



## COURSE OUTLINE: AST713 - ELEC & EMISSIONS SYS

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Approved: Corey Meunier, Chair, Technology and Skilled Trades

<b>Course Code: Title</b>	AST713: ELECTRICAL/ELECTRONIC & EMISSIONS SYSTEM
<b>Program Number: Name</b>	6068: AUTO SERV TN LEVEL 2
<b>Department:</b>	MOTIVE POWER APPRENTICESHIP
<b>Semesters/Terms:</b>	19S
<b>Course Description:</b>	Upon successful completion the apprentice will have the ability to explain the characteristics of various circuit types and perform circuit calculations using a selection of meters, the ability to explain the purpose, principles of operation and usage of diagnostic test equipment, the ability to explain the purpose, construction and operating principles of cranking systems, the ability to explain cranking system operations and perform diagnosis, the ability to explain the construction, principles of operation, inspection and testing of electronic devices, ignition systems, charging systems, electronic-controlled gasoline fuel injection systems, and emission control systems - all according to manufacturers' standards and recommendations, and accepted trade practices.
<b>Total Credits:</b>	12
<b>Hours/Week:</b>	12
<b>Total Hours:</b>	96
<b>Prerequisites:</b>	There are no pre-requisites for this course.
<b>Corequisites:</b>	There are no co-requisites for this course.
<b>Essential Employability Skills (EES) addressed in this course:</b>	<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>
<b>Course Evaluation:</b>	Passing Grade: 50%, D
<b>Other Course Evaluation &amp; Assessment Requirements:</b>	<p>In this course you will study electrical/electronic fundamentals and perform testing using a variety of diagnostic test equipment. Charging and starting system operation and testing will be covered. Emission control systems, Fuel injection and ignition system construction operation and testing will also be studied.</p> <p>Grade Definition Grade Point Equivalent A+ 90 - 100% 4.00 A 80 - 89%</p>



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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:**

Automotive Technology: A Systems Approach by Erjavec  
 RestoleErjavec/Restoule/Leroux/Thompson  
 Publisher: Thomson Nelson Learning/Cengage Learning Edition: 3rd Canadian Edition  
 ISBN: 0-17-653152-1

**Course Outcomes and Learning Objectives:**

Course Outcome 1	Learning Objectives for Course Outcome 1
Electrical Circuit Calculations	<p>Explain the characteristics of electrical circuits.</p> <ul style="list-style-type: none"> <li>- series circuits</li> <li>- parallel circuits</li> </ul> <p>Perform circuit calculations using Ohms ` &amp; Watts Law.</p> <ul style="list-style-type: none"> <li>- series circuits</li> <li>- parallel circuits</li> </ul> <p>Measure voltage, amperage and resistance.</p> <ul style="list-style-type: none"> <li>- circuit board exercises</li> <li>- simulated electrical circuits</li> <li>- vehicle electrical circuits</li> <li>- compare calculated and measured circuit performance</li> </ul>
Course Outcome 2	Learning Objectives for Course Outcome 2
Diagnostic Test Equipment	<p>Explain the purpose and principles of operation of diagnostic test equipment.</p> <ul style="list-style-type: none"> <li>- pressure gauges</li> <li>- vacuum gauges</li> <li>- compression tester</li> <li>- hand-held scan tools</li> <li>- oscilloscopes</li> <li>smoke generators</li> <li>- leak down tester</li> <li>- pressure transducers</li> </ul> <p>Perform diagnostic tests using the following equipment.</p> <ul style="list-style-type: none"> <li>- pressure gauges</li> <li>- vacuum gauges</li> <li>- compression tester</li> </ul>



