



COURSE OUTLINE: HET714 - ELECT/ELECTRONIC SYS

Prepared: Josh Boucher

Approved: Corey Meunier, Chair, Technology and Skilled Trades

Course Code: Title	HET714: ELECTRICAL/ELECTRONIC SYSTEMS
Program Number: Name	
Department:	MOTIVE POWER APPRENTICESHIP
Semesters/Terms:	21F, 22W, 22S
Course Description:	This course is designed to provide the Students with the theoretical and practical knowledge of how electricity, and electronics are used to operate and control multiple types of both Agricultural and Commercial Heavy Equipment and Vehicles used in various applications of their respective designated trade. Students will be taught electrical and electronic fundamentals and both the theory and the service and repair for cranking systems, chassis electrical and power accessories, electronic controlled accessories such as lighting and safety equipment. They will also use electronic and electrical testing equipment to perform diagnostic testing on electrical and electronic components and perform prescribed repairs to such type of components of these systems.
Total Credits:	5
Hours/Week:	0
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:	<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>
Course Evaluation:	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:

EVALUATION PROCESS/GRADING SYSTEM:

Students will be tested on the material covered per apprenticeship curriculum by multiple choice questions, assignments, and practical tests. The weigh factor for each area of testing will be as follows:

- Theory Tests 50%
- Practical Tests 30%
- Assignments 20%

This evaluation can change depending on the emphasis placed on each of the above testing procedures.

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 describe the principles of electricity following accepted scientific principles	Upon successful completion, the apprentice is able to: 4.1.1 Explain and identify the purpose, fundamentals, and principles of electricity. - principles of electricity - electron theory - magnetism - left and right hand rules - units of measure - Ohm`s Law - Kirchoffs Laws - capacitance, induction Perform circuit calculations for: - series, parallel, and seriesparallel circuits
Course Outcome 2	Learning Objectives for Course Outcome 2
Upon successful completion the apprentice is able to	Upon successful completion, the apprentice is able to: 4.2.1 Explain wiring fundamentals.

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trace current flow through circuits with the use of an electrical schematic

[1/0]

- wiring gauge numbers, colour
- temperature effects of current flow through a conductor
- SAE wire specifications
- AWG wire specifications

4.2.2 Identify the construction features of chassis electrical and power accessory systems.

[2/0]

- wiring
- lighting
- signal circuits
- headlamp circuits
- clearance circuits
- wiper circuits
- blower motor circuits
- warning and monitoring devices for:
 - temperature
 - pressure
 - vacuum
 - engine speed
 - noise
 - fuel supply
 - charging
 - engine shut down systems
 - engine starting aid circuits
 - glow plugs
 - manifold heaters
 - starting fluid injection circuits

4.2.3 Describe the principles of operation of chassis electrical and power accessory systems.

[4/0]

- wiring circuits
- lighting
- signal circuits
- headlamp circuits
- clearance circuits
- wiper circuits
- warning and monitoring devices for
 - temperature
 - pressure
 - vacuum
 - engine speed
 - noise
 - fuel supply
 - charging
 - engine shut down
 - engine starting aid circuits
 - glow plugs
 - manifold heaters
 - starting fluid injection circuits

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		<p>4.2.4 Perform inspection and testing procedures following manufacturers' recommendations for chassis electrical and power accessory systems. [1/3]</p> <ul style="list-style-type: none"> - trace wiring circuits using manufacturers wiring diagrams - demonstration of wiper and warning system component tests - identify circuit protection devices - develop a chronological sequence to trace wiring faults - demonstration of instrumentation troubleshooting - electronic service tools (EST) - visual
	<p>Course Outcome 3</p>	<p>Learning Objectives for Course Outcome 3</p>
	<p>GENERAL LEARNING OUTCOME Upon successful completion the apprentice is able to recommend repair of a cranking system following manufacturers' recommendations.</p>	<p>Upon successful completion, the apprentice is able to:</p> <p>4.3.1 Explain the purpose and fundamentals of cranking systems [1/0]</p> <ul style="list-style-type: none"> - battery - cables and connectors - switches, relays, condensers, and solenoids - cranking motor - thermal protection - starter drives <p>4.3.2 Identify the construction features of cranking system components. [3/0]</p> <ul style="list-style-type: none"> - cranking motors - configuration - internal circuits - thermal protection - starter drives - overrunning clutch - spragg clutch - ramp and roller - positorque - control devices - relays - solenoids - series parallel switch - master disconnect - pre-lubrication starting circuit - neutral safety switch <p>4.3.3 Describe the principles of operation of cranking systems and components.</p> <ul style="list-style-type: none"> - electromagnetic principles - series cranking motors - series shunt - series parallel - counter electromotive force effect on current flow - temperature effect on load and torque output

