COURSE OUTLINE: HET815 - FUEL SYSTEMS

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Course Code: Title	HET815: FUEL SYSTEMS
Program Number: Name	6086: HDE TECH LEVEL III
Department:	MOTIVE POWER APPRENTICESHIP
Semesters/Terms:	20W
Course Description:	Upon successful completion the apprentice is able to recommend the testing and servicing procedures for diesel fuel injection partial-authority engine management systems, is able to recommend repairs for diesel fuel injection full-authority engine management systems and is able to interpret the exhaust emissions produced by diesel engines following manufacturers` recommendations.
Total Credits:	5
Hours/Week:	5
Total Hours:	40
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 1 Communicate clearly, concisely and correctly in the written, spoken, and visual form that fulfills the purpose and meets the needs of the audience. 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 8 Show respect for the diverse opinions, values, belief systems, and contributions of others. EES 9 Interact with others in groups or teams that contribute to effective working relationships and the achievement of goals. EES 10 Manage the use of time and other resources to complete projects. EES 11 Take responsibility for ones own actions, decisions, and consequences.
Course Evaluation:	Passing Grade: 50%, D
Other Course Evaluation & Assessment Requirements:	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.

Course Outcomes and Learning Objectives:

Course Outcome 1	Learning Objectives for Course Outcome 1
Upon successful completion the apprentice is able to recommend the testing and servicing procedures for diesel fuel injection partial-authority engine management systems following manufacturers` recommendations.	5.1.1 Explain the fundamentals of partial-authority, electronic diesel engine management systems. - purpose, function, types, styles, and application inline system electronic engine management controls distributor systems - fundamentals enhancement transducers thermister negative/positive coefficient potentiometers magnetic engine timing requirements o static o electronic advance - overview of inline and distributor pump systems adapted electronic engine controls 5.1.2 Identify the construction features of partial-authority, electronic diesel engine management systems and components. - inline system rack actuators rack position sensors brushless torque motors (BTM) transducers - distributor systems inlet metering sleeve metering timing controls hydraulic head controls - electronic controls servo controls pulse wheels linear magnet variable timing control electronic governor hall effect sensor - hydraulic injectors hydraulic nozzle holders pintle nozzles multi-orifii nozzles

		- high pressure pipes - leak- off lines - fuel manifolds 5.1.3 Describe the principles of operation of partial-authority, electronic diesel engine management systems and components. - inline system rack actuators rack position sensors brushless torque motors (BTM) transducers - distributor systems inlet metering sleeve metering timing controls hydraulic head controls - electric controls servo controls pulse wheels linear magnet variable timing control electronic governor hall effect sensor - hydraulic injectors hydraulic nozzle holders pintle nozzles multi-orifii nozzles - high pressure pipes - leak- off lines - fuel manifolds 5.1.4 Demonstrate inspection, testing and diagnostic procedures following manufacturers` recommendations for partial-authority, electronic diesel engine management systems and components. - identify components and their location - recommended tests on system input sensors and output devices - reader/programmer/personal computer software diagnostics on the inline systems 5.1.5 Recommend reconditioning or repair procedures following manufacturers` recommendations for partial-authority electronic diesel engine management systems and components. - outline the recommended repair procedures for fuel injection systems electronic connections wiring harness connector repairs circuit resistance tests pump replacement

Course Outcome 2	Learning Objectives for Course Outcome 2
Upon successful completion the apprentice is able to recommend repairs for diesel fuel injection full-authority engine management systems following manufacturers` recommendations.	5.2.1 Explain the fundamentals of diesel fuel injection full-authority engine management systems. - applications - types - strategy - emission legislation 5.2.2 Identify the construction features of full-authority electronic control diesel fuel injection systems and components. - sensors speed o crankshaft o camshaft o turbocharger o driveline pressure o engine oil o exhaust o intake manifold o atmospheric o fuel o injection actuation o cylinder o boost temperature o fuel o engine oil o exhaust o DPF o coolant o ambient air position o throttle o crankshaft o camshaft o EGR (exhaust gas recirculation) o VGT (variable geometry turbocharger) - electronic unit injectors pulse width poppet control valve circuit protection - hydraulic electronic unit injector (HEUI) high pressure pump pressure regulator pressure sensor unit injector oil reservoir - high pressure common rail high pressure pump pressure regulator pressure sensor

time-pressure (PT) injector
- injector drivers
- status switches
cruise control
clutch and brake
exhaust brake
power take-off
air brake
- electronic control module
protection shut down
limp home mode
backup microprocessor

5.2.3 Describe the principles of operation of full-authority electronic control diesel fuel
injection systems and components.
- sensors
speed
o crankshaft
o camshaft
o turbocharger
o driveline
pressure
o engine oil
o exhaust
o intake manifold
o atmospheric
o fuel
o injection actuation
o cylinder
o boost
temperature
o fuel
o engine oil
o exhaust
o DPF
o coolant
o ambient air
position
o throttle
o crankshaft
o camshaft
o EGR (exhaust gas recirculation)
o VGT (variable geometry turbocharger)
- electronic unit injectors
pulse width
pulse profile
poppet control valve
effective stroke control
time control
- injector drivers
switching characteristics
spiked actuation
injector response time
- hydraulic electronic unit injector (HEUI)

	high pressure pump pressure regulator pressure sensor unit injector oil reservoir - high pressure common rail high pressure pump pressure regulator pressure sensor time-pressure (TP) injector - electronic control module protection shut down limp home mode backup microprocessor injector driver cooling power de-rate mode data management programming power bulge 5.2.4 Perform inspection and diagnostic procedures following manufacturers` recommendations for full-authority electronically controlled diesel fuel injection systems. - identify components and locations - diagnostic techniques - interpret electronic flow charts - demonstrate the application of the electronic service tool (EST) and personal computer - demonstrate reprogramming and uploading processes using a electronic service tool (EST) - confirm electronic diagnosis with multi-meter testing 5.2.5 Recommend reconditioning or repair procedures following manufacturers` recommendations for full-authority engine management systems. - describe connector seal assembly procedures - outline checking procedures for electrical ground connection integrity - outline boost starting procedures battery charger unit to unit
Course Outcome 3	**Learning Objectives for Course Outcome 3**
Upon successful completion the apprentice is able to interpret the exhaust emissions produced by diesel engines following manufacturers` recommendations.	5.3.1 Explain the fundamentals of diesel engine emission systems. - properties carbon monoxide hydrocarbons oxides of nitrogen particulates carbon dioxide

	sulphur dioxide aldehydes - catalysts oxidation emission standards federal regulations provincial regulations - aneroids - altitude compensators - sensors on emission controls 5.3.2 Demonstrate testing procedures following manufacturers` recommendations for diesel engine emission systems. - inspecting emission control devices - exhaust smoke analysis light extinction methods opacity meter filtration/colour code method - exhaust gas analysis four gas analysis

Evaluation Process and Grading System:

Evaluation Type	Evaluation Weight
Shop Assignments	40%
Theory Test	60%

Date: February 10, 2020

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