	<ul style="list-style-type: none"> <li>- hand-held scan tools</li> <li>- oscilloscopes</li> <li>- smoke generators</li> <li>- leak down tester</li> <li>- pressure transducers</li> </ul>
<b>Course Outcome 3</b>	<b>Learning Objectives for Course Outcome 3</b>
Cranking Systems and Control Circuits	<p>Explain the purpose and fundamentals of cranking systems.</p> <ul style="list-style-type: none"> <li>- cranking motors</li> <li>- control circuits</li> <li>- torque, load and cranking speed relationship</li> </ul> <p>Explain the construction, types, styles and principles of operation of cranking motor circuits.</p> <ul style="list-style-type: none"> <li>- starter control circuits</li> <li>- relay controlled cranking circuits</li> <li>- neutral switch</li> <li>- starter solenoid</li> <li>- cranking motors</li> <li>- gear reduction</li> <li>- permanent magnet field type</li> <li>- wire wound field type</li> <li>- cranking motor drives</li> </ul> <p>Disassemble and re-assemble cranking motors.</p> <ul style="list-style-type: none"> <li>- inspect and test major components of cranking motors</li> <li>- armature for shorts, opens, ground, alignment</li> <li>- field coils for shorts, opens, ground</li> <li>- identify type of winding</li> <li>- pole shoes</li> <li>- bushings and bearings</li> <li>- brushes and springs</li> </ul>
<b>Course Outcome 4</b>	<b>Learning Objectives for Course Outcome 4</b>
Cranking System Diagnostics and Testing	<p>Explain the factors affecting engine cranking system performance.</p> <ul style="list-style-type: none"> <li>- ambient temperature</li> <li>- battery conditions and ratings</li> <li>- engine mechanical loads</li> <li>- charging system operation</li> <li>- oxidation and corrosion of connections</li> <li>- cable sizes and condition</li> <li>- engine fuel and ignition system condition</li> <li>- excessive cranking time and overheating</li> </ul> <p>Perform inspection, testing, and diagnostic procedures on cranking motor circuits.</p> <ul style="list-style-type: none"> <li>- Analyze the results.</li> <li>- cranking system visual inspection</li> <li>- battery load test and verify capacity and performance to application</li> <li>- cranking circuit voltage drop tests</li> <li>- cranking system current draw test</li> <li>- perform ring gear tooth inspection</li> </ul>

	<ul style="list-style-type: none"> <li>- slow cranking</li> <li>- no cranking</li> </ul>
<b>Course Outcome 5</b>	<b>Learning Objectives for Course Outcome 5</b>
Electronic Fundamentals	<p>Explain the construction, composition, types, principles of operation and applications of electronic devices.</p> <ul style="list-style-type: none"> <li>- diodes</li> <li>- forward and reverse bias</li> <li>- current control</li> <li>- transistors</li> <li>- switching</li> <li>- gain</li> <li>- capacitors</li> <li>- sensors</li> <li>- permanent magnet pulse generators</li> <li>- piezoelectric</li> <li>- galvanic</li> <li>- hall effect</li> <li>- optical</li> <li>- variable resistors</li> <li>- rheostat</li> <li>- thermistors</li> <li>- potentiometers</li> <li>- piezoresistive</li> </ul> <p>Perform inspection and testing procedures for electronic devices.</p> <ul style="list-style-type: none"> <li>- diodes</li> <li>- forward and reverse bias</li> <li>- LED</li> <li>- rectifying / zener</li> <li>- light emitting</li> <li>- photo</li> <li>- capacitors</li> <li>- sensors</li> <li>- permanent magnet pulse generators</li> <li>- piezoelectric</li> <li>- galvanic</li> <li>- hall effect</li> <li>- optical</li> <li>- variable resistors</li> <li>- rheostat</li> <li>- thermistors</li> <li>- potentiometers</li> <li>- piezoresistive</li> </ul>
<b>Course Outcome 6</b>	<b>Learning Objectives for Course Outcome 6</b>
Electronic Ignition Fundamentals	<p>Explain the purpose and fundamentals of electronic ignition systems and controls.</p> <ul style="list-style-type: none"> <li>- electronic ignition systems</li> <li>- computer-controlled timing</li> <li>- distributorless ignition</li> <li>- coil over plug</li> <li>- factors that affect ignition timing</li> </ul>

- engine speed
- engine load
- engine temperature
- input sensors

Explain the construction, types, styles, operation and application of electronic ignition systems devices.

