SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

COURSE TITLE:	INTERNAL COMBUSTION ENGINES		
CODE NO. :	AST612	**APP LEVEL:**	ONE
PROGRAM:	AUTOMOTIVE SERVICE TECHNICIAN APPRENTICESHIP (6067)		
AUTHOR:	STEPHEN KENT		
DATE:	December 2015	**PREVIOUS OUTLINE DATED:**	August 2015
APPROVED:	*"Corey Meunier"* **CHAIR**		
TOTAL CREDITS:	Four		
PREREQUISITE(S):	NIL		
HOURS/WEEK:	Taught in eight-week block format (36 Hours)		

I. COURSE DESCRIPTION:

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

. 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.

II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:

Upon successful completion of this course, the student will demonstrate the ability to:

1. Explain the operating characteristics of internal combustion engines and perform engine disassembly / re- assembly procedures according to accepted industry standards.

Potential Elements of the Performance:

Define engine terminology.

- inertia
- force and energy
- torque
- bore
- stroke
- swept volume
- displacement
- clearance volume
- compression ratio
- compression pressure
- volumetric efficiency
- mechanical efficiency
- thermal efficiency
- power measurement
- mean effective pressure
- Boyle’s Law, Charles’ Law

Explain the principles of operation of internal combustion engines.

- four-stroke cycle gasoline
    - Otto cycle
    - Atkinson cycle
    - Miller cycle
- two-stroke cycle gasoline
- four-stroke diesel
- rotary

Perform applied calculations to verify engine performance measurements.

- swept volume
- piston displacement
- compression ratio
- compression pressure
- thermal efficiency
- power measurements

Perform recommended engine component identification.

- identify moving and stationary engine components
- identify proper disassembly / re-assembly sequence
- identify components requiring marking
- identify areas of components requiring measuring
- identify areas requiring lubrication on reassembly
- identify torque requirements

2. **Explain the construction and operating principles of cylinder block assemblies and components.**

Potential Elements of the Performance:

Explain the design of cylinder block and components.

- cylinder blocks
- cylinders and sleeves
    - wall finish
- pistons and related components
    - alignment
    - thrust offset
- connecting rods
- bearings

Describe the types and configurations of cylinder blocks and components.

- cylinder blocks – inline, rotary, opposed and V type
- cylinders and sleeves
  - wall finish
- pistons and related components
- connecting rods
- bearings

Describe the operations of cylinder block and components.

- cylinder blocks
- cylinders and sleeves
- wall finish
- pistons and related components
- connecting rods
- bearings

3. Perform recommended inspection / testing of cylinder block and components and explain recommended rebuilding procedures according to manufacturers' standards

Potential Elements of the Performance:

Perform recommended inspection and testing procedures on cylinder block and components and evaluate suitability for service.

- perform general cleaning procedures
  - solvents
  - equipment
- inspect carbon buildup on pistons
- inspect for cylinder ridge
- cylinder block dismantling / assembly procedures
- visual inspection of engine short block component assemblies
- perform measurements for:
  - cylinder wear
  - deck warpage
  - main bore alignment
  - piston wear/damage
  - connecting rod alignment

Describe recommended cylinder block rebuilding procedures.

- cylinder boring, honing and deglazing
- replacement of piston and piston pin
- inspect piston ring, replace and check end gap and side clearance
- inspect connecting rod
- line boring or honing
- deck resurfacing, cutters, grinders and sanders

4. Explain the operation of crankshafts and bearings, and perform recommended inspection and measuring procedures according to manufacturers' design.

Potential Elements of the Performance:

Explain the design and application of engine crankshafts and bearings.

- crankshafts
- engine bearings
- balance shafts
- torsional impulse neutralizers
- flywheels

Describe the principles of operation of engine crankshafts and bearings.

- crankshafts journals
- engine block bearings

Describe the procedures and equipment used for servicing engine crankshafts and bearings.

- inspection and reconditioning of the crankshaft
- inspection and fitting of the crankshaft bearings

Describe the effect of the following in relation to engine performance.

- piston speed and acceleration
- balance shafts and gears
- crankshaft counterweights
- number of engine cylinders
- flywheel design features
- intake and exhaust timing
- static and dynamic imbalance

Perform recommended inspection / measuring procedures on engine crankshaft and bearings.

- perform visual inspection
- measure crankshaft end play
- check journal wear
- measure bearing clearance
- check bearing wear
- check crankshaft warpage

III. TOPICS:

1 Operating characteristics of internal combustion engines
2 Construction and operating principles of cylinder block assemblies and components
3. Perform recommended inspection / testing of cylinder block and components
4. Explain the operation of crankshafts and bearings.

IV. REQUIRED RESOURCES/TEXTS/MATERIALS:

Automotive Technology Third Canadian Edition

Pens, pencils, calculator, 3-ring binder

The following items are mandatory in the shop:

- shop coat or coveralls
- CSA approved steel toe boots (high top)
- CSA approved safety glasses

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 – 60% of the final grade is comprised of term tests.
- Assignments – 10% of the final grade is comprised of a number of technical reports.
- 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)

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.

If a faculty member determines that a student is at risk of not being successful in their academic pursuits and has exhausted all strategies available to faculty, student contact information may be confidentially provided to Student Services in an effort to offer even more assistance with options for success. Any student wishing to restrict the sharing of such information should make their wishes known to the coordinator or faculty member.

VI. SPECIAL NOTES:

Attendance:
Sault College is committed to student success. There is a direct correlation between academic performance and class attendance; therefore, for the benefit of all its constituents, all students are encouraged to attend all of their scheduled learning and evaluation sessions. This implies arriving on time and remaining for the duration of the scheduled session.

It is the departmental policy that once the classroom door has enclosed, the learning process has begun. Late arrivers will not be granted admission to the room.

VII. COURSE OUTLINE ADDENDUM:

The provisions contained in the addendum located on the Student Portal, form part of this course outline.