



## COURSE OUTLINE: AST814 - DRIVE TRAIN SYSTEMS

Prepared: Stephen Kent

Approved: Corey Meunier, Chair, Technology and Skilled Trades

<b>Course Code: Title</b>	AST814: DRIVE TRAIN SYSTEMS
<b>Program Number: Name</b>	6069: AUTO SERV TN LEVEL 3
<b>Department:</b>	MOTIVE POWER APPRENTICESHIP
<b>Semesters/Terms:</b>	19S, 20W
<b>Course Description:</b>	Upon successful completion the apprentice will have the ability to explain the detailed operation of automatic transmissions/transaxles, the ability to perform visual inspection, diagnosis, troubleshoot and repair automatic transmissions/transaxles, hydraulic systems, electronic controls, and 4-wheel drive and all-wheel drive systems, and the ability to identify and define the basic operation of Hybrid/Alternate Drive Trains - all according to manufacturers` standards and recommendations.
<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>	<p>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.</p> <p>EES 2 Respond to written, spoken, or visual messages in a manner that ensures effective communication.</p> <p>EES 3 Execute mathematical operations accurately.</p> <p>EES 4 Apply a systematic approach to solve problems.</p> <p>EES 5 Use a variety of thinking skills to anticipate and solve problems.</p> <p>EES 6 Locate, select, organize, and document information using appropriate technology and information systems.</p> <p>EES 7 Analyze, evaluate, and apply relevant information from a variety of sources.</p> <p>EES 8 Show respect for the diverse opinions, values, belief systems, and contributions of others.</p> <p>EES 9 Interact with others in groups or teams that contribute to effective working relationships and the achievement of goals.</p> <p>EES 10 Manage the use of time and other resources to complete projects.</p> <p>EES 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>V. EVALUATION PROCESS/GRADING SYSTEM:</p> <p>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</p>



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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:**

Course Outcome 1	Learning Objectives for Course Outcome 1
Perform visual inspection, diagnosis, troubleshoot, and repair automatic transmission / transaxle hydraulic systems according to manufacturers standards.	<ul style="list-style-type: none"> <li>- Identify the specific components and describe the detailed operation of automatic transmission / transaxle hydraulics.</li> <li>- pumps</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>- flow control</li> <li>- detent valves</li> <li>- hydraulic, mechanical, electrical and electronic control</li> <li>- hydraulic circuits and schematics</li> </ul> <p>Perform inspection, testing, and diagnosis procedures on automatic transmissions / transaxle hydraulics.</p> <ul style="list-style-type: none"> <li>- test hydraulic system pressure</li> <li>- perform pump service</li> <li>- visual inspection</li> <li>- measurements</li> </ul>

	<ul style="list-style-type: none"> <li>- clearance checks</li> <li>- inspect and service valve body</li> <li>- perform failure analysis</li> </ul>
<b>Course Outcome 2</b>	<b>Learning Objectives for Course Outcome 2</b>
Explain the detailed operation of automatic transmissions / transaxles according to manufacturers standards.	<p>Explain the detailed operation of automatic transmission / transaxle applied and mechanical devices</p> <ul style="list-style-type: none"> <li>- applied hydraulic circuits and schematics</li> <li>- driving and holding devices o bands o servos and pistons o clutches o one-way clutches</li> <li>- gear train power flow</li> <li>- Simpson</li> <li>- Ravigneaux</li> <li>- Tandem compound</li> </ul>
<b>Course Outcome 3</b>	<b>Learning Objectives for Course Outcome 3</b>
Perform visual inspection, diagnosis, troubleshoot, and repair automatic transmission / transaxles following manufacturers' recommendations.	<p>Perform inspection, testing, and diagnosis procedures on automatic transmissions / transaxles.</p> <ul style="list-style-type: none"> <li>- visual inspection</li> <li>- evaluate fluid level and condition</li> <li>- interpret road test results</li> <li>- access on board diagnostics and analyze data</li> <li>- access applicable service information / technical service bulletins</li> <li>- adjust linkage</li> <li>- interpret hydraulic pressure test results</li> <li>- power flow analysis</li> <li>- shift evaluation</li> <li>- symptom based diagnosis of transmission / component failures</li> <li>- identify specific component failure and causes</li> </ul> <p>Perform and explain service and repair procedures.</p> <ul style="list-style-type: none"> <li>- determine disassembly sequence</li> <li>- note cautions</li> <li>- air test</li> <li>- identify and locate special tools</li> <li>- perform required measurements</li> <li>- identify and determine manufacturers specific corrections</li> <li>- selective washers</li> <li>- clutch components</li> </ul> <ul style="list-style-type: none"> <li>- disassemble transmission / transaxle</li> <li>- identify components</li> <li>- trace power flow through unit</li> <li>- disassemble and inspect sub components</li> <li>- perform failure analysis</li> <li>- re-assemble and verify correct function</li> <li>- change automatic transmission fluid and filters</li> <li>- perform flushing of assemblies</li> <li>- identify cautions to be observed during removal and replacement</li> </ul>

