform disassembly, inspection, reassembly, testing and diagnostic procedures on automatic transmissions and vehicle retarders:

- disassemble
- visual inspection
- reassemble
- noise analysis
- temperature analysis
- performance testing
- fluid level and condition
- pressure testing
- stall testing procedure

Recommend reconditioning or repairs following manufacturers` procedures on automatic transmissions and retarders:

- outline procedure for checking fluid level
- outline recommended lubrication change intervals and procedures
- verify lubricant type and application
- transmission removal, disassembly, reassembly and replacement procedure
- failure analysis to identify:
  - friction material
  - seals and gaskets and O rings
  - gear and shafts
  - bushings and bearings
  - pump drives and controls
  - valve body and governor test stand

### **Course Outcome 3.**

Upon successful completion, the apprentice is able to understand the principles of operation, diagnose and repair electronically controlled automatic transmissions.

### **Learning Objectives 3.**

Explain the purpose and fundamentals of electronically controlled automatic transmissions:

- shift point control
- engine load
- driver input
- road speed
- digital electronics
- input and output circuits
- hydraulics

Identify the functions, construction, composition, types, styles and application of electronically controlled automatic transmissions:

- electronic shift control systems
- input signals
- vehicle speed sensor
- engine speed sensor
- turbine speed sensor
- pressure sensor
- temperature sensor
- fluid level sensor
- shift selector
- output actuators
- latching solenoids
- non-latching solenoids
- normally open solenoids
- normally closed solenoids
- connectors and harnesses
- ECM
- interface module

Describe the principle(s) of operation of electronically controlled automatic transmissions. input signal mechanisms (sensors):

- vehicle speed
- engine speed (load)
- turbine speed
- pressure
- temperature
- shift selector
- solenoids
- output actuators
- latching solenoids
- non-latching solenoids
- pulse width modulation
- modulated solenoids
- normally open solenoids
- normally closed solenoids
- ECM / ECU
- electronic shift quality control
- interface modules
- customer data reprogramming
- default modes
- data link protocols

Perform inspection, testing and diagnostic procedures on electronically controlled automatic transmissions:

- visual inspection
- pressure testing
- fluid level and condition
- digital multimeter
- EST
- sequential troubleshooting strategies
- interpretation of schematics
- electrical
- hydraulic
- fault code interpretation
- retrieving and clearing fault codes
- EST (Electronic Service Tool)
- shift selector

Recommend reconditioning or repairs following manufacturers` procedures on electronically controlled automatic transmissions:

- performance testing
- identify harness and connector failures
- sensor / actuator replacement
- potentiometer calibration / adjustment
- ECM replacement
- PROM replacement
- maintenance / repair precautions

#### **Course Outcome 4.**

Upon successful completion, the apprentice is able to understand the principles of operation, diagnose and repair transfer case, drop box and power take-off assemblies.

#### **Learning Objectives 4.**

Explain the purpose and fundamentals of transfer case, drop box and power take-off assemblies:

- mechanical advantage
- laws of levers
- torque
- input / output rotational speed
- gear ratios
- shafts, splines and gears
- lubrication

Identify the function, construction, composition, types, styles and application of transfer case, drop box and power take-off assemblies:

- clutching mechanisms
- case
- gears
- shafts
- bearings and bushings
- spacers and thrust washer
- seals and gaskets
- shifting mechanisms

Describe the principle(s) of operation of transfer case drop box and power take-off assemblies:

- gears
- clutching mechanisms
- bearings and bushings
- shafts and splines
- thrust control seals and gaskets
- shift mechanisms
- power flow
- lubrication system
- PTO backlash

Perform inspection, testing and diagnostic procedure on transfer case drop box and power take-off assemblies:

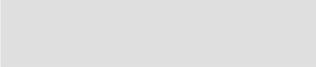
- visual inspection
- performance test
- temperature testing
- thrust measurement
- fluid level condition
- verify power flow

Recommend reconditioning or repairs following manufacturers' procedures on transfer case, drop box and power take off assemblies:

- outline procedures for checking lubricant levels
- outline recommended lubricant change intervals and procedure
- verify lubricant type and application
- component and controls / shift mechanism,
- removal, disassembly, reassembly and replacement procedure
- failure analysis to identify
- shock failures
- fatigue failures
- torsional failure
- surface failures

**Date:**

Thursday, March 1, 2018



Please refer to the course outline addendum on the Learning Management System for further information.