



## COURSE OUTLINE: AST714 - DRIVE TRAIN SYSTEMS

Prepared: Stephen Kent

Approved: Corey Meunier, Chair, Technology and Skilled Trades

<b>Course Code: Title</b>	AST714: DRIVE TRAIN SYSTEMS
<b>Program Number: Name</b>	6068: AUTO SERV TN LEVEL 2
<b>Department:</b>	MOTIVE POWER APPRENTICESHIP
<b>Semesters/Terms:</b>	20F, 21S
<b>Course Description:</b>	Upon successful completion the apprentice will have the ability to perform visual inspection, diagnose, troubleshoot and repair front wheel drive axle assemblies, rear wheel drive drivelines, final drive assemblies, automatic transmission torque converters, and automatic transmission/transaxles, and the ability to describe the operation of automatic transmissions/transaxles - all according to manufacturers' standards.
<b>Total Credits:</b>	5
<b>Hours/Week:</b>	0
<b>Total Hours:</b>	36
<b>Prerequisites:</b>	There are no pre-requisites for this course.
<b>Corequisites:</b>	There are no co-requisites for this course.
<b>Essential Employability Skills (EES) addressed in this course:</b>	<div>EES 1 Communicate clearly, concisely and correctly in the written, spoken, and visual form that fulfills the purpose and meets the needs of the audience.</div> <div>EES 2 Respond to written, spoken, or visual messages in a manner that ensures effective communication.</div> <div>EES 3 Execute mathematical operations accurately.</div> <div>EES 4 Apply a systematic approach to solve problems.</div> <div>EES 5 Use a variety of thinking skills to anticipate and solve problems.</div> <div>EES 6 Locate, select, organize, and document information using appropriate technology and information systems.</div> <div>EES 7 Analyze, evaluate, and apply relevant information from a variety of sources.</div> <div>EES 8 Show respect for the diverse opinions, values, belief systems, and contributions of others.</div> <div>EES 9 Interact with others in groups or teams that contribute to effective working relationships and the achievement of goals.</div> <div>EES 10 Manage the use of time and other resources to complete projects.</div> <div>EES 11 Take responsibility for ones own actions, decisions, and consequences.</div>
<b>Course Evaluation:</b>	<div>Passing Grade: 50%, D</div> <div>A minimum program GPA of 2.0 or higher where program specific standards exist is required for graduation.</div>

In response to public health requirements pertaining to the COVID19 pandemic, course delivery and assessment traditionally delivered in-class, may occur remotely either in whole or in part in the 2020-2021 academic year.



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**Other Course Evaluation & Assessment Requirements:****V. EVALUATION PROCESS/GRADING SYSTEM:**

The final grade for this course will be based on the results of classroom, assignments and shop evaluations weighed as indicated:

- Classroom 70% of the final grade is comprised of term tests
  - Shop 30% of the final grade is comprised of attendance, punctuality, preparedness, student ability, work organization and general attitude
- (Student will be given notice of test and assignment dates in advance)

The following semester grades will be assigned to students:

**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

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.

**Books and Required Resources:**

Automotive Technology: A Systems Approach by Erjavec

Publisher: Thomson Nelson Learning Canada Edition: 3rd Canadian

**Course Outcomes and Learning Objectives:**

<b>Course Outcome 1</b>	<b>Learning Objectives for Course Outcome 1</b>
perform visual inspection, diagnose, troubleshoot, repair front wheel drive axle assemblies according to manufacturers standards.	<b>LEARNING OUTCOMES AND CONTENT</b>  Identify the specific components and describe the operation of front wheel drive axle assemblies. <ul style="list-style-type: none"><li>- front wheel drive axles</li><li>- half shafts</li><li>- inner and outer constant velocity joints</li><li>- joint types and boot retention</li><li>- vibration damper</li><li>- torque steer</li><li>- bearings and supports</li></ul>