<b>Course Outcome 4</b>	<b>Learning Objectives for Course Outcome 4</b>
Perform preliminary checks, diagnosis, troubleshoot, and repair automatic transmission / transaxles electronic controls according to manufacturers` recommendations.	<p>Identify and describe specific applications of automatic transmission / transaxle electronic controls.</p> <ul style="list-style-type: none"> <li>- power train control units (PCU)</li> <li>- input devices (sensors) speed, position, pressure, temperature</li> <li>- output devices (solenoids, relays) pressure, shift, torque converter clutch controls (TCC)</li> <li>- data lines / communications</li> <li>- on board diagnostics</li> <li>- scan tool utilization</li> <li>- code access</li> <li>- effects on performance characteristics</li> <li>- shift timing</li> <li>- shift feel</li> <li>- torque</li> <li>- fuel economy</li> <li>- integrated vehicle control systems</li> <li>- engine control module</li> <li>- body control module</li> <li>- suspension / traction control / electronic brake control module</li> </ul> <p>Perform and interpret results of functional and diagnostic tests on automatic transmission / transaxle electronic controls</p> <ul style="list-style-type: none"> <li>- component testing</li> <li>- input devices</li> <li>- output devices</li> </ul> <ul style="list-style-type: none"> <li>- scan tool utilization</li> <li>- data lines / communications</li> <li>- on board diagnostics</li> <li>- code access</li> <li>- shift adaptives</li> <li>- perform performance testing</li> <li>- test pressure controls</li> <li>- test shift controls</li> <li>- test TCC control</li> <li>- test integrated vehicle control systems</li> <li>- engine control module</li> <li>- body control module</li> <li>- suspension / traction control / electronic brake control module</li> </ul>
<b>Course Outcome 5</b>	<b>Learning Objectives for Course Outcome 5</b>
Perform visual inspection, diagnosis, troubleshoot, repair 4 wheel drive and all wheel drive systems according to manufacturers, recommendations.	<p>Explain the fundamentals of 4 wheel drive and all wheel drive systems.</p> <ul style="list-style-type: none"> <li>- function, types, styles and applications</li> <li>- 4 wheel drive</li> <li>- part time</li> <li>- full time</li> </ul>



	<p>Describe the operation of 4 wheel and all-wheel drive systems.</p> <ul style="list-style-type: none"> <li>- 4 wheel drive components and variations</li> <li>- all-wheel drive components and variations</li> <li>- automatic / manual locking hubs</li> <li>- axle disconnects</li> <li>- electric / vacuum actuators</li> <li>- viscous drive</li> <li>- rear drive modules (RDM)</li> <li>- controls and indicators</li> <li>- electronic sensors</li> </ul> <p>Perform inspection, testing, and diagnostic procedures on 4 wheel drive and all wheel drive systems.</p> <ul style="list-style-type: none"> <li>- inspect wheel circumference</li> <li>- identify operating ranges</li> <li>- describe the removal and installation procedures</li> <li>- perform measurements and adjustments</li> <li>- identify component failures and causes</li> </ul>				
	<table border="1"> <tr> <td><b>Course Outcome 6</b></td> <td><b>Learning Objectives for Course Outcome 6</b></td> </tr> <tr> <td>Identify and define the basic operation of Hybrid / Alternate Drive Trains according to manufacturers' standards.</td> <td> <p>Identify and define hybrid / alternate drive trains applications.</p> <ul style="list-style-type: none"> <li>- CVT / continuously variable transmission</li> <li>- Sentronic / manual transmission automatically controlled (manumatic)</li> <li>- Hybrid Drive Trains</li> <li>- CVT</li> <li>- Transmission / transaxle</li> <li>- BAS / belt alternator starter</li> <li>- IMA / integrated motor assist</li> <li>- ISAD / integrated starter alternator dampner</li> <li>- 2 Mode</li> <li>- Motor / Generator (MG1, MG2)</li> <li>- Auxiliary Drive Trains</li> <li>- Electric Drive Trains</li> </ul> <p>Servicing Hybrid Vehicles.</p> <ul style="list-style-type: none"> <li>- identify safety precautions</li> <li>- manufacturers safety procedures</li> <li>- high voltage</li> <li>- protective equipment</li> <li>- battery disconnect procedures</li> </ul> </td> </tr> </table>	<b>Course Outcome 6</b>	<b>Learning Objectives for Course Outcome 6</b>	Identify and define the basic operation of Hybrid / Alternate Drive Trains according to manufacturers' standards.	<p>Identify and define hybrid / alternate drive trains applications.</p> <ul style="list-style-type: none"> <li>- CVT / continuously variable transmission</li> <li>- Sentronic / manual transmission automatically controlled (manumatic)</li> <li>- Hybrid Drive Trains</li> <li>- CVT</li> <li>- Transmission / transaxle</li> <li>- BAS / belt alternator starter</li> <li>- IMA / integrated motor assist</li> <li>- ISAD / integrated starter alternator dampner</li> <li>- 2 Mode</li> <li>- Motor / Generator (MG1, MG2)</li> <li>- Auxiliary Drive Trains</li> <li>- Electric Drive Trains</li> </ul> <p>Servicing Hybrid Vehicles.</p> <ul style="list-style-type: none"> <li>- identify safety precautions</li> <li>- manufacturers safety procedures</li> <li>- high voltage</li> <li>- protective equipment</li> <li>- battery disconnect procedures</li> </ul>
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**Evaluation Process and Grading System:**

Evaluation Type	Evaluation Weight
shop	30%
Theory Tests	70%

**Date:** June 20, 2019

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

