Prepared: Sylvain Belanger Approved: Corey Meunier

Course Code: Title	TCT815: VEHICLE ELECTRONICS MGNT & EMISSIONS SYS
Program Number: Name	6082: T/C TECHN-LEVEL III
Department:	MOTIVE POWER APPRENTICESHIP
Semester/Term:	18W
Course Description:	Upon successful completion the apprentice is able to understand the difference between customer and proprietary data programming and outline the procedure required to perform vehicle computer programming, is able to understand the basics of vehicle electronic system multiplexing and describe how digital communications can reduce the complexity of control circuits, is able to understand the principles of operation, diagnose and repair emission control devices and systems on trucks and coaches, is able to understand the operating principles and perform repairs on hybrid drive (diesel/electric) systems and their control mechanisms, and is able to describe the operating principles of typical collision avoidance systems, identify the system hardware and access stored data in the system.
Total Credits:	4
Hours/Week:	0
Total Hours:	32
Essential Employability Skills (EES):	#2. Respond to written, spoken, or visual messages in a manner that ensures effective communication. #3. Execute mathematical operations accurately. #4. Apply a systematic approach to solve problems. #5. Use a variety of thinking skills to anticipate and solve problems. #6. Locate, select, organize, and document information using appropriate technology and information systems. #7. Analyze, evaluate, and apply relevant information from a variety of sources. #10. Manage the use of time and other resources to complete projects.
General Education Themes:	Science and Technology
Course Evaluation:	Passing Grade: 50%, D
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%
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W Student has withdrawn from the course without academic penalty.

Evaluation Process and Grading System:

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

Books and Required Resources:

medium/heavy duty truck engines,fuels and computerized management systems by Sean Bennett
Publisher: cengage Edition: 5

Course Outcomes and Learning Objectives:

Course Outcome 1.

Upon successful completion, the apprentice is able to understand the difference between customer and proprietary data programming and outline the procedure required to perform vehicle computer programming

Learning Objectives 1.

Explain the purpose and fundamentals of customer and proprietary data programming.

- electronics
- computers
- ESTs
- telecommunications

Identify the functions, construction and application of customer and proprietary data programming.
- ESTs
- generic reader / programmers
- proprietary reader / programmers
- dash data switches
- PCs
- SAE J1939 and J1708 data connectors
- serial linkages and modules
- modems
- hard and soft telecommunications devices

Describe the principle(s) of operation of customer and proprietary data programming.

- data retention
- types of programming
- PROM
- EEPROM
- flash programming
- non-volatile RAM
- magnetic data retention
- electronic data retention
- optical data retention
- programming instruments
- programming security
- programming protocols
- SAE J1939 codes and protocols
- mainframe data hubs
- wireless interface

Perform customer and proprietary data programming using the appropriate ESTs and truck chassis or simulators.
- download customer data engine parameters
- download chassis data
- diagnose engine and chassis conditions from downloaded data
- convert codes and audit trails
- verify the need for proprietary reprogramming of an ECM
- specification reprogramming
- corrupted retained data
- proprietary upgrade
- perform customer data programming to an ECM using an EST on a truck, coach or simulator
- road speed
- tire rolling radii programming factors
- transmission ratio programming factors
- reprogram a throttle position sensor-operating window
- download proprietary data to diskettes or ECM
- reprogram engine / chassis data
- upload verification files to data hub

Course Outcome 2.

Upon successful completion, the apprentice is able to understand the basics of vehicle electronic system multiplexing and describe how digital communications can reduce the complexity of control circuits.

Learning Objectives 2.

Explain the purpose and fundamentals of vehicle multiplexing communications.
- electronics
- computers
- digital signals
- networking
- binary system
- information packets

Identify the functions, construction and application of vehicle multiplexing systems.

- Control area network (CAN) fundamentals
- SAE J1587/1708 data protocols

- SAE J1939 data protocols
- power line carrier (PLC) communications (trailers)
- communication adapters (CAs)
- module addresses on the data bus
- transaction frequency
- data packet architecture
- electromagnetic interference (EMI)
- ladder switches
- silicon controlled rectifier (SCR) switching
- twisted wire pairs
- Hi bus
- Lo bus
- terminating resistors
- data connectors

Describe the principle(s) of operation of vehicle multiplexing systems.

- CAN data protocols and ISO 9141
- SAE J1587/1708
- SAE J1939 data protocols
- clock speeds
- bandwidth
- neural network
- bus topology
- packet architecture
- bus negotiation
- arbitration field
- data field
- acknowledgement field
- information coding
- ladder switches

Navigate the data bus on a truck or coach chassis or simulator accessing MIDs, PIDs, SIDs, and FMIs using the appropriate ESTs.

- identify high and low bus twisted wire pairs
- identify J1708 and J1939 data connectors
- navigate MIDs, PIDs, and SIDs
- log and erase fault codes
- outline repair procedures according to manufacturer procedures
- download chassis data
- identify location of MIDs on a chassis

Course Outcome 3.