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		<p>Perform inspection, diagnosis, troubleshooting, and service on front wheel drive axle assemblies.</p> <ul style="list-style-type: none"> <li>- visual inspection</li> <li>- symptom diagnosis / noise and vibration</li> <li>- removal and installation constant velocity (CV) shaft</li> <li>- repair constant velocity (CV) shaft</li> <li>- component inspection</li> <li>- joint replacement</li> <li>- boot service</li> <li>- lubrication</li> </ul>
	<b>Course Outcome 2</b>	<b>Learning Objectives for Course Outcome 2</b>
	perform visual inspection, diagnose, troubleshoot, repair rear wheel drive drivelines according to manufacturers standards.	<p>LEARNING OUTCOMES AND CONTENT</p> <p>Explain the basic fundamentals of driveline (RWD) systems.</p> <ul style="list-style-type: none"> <li>- angular movement</li> <li>- linear movement</li> <li>- centrifugal force</li> <li>- relationship of drive shaft speed and balance</li> <li>- phasing and working angles</li> </ul> <p>Identify the specific components and describe the operation of rear wheel drivelines.</p> <ul style="list-style-type: none"> <li>- rear wheel drive shaft assemblies</li> <li>- single, multiple</li> <li>- steel, aluminum, and composite</li> <li>- joint types</li> <li>- constant velocity</li> <li>- slip yoke and flanges</li> <li>- bearings and supports</li> <li>- vibration damper</li> </ul> <p>Perform inspection, diagnosis, troubleshooting, and service on rear wheel drivelines.</p> <ul style="list-style-type: none"> <li>- visual inspection</li> <li>- symptom diagnosis / noise and vibration</li> <li>- measurements - runout</li> <li>- phasing</li> <li>- working angles</li> </ul> <ul style="list-style-type: none"> <li>- shaft removal and installation procedures</li> <li>- shaft repair</li> <li>- component inspection</li> <li>- joint replacement</li> <li>- indexing</li> <li>- boot service</li> <li>- lubrication</li> </ul>

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	<b>Course Outcome 3</b>	<b>Learning Objectives for Course Outcome 3</b>
	perform visual inspection, diagnose, troubleshoot, repair final drive assemblies according to manufacturers standards.	<p>LEARNING OUTCOMES AND CONTENT</p> <p>Identify the specific components and describe the operation of final drive assemblies.</p> <ul style="list-style-type: none"> <li>- hotchkiss</li> <li>- torque tube</li> <li>- housing types</li> <li>- banjo</li> <li>- independent</li> <li>- carrier types</li> <li>- integral, removable</li> <li>- gear types</li> <li>- spur bevel, spiral bevel, helical, hypoid, planetary</li> <li>- gear set / ratio</li> <li>- hunting, non-hunting, partial non-hunting</li> <li>- pinion mounting</li> <li>- straddle, overhung</li> <li>- axle types</li> <li>- full floating, "" floating, semi-floating</li> <li>- differential types</li> <li>- open, limited slip, locking, air, hydraulic, electronic, viscous, planetary</li> <li>- front and rear axle controls</li> <li>- bearings, seals, and gaskets</li> <li>- lubricating oils</li> </ul> <p>Perform inspection, diagnosis, troubleshooting, and service on final drive assemblies.</p> <ul style="list-style-type: none"> <li>- visual inspection</li> <li>- symptom diagnosis / noise and vibration</li> <li>- check unit bearing preload</li> <li>- check pinion bearing preload</li> <li>- check differential case side bearing preload</li> <li>- measure backlash</li> <li>- measure ring gear runout</li> <li>- determine tooth contact</li> <li>- patterns and corrections</li> <li>- perform adjustments - pinion depth</li> <li>- pinion preload</li> <li>- backlash and side bearing preload</li> <li>- patterns and corrections</li> <li>- perform axle shaft service procedures</li> <li>- retention, bearings and seals</li> <li>- perform differential service procedures</li> <li>- open and limited slip</li> </ul>
	<b>Course Outcome 4</b>	<b>Learning Objectives for Course Outcome 4</b>
	perform visual inspection, diagnose, troubleshoot,	LEARNING OUTCOMES AND CONTENT

