



## COURSE OUTLINE: AST712 - ENGINE SYSTEMS

Prepared: Stephen Kent

Approved: Corey Meunier, Chair, Technology and Skilled Trades

<b>Course Code: Title</b>	AST712: ENGINE SYSTEMS
<b>Program Number: Name</b>	
<b>Department:</b>	MOTIVE POWER APPRENTICESHIP
<b>Semesters/Terms:</b>	21F, 22F
<b>Course Description:</b>	Upon successful completion the apprentice will have the ability to: explain the operating characteristics, perform inspection and service of camshafts and valve train according to manufacturers standards. Also explain the service procedures, perform inspection, measurement and replacement procedures of engine cylinder heads and related components according to manufacturers standards. The student will also explain the operation, perform inspection, diagnosis and replacement procedures of turbochargers, superchargers and related components according to manufacturers standards.
<b>Total Credits:</b>	4
<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  A minimum program GPA of 2.0 or higher where program specific standards exist is required

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 2021-2022 academic year.



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for graduation.

**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: 4th Canadian

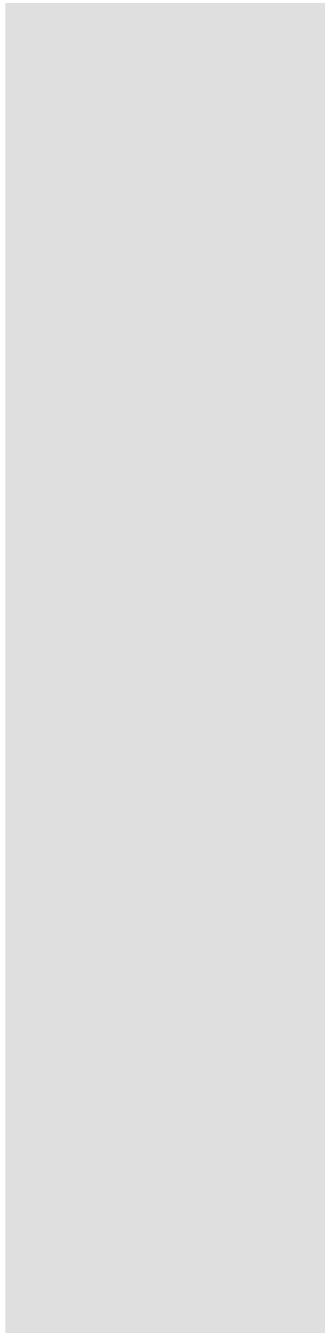
**Course Outcomes and Learning Objectives:**

Course Outcome 1	Learning Objectives for Course Outcome 1
Explain the operating characteristics, perform inspection and service of camshafts and valve train according to manufacturer's standards.	Potential elements of the performance: Explain the fundamentals of camshafts and valve train assemblies. <ul style="list-style-type: none"><li>- camshafts</li><li>- valve timing</li><li>- lead, lag, overlap, duration</li><li>- valve train alignment</li><li>- degreasing a camshaft</li><li>- relationship of valves to piston position</li><li>- interpret and draw valve timing diagram</li></ul>

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- camshaft location and drive mechanisms
  - valve train assemblies
- Describe the characteristics and application of camshafts and valve train components.
- camshafts
  - valve train mechanisms
  - bearings, including split and bushing styles
  - sprockets and gears
  - thrust controls
  - chains
  - belts
  - timing covers
  - specific gaskets and seals
- Explain the operating principles of valve train and camshaft components.
- camshafts
  - valve train drive mechanisms
  - chains
  - belts
  - gears and sprockets
  - bearings, including split and bushing styles
  - thrust controls
  - camshaft bearing removal and installation
- Perform recommended inspection and testing procedures on camshafts and valve train components.
- visual inspection
  - perform disassembly procedures
  - check lobe wear
  - check journal wear and thrust wear
  - check camshaft warpage
  - check bearing wear
  - check timing chain, belt wear
  - check tensioners, guides and idlers
  - check lifters, rocker arms
- Perform recommended service operations.
- remove and install timing belts and chains
  - adjust timing chains and belts
  - perform valve adjustment on a variety of styles

**Course Outcome 2**

**Learning Objectives for Course Outcome 2**

Explain the service procedures, perform inspection, measurement and replacement procedures of engine cylinder heads and related

Potential elements of the performance:  
Define the fundamentals of engine cylinder heads and components.

- valves
- seats

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components according to manufacturers` standards.

- guides
- valve seals
- valve springs
- rocker arms and shafts
- push rods
- lifters, followers, lash controllers and variable valve actuators
- combustion chamber designs
- specific related gaskets

Explain the characteristics and applications of engine cylinder heads and components.