Upon successful completion, the apprentice is able to understand the principles of operation, diagnose and repair emission control devices and system on trucks and coaches.

Learning Objectives 3.

Explain the purpose and fundamentals of emission controls and testing.

- fuel chemistry
- engine theory
- engine breathing
- engine exhaust systems

- combustion dynamics
- electronics
- engine emissions
- CO
- NOx
- HC
- Particulate matter
- SO & SO2
- carbon footprint
- greenhouse gases (GHGs)

Identify the functions, types, and application of emission controls and testing.

- pre-combustion noxious emission control devices
- boost air management
- charge air heat exchangers
- sealed fuel sub-systems
- post-combustion noxious emission control devices
- diesel particulate filters (DPFs)
- catalyzed
- non catalyzed
- DPF regeneration cycles
- single stage, oxidizing catalytic converters
- dual stage, oxidation and reduction catalytic converters
- NOx adsorption catalysts
- selective catalytic reduction (SCR)

EGR systems
- crankcase emissions control
- S.I. emission controls
- C.I. emission controls
- closed loop factors in SI engines
- sealed evaporative emissions control

Describe the principles of noxious emissions, emission control devices and testing mechanisms.
- photochemical smog composition
- NOx, HC emission
- evaporative emission controls
- cylinder combustion temperature management
- O2 sensors
- NOx sensors
- pressure differential sensor
- closed loop operation
- EGR principles
- oxidation catalysts
- reduction catalysts
- NOx adsorption catalysts
- SCR
- sonic emissions
- S.I. noxious emissions
- C.I. noxious emissions
- lean, stoichiometric and rich burn factors
- combustion temperature effect on emissions

Perform inspection, testing and diagnostic procedures on emission controls.

- perform exhaust gas analysis on diesel engines
- perform exhaust gas analysis on gasoline engines

- perform smoke analysis tests
- analyze opacity meter test codes
- measure exhaust gas temperature using a pyrometer
- diagnose engine-running conditions using an infrared thermometer
- outline DPF regeneration

Recommend reconditioning or repairs following manufacturersâ€™ procedures on emission controls.
- analyze emission control instruments results and recommend repairs as prescribed in OEM literature

Course Outcome 4.

Upon successful completion, the apprentice is able to understand the operating principles and perform repairs on hybrid drive (diesel/electric) systems and their control mechanisms.

Learning Objectives 4.

Explain the purpose and fundamentals of a hybrid drive systems.

- diesel power units
- electric drive motors
- hydraulic motors and accumulators
- hydraulic regeneration
- gear sets

Identify the functions, construction, and application of hybrid drive systems.

- diesel power units
- gas turbine power units
- electric drive motors
- blended torque transmissions
- battery banks
- nickel metal hydride (NiMH)
- lithium ion (LiOn)
- inverters
- ultracapacitors
- hydraulic regeneration

Describe the principle(s) of operation and advantages of hybrid drive systems

- generator principles
- isochronous governing
- regenerative braking
- hydraulic regeneration
- emissions
- multiplexing
- drive gear trains
- urban transit applications
- less-than-load (LTL) applications
- hybrid electric powertrains
- series driven
- parallel driven
- series hydraulic hybrid (SHH)
- parallel hydraulic hybrid (PHH)
- electronic steering assist

Recommend reconditioning or repairs following manufacturers procedures on emission controls .
- identify high electrical potential circuits
- distinguish chassis electrical circuits from â€ powertrain electrical circuits
- use wiring schematics to identify high potential electrical components
- outline procedure to isolate neutralize high potential battery banks
- outline procedure to neutralize high potential capacitor banks
- outline procedure required to equalize accumulator and residual pressures in hydraulic circuits

Course Outcome 5.

Upon successful completion, the apprentice is able to describe the operating principles of typical
collision avoidance systems, identify the system hardware and access stored data in the system.

Learning Objectives 5.

Explain the purpose and fundamentals of truck and coach Collision Avoidance Systems
- doppler effect
- yaw and rollover detection
- chassis multiplexing
- MID negotiation on data bus
- video processing

Identify the construction, composition, type, styles and application of truck and coach Collision Avoidance Systems.

- microwave sensor
- radar antenna
- driver display unit
- doppler radar based systems
- video based systems
- back-up scanning
- lane guidance systems
- programmable logic controllers (PLCs)
- accelerometer systems
- lane Guidance Systems

Describe the principle(s) of operation of truck and coach Collision Avoidance Systems

- doppler effect
- frequency shift analysis
- microwave
- data collection and retention
- lane Guidance Systems

Perform the inspection, testing and diagnostic procedures for truck and coach Collision Avoidance Systems

- collision analysis profiles
- access Proximity Data
- system programming

Date:	Thursday, March 1, 2018
	Please refer to the course outline addendum on the Learning Management System for further information.