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	<p>repair automatic transmission torque converter according to manufacturers standards.</p>	<p>Explain the basic fundamentals of fluid couplers and torque converters.</p> <ul style="list-style-type: none"> <li>- centrifugal force</li> <li>- torque transmission</li> <li>- torque multiplication</li> </ul> <p>Identify the specific torque converter components</p> <ul style="list-style-type: none"> <li>- impeller</li> <li>- turbine</li> <li>- stator, one way clutch</li> <li>- split guide rings</li> <li>- vane pitch</li> <li>- fixed vane</li> <li>- variable vane</li> <li>- piston lockup clutch</li> <li>- pressure plate, friction material, dampener</li> <li>- clutch controls, hydraulically, electronically</li> <li>- shafts</li> <li>- turbine</li> <li>- direct drive shaft</li> <li>- stator</li> <li>- pump drive</li> </ul> <p>Describe the operation of torque converters.</p> <ul style="list-style-type: none"> <li>- flow characteristics</li> <li>- vortex, rotary, and centrifugal force</li> </ul> <p>Continued.</p> <ul style="list-style-type: none"> <li>- impeller</li> <li>- turbine</li> <li>- stator / multi stator</li> <li>- pitch</li> <li>- fixed vane</li> <li>- variable vane</li> <li>- operational phases</li> <li>- stall phase</li> <li>- torque multiplication phase</li> <li>- coupling phase</li> <li>- lock-up phase</li> </ul> <p>Perform inspection, diagnosis, troubleshooting, and service on torque converters and controls.</p> <ul style="list-style-type: none"> <li>- perform unit inspection</li> <li>- leaks</li> <li>- contamination</li> <li>- endplay</li> <li>- drive surface</li> <li>- seal surface</li> <li>- perform functional / performance test</li> </ul>
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		<ul style="list-style-type: none"> <li>- check for noise and vibration</li> <li>- verify torque converter lockup and release operation</li> </ul>
	<b>Course Outcome 5</b>	<b>Learning Objectives for Course Outcome 5</b>
	describe the operation of automatic transmissions / transaxles according to manufacturers standards.	<p>LEARNING OUTCOMES AND CONTENT</p> <p>Explain the basic fundamentals of automatic transmissions / transaxles.</p> <ul style="list-style-type: none"> <li>- Pascals Law</li> <li>- basic hydraulics</li> <li>- force, area, pressure</li> <li>- hydraulic mechanical advantage</li> <li>- valve purpose: control, regulation, balanced, differential force.</li> <li>- simple planetary gear operation</li> </ul> <p>Identify the specific components and describe the basic operation of automatic transmissions / transaxles.</p> <ul style="list-style-type: none"> <li>- pumps</li> <li>- positive displacement o internal / external o gearotor o vane</li> <li>- variable displacement</li> <li>- control system / valve body</li> <li>- mainline or control pressure regulator</li> <li>- manual, throttle, governor, shift, and modulator valves</li> <li>- converter control valves</li> <li>- limit valves</li> <li>- apply devices</li> <li>- material types</li> <li>- bands</li> <li>- single / double wrap</li> <li>- flex / rigid</li> <li>- multiple disc clutches</li> </ul> <p>Continued</p> <ul style="list-style-type: none"> <li>- one-way clutches</li> <li>- sprag</li> <li>- roller</li> <li>- mechanical diode</li> <li>- gear sets and power flow</li> <li>- Simpson</li> <li>- Ravineaux</li> <li>- tandem compound</li> <li>- parking mechanism</li> <li>- park pawl and park gear</li> <li>- transmission / transaxle case passages and fluid circuits</li> <li>- filters</li> <li>- orifices, check balls</li> <li>- accumulators</li> <li>- pistons and servos</li> <li>- cooling / lubrication system</li> <li>- heat exchanger</li> <li>- lines</li> </ul>

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		<ul style="list-style-type: none"><li>- auxiliary cooling systems</li><li>- air cooled systems</li></ul>						
	<b>Course Outcome 6</b>	<b>Learning Objectives for Course Outcome 6</b>						
	perform visual inspection, diagnose, troubleshoot, repair automatic transmission / transaxles according to manufacturers standards.	<p>LEARNING OUTCOMES AND CONTENT</p> <p>Perform inspection, testing, and diagnosis procedures on automatic transmissions / transaxles.</p> <ul style="list-style-type: none"><li>- visual inspection</li><li>- fluid level checks</li><li>- road test procedures</li><li>- linkage adjustments</li><li>- hydraulic pressure testing</li><li>- power flow analysis</li><li>- noise and vibration</li><li>- identify component failures and causes</li></ul> <p>Perform service and repair procedures.</p> <ul style="list-style-type: none"><li>- determine disassembly sequence</li><li>- note cautions</li><li>- check for required end play</li><li>- air test</li><li>- identify and locate special tools</li><li>- disassemble transmission / transaxle</li><li>- identify components</li><li>- layout parts in order removed</li><li>- trace power flow through unit</li><li>- disassemble and inspect sub components</li><li>- perform required measurements</li><li>- locate selective washers</li><li>- locate thrust washers</li><li>- reassemble and test</li></ul>						
<b>Evaluation Process and Grading System:</b>	<table><tr><th>Evaluation Type</th><th>Evaluation Weight</th></tr><tr><td>shop</td><td>30%</td></tr><tr><td>Theory Tests</td><td>70%</td></tr></table>		Evaluation Type	Evaluation Weight	shop	30%	Theory Tests	70%
	Evaluation Type	Evaluation Weight						
	shop	30%						
Theory Tests	70%							
<b>Date:</b>	October 6, 2020							
<b>Addendum:</b>	Please refer to the course outline addendum on the Learning Management System for further information.							

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