- valves
- seats
- guides
- valve seals
- valve springs
- rocker arms and shafts
- push rods
- lifters, followers, lash controllers and variable valve actuators
- combustion chamber designs
- specific related gaskets

Explain the recommended service procedures for engine cylinder heads and related components.

- cylinder head and intake manifold resurfacing
- cylinder head removal and disassembly procedures
- valve guide reaming, replacement, liner installation
- valve and valve seat interference angles
- valve seat width
- valve seal replacement
- valve spring inspection and installation
- valve retainers and rotators
- cylinder head installation procedures

Perform inspection and measuring procedures on engine cylinder heads and related components.

- disassembly procedures
- perform cleaning procedures
- visual inspection
- check for cracks
- check for cylinder head distortion
- check for valve guide wear
- check valve spring condition
- check valve condition
- check surface finish

Explain recommended service and reconditioning procedures on engine cylinder heads and related components.

- valve resurfacing
- seat cutting, grinding and replacing

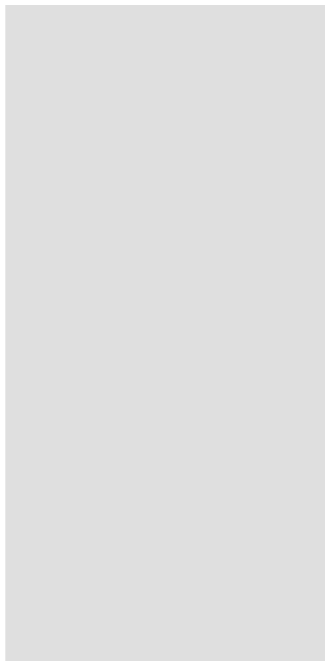
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	<ul style="list-style-type: none"> <li>- valve guides</li> <li>- valve spring installation</li> <li>- head re-surfacing</li> <li>- verify valve to seat contact and sealing</li> </ul>
<b>Course Outcome 3</b>	<b>Learning Objectives for Course Outcome 3</b>
To explain the operation, perform inspection, diagnosis and replacement procedures of turbochargers, superchargers and related components according to manufacturer`s standards.	<p>Potential elements of the performance: Define the purpose and fundamentals of turbochargers and superchargers.</p> <ul style="list-style-type: none"> <li>- relationship to</li> <li>- volumetric efficiency</li> <li>- air temperature</li> <li>- air flow rates</li> <li>- electronic monitoring and controls</li> </ul> <p>Describe the characteristics and application of turbochargers, superchargers and related components.</p> <ul style="list-style-type: none"> <li>- turbochargers</li> <li>- housings, shaft, turbine, wheels, drive mechanisms, seals, bearings</li> <li>- intercoolers</li> <li>- controls</li> <li>- wastegate and exhaust system</li> <li>- exhaust thrust</li> <li>- electronic and mechanical</li> <li>- lubrication</li> <li>- oils, passages, lines</li> <li>- cooling</li> <li>- cooling</li> <li>- liquid coolant, air flow</li> <li>- intercoolers</li> <li>- superchargers</li> <li>- housings, drive mechanisms, shaft, rotors, bearings, seals - air flow</li> <li>- controls</li> <li>- power relief</li> <li>- boost control</li> <li>- electronic and mechanical</li> </ul> <p>Explain the principles of operation of turbochargers and superchargers.</p> <ul style="list-style-type: none"> <li>- turbochargers</li> <li>- boost pressures</li> <li>- wastegate</li> <li>- filtered air</li> <li>- exhaust gaskets</li> <li>- oil feed and pressure</li> <li>- exhaust pressures `` superchargers</li> <li>- low and high pressure</li> <li>- air flow</li> </ul>

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- controls
- Perform recommended service procedures on turbochargers and related components.
- inspect boost pressure and controls
  - examine wastegate operation
  - perform axial and radial runout checks
  - measure end play
  - inspect for air, oil, coolant and exhaust leaks
  - verify oil supply and pressure
  - research lubrication and cooling requirements
  - clean air flow passages
  - research replacement procedures
  - research startup and shutdown procedures
  - check for intercooler leaks and restrictions
- Perform recommended service procedures on superchargers and related components.
- inspect boost pressure and controls
  - perform clearance checks
  - perform axial and radial runout checks
  - measure rotor end play
  - inspect for air, oil and coolant leaks
  - research lubrication and cooling requirements

**Evaluation Process and Grading System:**

Evaluation Type	Evaluation Weight
Shop	40%
Theory Tests	60%

**Date:**

July 30, 2021

**Addendum:**

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

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