- ignition coils
- primary windings
- secondary windings
- distributors
- magnetic pulse generator
- Hall Effect device
- optical device
- secondary voltage circuit
- high tension spark plug wires
- spark plugs
- distributor cap and rotor
- modules
- sensors

Inspect, test and diagnose electronic ignition systems devices.

- identify and locate electronic ignition system components on various vehicles
- distributor components
- coils, modules
- sensors
- check and test ignition timing operation using a scan tool
- diagnose electronic ignition system components
- high tension wires
- spark plugs
- distributor cap and rotor

**Course Outcome 7**

**Learning Objectives for Course Outcome 7**

Charging Systems and Control Circuits

Explain the purpose and fundamentals of charging systems and control circuits.

- alternators
- voltage regulation
- electromagnetic induction principles
- factors affecting alternator output
- battery condition and temperature
- circuit condition
- engine speed
- electrical loads

Explain the construction, types, principles of operation and application of charging systems and voltage regulations

- alternators
- rectifier & diodes
- stator
- rotor
- field winding, poles, slip rings
- brush assemblies



	<ul style="list-style-type: none"> <li>- bearings</li> <li>- pulleys</li> <li>- cooling fans</li> <li>- idlers and tensioners</li> <li>- clutch pulleys / damper</li> <li>- voltage regulator</li> </ul> <p>Inspect, test and diagnose alternator and voltage regulation systems.</p> <ul style="list-style-type: none"> <li>- perform charging system visual inspection</li> <li>- belt tension and alignment</li> <li>- connections and wiring</li> <li>- perform charging system current and voltage output tests</li> <li>- disassemble, test and re-assemble alternator</li> <li>- rotor field tests</li> <li>- rectifier diodes</li> <li>- stator</li> </ul>
<b>Course Outcome 8</b>	<b>Learning Objectives for Course Outcome 8</b>
Gasoline Fuel Injection Fundamentals	<p>Explain the purpose and fundamentals of gasoline fuel injection systems.</p> <ul style="list-style-type: none"> <li>- port injection</li> <li>- throttle body injection</li> <li>- direct injection</li> </ul> <p>Explain the construction, types, styles, operation and application of gasoline fuel injection and delivery systems.</p> <ul style="list-style-type: none"> <li>- fuel tanks, lines and fittings</li> <li>- filters and pumps</li> <li>- injectors</li> <li>- pressure regulators</li> <li>- electronic control units</li> <li>- returnless fuel systems</li> </ul> <p>Inspect and test fuel injection systems.</p> <ul style="list-style-type: none"> <li>- perform fuel pump tests</li> <li>- pressure</li> <li>- visual inspection</li> <li>- leaks</li> </ul>
<b>Course Outcome 9</b>	<b>Learning Objectives for Course Outcome 9</b>
Emission Control Systems	<p>Explain the principles of operation of emission control systems.</p> <ul style="list-style-type: none"> <li>- exhaust gas re-circulation systems</li> <li>- vacuum controlled</li> <li>- electronic controlled</li> <li>- positive crankcase ventilation</li> <li>- evaporative emissions systems</li> <li>- carbon canister</li> <li>- computer controlled fuel evaporative emission solenoids</li> <li>- air injection systems</li> <li>- air pumps</li> <li>- air switching valves</li> <li>- catalytic converters</li> <li>- three-way</li> </ul>

- sensors / actuators

Inspect and test emission control systems.

- exhaust gas re-circulation systems
- positive crankcase ventilation
- evaporative emission systems
- air injection systems
- catalytic converters

**Evaluation Process and Grading System:**

<b>Evaluation Type</b>	<b>Evaluation Weight</b>	<b>Course Outcome Assessed</b>
Assignments	10%	
Shop	30%	
Tests	60%	

**Date:**

April 1, 2019

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

