



## COURSE OUTLINE: AST612 - ENGINE SYSTEMS

Prepared: Stephen Kent

Approved: Corey Meunier, Chair, Technology and Skilled Trades

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| <b>Course Code: Title</b>   | AST612: ENGINE SYSTEMS   |
| <b>Program Number: Name</b>   |  |
| <b>Department:</b>  | MOTIVE POWER APPRENTICESHIP  |
| <b>Semesters/Terms:</b>   | 21F, 22W, 22F  |
| <b>Course Description:</b>  | <p>The internal combustion engine course has been designed to give the student a sound working knowledge of the construction, operating principles, testing and servicing of internal combustion engine assemblies. It will also give them the opportunity to dismantle short block assemblies for testing and inspection of internal components. The students will also learn the recommended cylinder block rebuilding procedures</p> <p>. Students will be required to follow proper safety procedures when performing the above tasks according to both Sault College Motive Power Department Standards and Vehicle Manufacturers safety regulations and specifications.</p>   |
| <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  |

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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A minimum program GPA of 2.0 or higher where program specific standards exist is required for graduation.

**Other Course Evaluation & Assessment Requirements:**

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.

(Students will be given notice of test and assignment dates in advance)

**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 of internal combustion engines and perform engine disassembly / re- assembly procedures according to accepted industry standards. | 1.1 Define engine terminology.<br>inertia<br>force and energy<br>torque<br>bore<br>stroke<br>swept volume<br>displacement<br>clearance volume<br>compression ratio<br>compression pressure<br>volumetric efficiency<br>mechanical efficiency<br>thermal efficiency<br>power measurement<br>mean effective pressure<br>Boyle`s Law, Charles Law<br><br>1.2 Explain the principles of operation of internal combustion engines.<br>four-stroke cycle gasoline<br>Otto cycle<br>Atkinson cycle<br>Miller cycle<br>two-stroke cycle gasoline<br>four-stroke diesel<br>rotary<br><br>1.3 Perform applied calculations to verify engine performance measurements.<br>swept volume<br>piston displacement |

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|  | <p>compression ratio<br/>compression pressure<br/>thermal efficiency<br/>power measurements</p> <p>1.4 Perform recommended engine component identification.<br/>identify moving and stationary engine components<br/>identify proper disassembly / re-assembly sequence<br/>identify components requiring marking<br/>identify areas of components requiring measuring<br/>identify areas requiring lubrication on reassembly<br/>identify torque requirements</p>  |
| <b>Course Outcome 2</b>  | <b>Learning Objectives for Course Outcome 2</b>   |
| Explain the construction and operating principles of cylinder block assemblies and components.   | <p>2.1 Explain the design of cylinder block and components.<br/>cylinder blocks<br/>cylinders and sleeves<br/>wall finish<br/>pistons and related components<br/>alignment<br/>thrust offset<br/>connecting rods<br/>bearings</p> <p>2.2 Describe the types and configurations of cylinder blocks and components.<br/>cylinder blocks, inline, rotary, opposed and V type<br/>cylinders and sleeves<br/>wall finish<br/>pistons and related components<br/>connecting rods<br/>bearings</p> <p>2.3 Describe the operations of cylinder block and components.<br/>cylinder blocks<br/>cylinders and sleeves<br/>wall finish<br/>pistons and related components<br/>connecting rods</p> |
| <b>Course Outcome 3</b>  | <b>Learning Objectives for Course Outcome 3</b>   |
| Perform recommended inspection / testing of cylinder block and components and explain recommended rebuilding procedures according to manufacturers standards | <p>3.1 Perform recommended inspection and testing procedures on cylinder block and components and evaluate suitability for service.<br/>perform general cleaning procedures<br/>solvents<br/>equipment<br/>inspect carbon buildup on pistons<br/>inspect for cylinder ridge<br/>cylinder block dismantling / assembly procedures<br/>visual inspection of engine short block component assemblies<br/>perform measurements for:<br/>cylinder wear</p>   |

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|  |  | <p>deck warpage<br/>main bore alignment<br/>piston wear/damage<br/>connecting rod alignment</p> <p>3.2 Describe recommended cylinder block rebuilding procedures.<br/>cylinder boring, honing and deglazing<br/>replacement of piston and piston pin<br/>inspect piston ring, replace and check end gap and side clearance<br/>inspect connecting rod<br/>line boring or honing<br/>deck resurfacing, cutters, grinders and sanders</p>   |
|  | <b>Course Outcome 4</b>  | <b>Learning Objectives for Course Outcome 4</b>   |
|  | <p>Explain the operation of crankshafts and bearings, and perform recommended inspection and measuring procedures according to manufacturers design.</p> | <p>4.1 Explain the design and application of engine crankshafts and bearings.<br/>crankshafts<br/>engine bearings<br/>balance shafts<br/>torsional impulse neutralizers<br/>flywheels</p> <p>4.2 Describe the principles of operation of engine crankshafts and bearings.<br/>crankshafts journals<br/>engine block bearings</p> <p>4.3 Describe the procedures and equipment used for servicing engine crankshafts and bearings.<br/>inspection and reconditioning of the crankshaft<br/>inspection and fitting of the crankshaft bearings</p> <p>4.4 Describe the effect of the following in relation to engine performance.<br/>piston speed and acceleration<br/>balance shafts and gears<br/>crankshaft counterweights<br/>number of engine cylinders<br/>flywheel design features<br/>intake and exhaust timing<br/>static and dynamic imbalance</p> <p>4.5 Perform recommended inspection / measuring procedures on engine crankshaft and bearings.<br/>perform visual inspection<br/>measure crankshaft end play<br/>check journal wear<br/>measure bearing clearance<br/>check bearing wear<br/>check crankshaft warpage</p> |

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**Evaluation Process and Grading System:**

| <b>Evaluation Type</b> | <b>Evaluation Weight</b> |
|------------------------|--------------------------|
| 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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