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- configuration adjustment
- thermal protection
- drives
- overrunning clutch
- spragg
- clutch
- ramp and roller
- posi
- torque
- control devices
- relays
- solenoids
- series
- parallel switch
- master disconnect
- pre-lubrication starting circuit
- neutral safety switch

4.3.4 Perform inspection, testing, and diagnostic procedures following manufacturers` recommendations for cranking motors and control devices. [2/4]

- outline the recommended diagnostic sequence for cranking system malfunctions
- battery condition tests
- cranking circuit current draw and voltage drop tests
- identify specific cranking system faults from test results
- demonstration of cranking no
- load bench test
- cranking motor component tests
- demonstration of relay and solenoid testing
- component failure analysis
- outline the recommended procedures for boosting multiple batteries
- 12 volt circuits
- 24 volt circuits
- ring gear inspection
- drive gear and ring gear
- starter gear reduction

3.5 Recommend reconditioning or repairs following manufacturers` recommendations for cranking motors and control devices. [0/2] - perform a starter motor removal and replacement procedure as recommended by the manufacture

Course Outcome 4

Learning Objectives for Course Outcome 4

GENERAL LEARNING OUTCOME

Upon successful completion the apprentice is able to test basic electronic components following

LEARNING OUTCOMES AND CONTENT

Upon successful completion, the apprentice is able to:

4.4.1 Explain the purpose and fundamentals of basic electronics. [1/0]

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manufacturers
recommendations

- semi-conductor materials
- waveforms
- voltage spike control
- static electricity
- electrostatic discharge
- shielding
- grounding

4.4.2 Identify the function, construction features, composition, types, and application of electronic devices.

[2/0]

- diodes
- rectifying
- zener
- light emitting
- photo
- transistors
- Positive-Negative-Positive (PNP)
- Negative-Positive-Negative (NPN)
- sensors
- reductors
- thermistors
- piezoelectric
- peizoresistive
- variable resistor
- rheostat
- potentiometers
- optical devices

4.4 Basic Electronic Devices

Duration: Total 9 hours Theory 7 hours Practical 2 hours

Prerequisites:

Cross-Reference to Training Standard:

AET: 5926.01, 5926.02, 5926.05, 5926.08, 5926.13

HDET: 5892.08, 5892.09

GENERAL LEARNING OUTCOME

Upon successful completion the apprentice is able to test basic electronic components following manufacturers recommendations.

LEARNING OUTCOMES AND CONTENT

Upon successful completion, the apprentice is able to:

4.4.1 Explain the purpose and fundamentals of basic electronics.

[1/0]

- semi-conductor materials
- waveforms
- voltage spike control
- static electricity
- electrostatic discharge
- shielding

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- grounding

4.4.2 Identify the function, construction features, composition, types, and application of electronic devices.

[2/0]

- diodes
- rectifying
- zener
- light emitting
- photo
- transistors
- Positive-Negative-Positive (PNP)
- Negative-Positive-Negative (NPN)
- sensors
- reluctors
- thermistors
- piezoelectric
- piezoresistive
- variable resistor
- rheostat
- potentiometers
- optical devices
- capacitors

4.4.3 Describe the principles of operation of electronic devices.

[3/0]

- diodes
- forward and reverse bias
- current control
- transistors
- forward and reverse bias
- positive-negative-positive (PNP) and negative-positivenegative (NPN)
- gate controls
- switching
- amplification
- capacitors
- sensors
- reluctors
- thermistors
- piezoelectric
- piezorestive
- variable resistor
- rheostat
- potentiometers
- binary logic

4.4.4 Perform inspection and testing procedures following manufacturers recommendations for electronic devices.

[1/2]

- Diodes

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- transistors
- capacitors
- Resistors
- potentiometer
- sensors
- reluctors
- thermistors
- piezoelectric
- piezorestive

Evaluation Process and Grading System:

Evaluation Type	Evaluation Weight
Assingments	20%
Shop Practical	30%
Theory	50%

Date:

July 30, 2021

Addendum:

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

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