COURSE OUTLINE: HET713 - ENGINE SYSTEMS

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Course Code: Title	HET713: ENGINE SYSTEMS
Program Number: Name	
Department:	MOTIVE POWER APPRENTICESHIP
Semesters/Terms:	21F, 22W, 22S
Course Description:	Upon successful completion the apprentice is able to describe testing procedures for combustion chamber condition, is able to describe the testing and servicing procedures for cylinder heads, valve trains and related components, cooling systems components and coolants, lubricating systems components and lubricants, and air induction and exhaust systems - all following manufacturers` recommendations and safe work practices.
Total Credits:	4
Hours/Week:	0
Total Hours:	24
Prerequisites:	There are no pre-requisites for this course.
Corequisites:	There are no co-requisites for this course.
Essential Employability Skills (EES) addressed in this course:	EES 2 Respond to written, spoken, or visual messages in a manner that ensures effective communication. EES 3 Execute mathematical operations accurately. EES 4 Apply a systematic approach to solve problems. EES 5 Use a variety of thinking skills to anticipate and solve problems. EES 6 Locate, select, organize, and document information using appropriate technology and information systems. EES 7 Analyze, evaluate, and apply relevant information from a variety of sources. EES 10 Manage the use of time and other resources to complete projects.
General Education Themes:	Science and Technology
Course Evaluation:	Passing Grade: 50%, D A minimum program GPA of 2.0 or higher where program specific standards exist is required for graduation.
Other Course Evaluation & Assessment Requirements:	Theory testing 70% Practical application testing 30% Grade Definition Grade Point Equivalent A+ 90 - 100% 4.00 A 80 - 89%

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.

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:

medium/heavy duty truck engines,fuels and computerized management systems by Sean Bennett
Publisher: cengage Edition: 7

Course Outcomes and Learning Objectives:

Course Outcome 1	Learning Objectives for Course Outcome 1
Upon successful completion the apprentice is able to describe the testing and servicing procedures of an engine short block assembly following manufacturers recommendations.	Upon successful completion, the apprentice is able to: 3.1.1 Explain the fundamentals of the engine short block components. 3.1.2 Identify the construction features of the engine short block components. [2/0] - cylinder block - parent/Enbloc - liner types - wet - dry - liner construction materials - crankshaft and bearings construction - thrust bearings - connecting rod to piston attaching methods - designs of connecting rod mating surfaces - cracked rod (fractured) [2/0] - bore - stroke - engine displacement - stress areas - engine efficiency - calculations - torque rise - overview of block types - wet/dry sleeves - parent/Enbloc (No liners) - anti vibration methods - cooling and lubrication methods - camshaft bearings 3.1.2 Identify the construction features of the engine short block components. [2/0] - cylinder block - parent/Enbloc

		- liner types - wet - dry - liner construction materials - crankshaft and bearings construction - thrust bearings - connecting rod to piston attaching methods - designs of connecting rod mating surfaces - cracked rod (fractured) - piston features, types and construction materials - forged steel - composite steel - aluminum - articulating - cam ground - piston cooling methods - piston ring types - anti-vibration devices - vibration dampers - viscous - rubber - balance shafts - covers, seals, and gaskets - fly-wheel types - camshaft bearings 3.1.3 Describe the principles of operation of the engine short block components. [1/0] - cylinder block - wet versus dry sleeve engines - sleeve materials - crankshaft and bearings construction - thrust bearings - connecting rod to piston attaching methods - designs of connecting rod mating surfaces - cracked rod - pistons - one-piece (trunk type) - forged steel - composite steel - aluminum - articulating - cam ground - piston cooling methods - piston ring types - anti-vibration devices - vibration dampers - viscous - rubber - balance shafts - flywheel types - camshaft bearings

Course Outcome 2	Learning Objectives for Course Outcome 2
Upon successful completion the apprentice is able to demonstrate the diagnostic procedures used for engines following manufacturers recommendations.	Upon successful completion, the apprentice is able to: 3.2.1 Explain the fundamentals of engine diagnosis. [3/0] - identify diagnostic procedures to verify engine performance complaints - power loss - noises - oil consumption - exhaust smoke - excessive - blue - white - black - vibrations - coolant consumption - external leaks - overheating - overcooling - hard starting - excessive fuel consumption 3.2.2 Identify engine performance test procedures following manufacturers` recommendations and safe work practices. [1/2] - demonstrate the following using a stall test - fuel pressure - torque, power - operating temperatures - exhaust /intake temperatures - intake pressures - exhaust pressures - crankcase pressures - stall speeds - electronic monitoring - boost pressure 3.2.3 Perform failure analysis following the manufacturers` recommended procedures. [2/4] - Blocks - warpage - cracks - corrosion - wear - crankshafts/camshafts - breakage - bending - lack of lubrication - wear/scoring - cracks - sleeves - erosion - corrosion

	- wear/scoring - cracks - protrusion height - pistons, rings, pins, piston cooling devices - wear/scoring - cracks - overheating - seizure - connecting rod - bending/twisting - bore distortions - cracks - stretch - fastener failures - flywheels - distortion - anti vibration devices - separation - cracks - leakage - bearings and seals - wear /scoring - cracks - overheating - seizure - diagnostic tests to determine root cause failures for: - cooling system components - lubrication system components - engine oil contamination - coolant contamination
Course Outcome 3	**Learning Objectives for Course Outcome 3**
Upon successful completion the apprentice is able to describe the testing and servicing procedures for engine short block reconditioning following manufacturers recommendations.	Upon successful completion, the apprentice is able to: 3.3.1 Explain the fundamentals of engine short block reconditioning. [1.5/0] - procedures for: - piston pin fits and tolerances, including press fit, burnishing and honing - cylinder ridge removal, de-glazing, honing, and boring - cylinder sleeve removal, fits, tolerances, and installation - cylinder block counter bore and sleeve protrusion - precision measuring devices - camshaft bearing replacement 3.3.2 Identify the construction features of equipment required for cylinder sleeve reconditioning, removal, and replacement. [1/0] - ridge remover - de-glazer - hone - counter-bore reconditioner - liner puller

	3.3.3 Describe the principles of operation of the equipment for cylinder sleeve reconditioning, removal and replacement. [1.5/0] - cylinder service equipment - ridge removal - de-glazing - honing - sleeve installation - counter boring - cleaning equipment - cleaning solutions - material reaction 3.3.4 Demonstrate inspection and testing procedures following manufacturers` recommendations for engine short block components. [1/2] - clean the engine block - oil passages - coolant passages - post cleaning corrosion protection - internal protective coating integrity - external surfaces - clean piston and connecting rod assemblies - cleaning agents - carbon removal - block distortion and gasket surface checks - crankshaft checks - end play - bearing clearance - plastigage - flywheel run-out - rod side clearance checks - piston ring side clearance and end gap checks

Evaluation Process and Grading System:

Evaluation Type	Evaluation Weight
practical application testing	30%
theory testing	70%

Date: July 30, 2021

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