



COURSE OUTLINE: AST813 - ELEC & EMISSIONS SYS

Prepared: Jamie Schmidt

Approved: Sherri Smith, Chair, Natural Environment, Business, Design and Culinary

Course Code: Title	AST813: ELECTRICAL/ELECTRONIC & EMISSIONS SYSTEM
Program Number: Name	6069: AUTO SERV TN LEVEL 3
Department:	MOTIVE POWER APPRENTICESHIP
Semesters/Terms:	19S, 20W
Course Description:	Upon successful completion the apprentice will have the ability to explain the principles of operations of vehicle on board computers, the ability to explain the fundamentals, construction, principles of operation, inspection, and testing procedures of supplemental restraint systems, distributorless ignition systems, computer-controlled charging systems, gasoline fuel injection systems, and diesel fuel systems, the ability to explain the principles of operation, inspection and testing procedures of electrical accessories, and emission control systems to On Board Diagnostics II (ODB II) standards, and the ability to explain the principles of operation and diagnosis of fuel, electrical drive and regenerative braking systems associated with hybrid vehicles - all according to manufacturers' standards.
Total Credits:	12
Hours/Week:	12
Total Hours:	96
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 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
Other Course Evaluation & Assessment Requirements:	<p>Grade</p> <p>Definition Grade Point Equivalent</p> <p>A+ 90 - 100% 4.00</p> <p>A 80 - 89%</p> <p>B 70 - 79% 3.00</p> <p>C 60 - 69% 2.00</p>



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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 Restole
 ISBN: 9780176599584

Course Outcomes and Learning Objectives:

Course Outcome 1	Learning Objectives for Course Outcome 1
Computer Fundamentals	<p>Explain the principles of operation of vehicle on board computers.</p> <ul style="list-style-type: none"> - onboard computers - multiplexing - fibre optics - data bus communication lines - CAN bus - central processing unit (CPU) - random access memory (RAM) - read only memory (ROM) <p>Perform data retrieval with appropriate test equipment.</p> <ul style="list-style-type: none"> - oscilloscope - scan tool - flight recorder
Course Outcome 2	Learning Objectives for Course Outcome 2
Supplemental Restraint Systems	<p>Explain the purpose, construction, types, applications and fundamentals of supplemental restraint systems.</p> <ul style="list-style-type: none"> - deceleration forces - inflatable supplemental restraint systems - pretension seat belts - crash sensors - control modules - air bags - air bags inflators - clock spring - seat occupancy sensors - passenger-side airbag disabling system - explain safe handling precautions for service and testing of inflatable and noninflatable restraint systems <p>Inspect, test and explain safe handling procedures for restraint system components.</p> <ul style="list-style-type: none"> - safely disable restraint systems - perform system tests using scan tools, multimeter and specific test equipment
Course Outcome 3	Learning Objectives for Course Outcome 3



	Distributorless Ignition Systems	<p>Explain the purpose, construction, types, applications and fundamentals of distributorless ignition systems.</p> <ul style="list-style-type: none"> - coils - coil over plug - modules - sensors - crankshaft position - camshaft position <p>Inspect and test distributorless ignition systems.</p> <ul style="list-style-type: none"> - identify and locate ignition system components - coils - modules - sensors - wiring and connections - test for correct operation of distributorless ignition systems
	Course Outcome 4	Learning Objectives for Course Outcome 4
	Computer Controlled Charging Systems	<p>Explain the purpose, construction, types, applications and fundamentals of computer-controlled charging systems and electronic regulators.</p> <ul style="list-style-type: none"> - computer-controlled charging system - alternator field current control - ambient temperature sensing - battery voltage sensing - battery temperature sensing - voltage regulator operation - location - alternator output monitoring - charging system indicators <p>Inspect and test computer-controlled charging systems.</p> <ul style="list-style-type: none"> - test computer-controlled charging systems - identify and isolate faulty charging system components
	Course Outcome 5	Learning Objectives for Course Outcome 5
	Power Accessories and Electrical Options	<p>Explain the fundamentals, types, principles of operation of electrical accessories.</p> <ul style="list-style-type: none"> - lighting system - daytime running lights - automatic operation - light emitting diode - high intensity discharge - power accessories - power windows - power door locks - wiper washer systems - power seats - inverters - security systems - remote entry and remote starting systems - instrumentation - cruise control systems - communication and entertainment systems <p>Inspect, test and diagnose electrical accessories.</p> <ul style="list-style-type: none"> - diagnose faults, i.e., shorts, opens, grounds, high resistance - analysis circuit with wiring diagrams and troubleshooting

	charts - perform safety precautions when dealing with electronic devices
Course Outcome 6	Learning Objectives for Course Outcome 6
Gasoline Fuel Injection Diagnosis and Repair	<p>Explain the construction, types, and principles of operation of fuel injection systems and components.</p> <ul style="list-style-type: none"> - input sensors - temperature sensors - manifold absolute pressure sensors - air flow sensors - oxygen sensors - throttle position sensors - throttle-pedal position sensors - crank & cam position sensors - switch inputs - electronic control module - powers & grounds - data communication lines - diagnostics - output actuators - malfunction indicator light - fuel injectors - idle speed control - exhaust gas recirculation - electronic throttle actuator - evaporative emission controls - cooling fans - spark control - air pumps - solenoids - relays - modules <p>Identify, inspect and test electronic fuel injection systems.</p> <ul style="list-style-type: none"> - input sensors - temperature sensors - manifold absolute pressure sensors - air flow sensors - oxygen sensors - throttle position sensors - throttle-pedal position sensors - crank & cam position sensors - switch inputs - electronic control module - powers & grounds - data communication lines - diagnostics - data stream - diagnostic trouble codes - freeze frame data - output actuators - malfunction indicator light - fuel injectors - idle speed control - exhaust gas recirculation - electronic throttle actuator

	<ul style="list-style-type: none"> - evaporative emission controls - cooling fans - spark control - air pumps - solenoids - relays - modules - perform an injector balance test - diagnose fault(s) - retrieve trouble code - access diagnostic information - diagnose - repair & verify
Course Outcome 7	Learning Objectives for Course Outcome 7
Diesel Electronic Fuel Injection Fundamentals	<p>Explain the purpose and fundamentals of diesel fuel injection systems.</p> <ul style="list-style-type: none"> - fundamentals of diesel fuel - principles of compression ignition - principles of fuel metering <p>Explain the construction, types, application and principles of operation of diesel fuel injection components.</p> <ul style="list-style-type: none"> - transfer pumps - common rail fuel systems - tanks, lines, filters, hoses and fittings - water separators / fuel heater - mechanical injectors - injection inline pumps - injection distributor pumps - glow plugs systems - emission controls - bio diesel <p>Explain inspection and testing procedures.</p> <ul style="list-style-type: none"> - visual inspection of lines, filters, fuel delivery pumps and water separators - interpret data for electronic management systems - common rail fuel systems - demonstration of fuel delivery pump test - capacity, pressure, vacuum, return flow - demonstrate fuel injector testing adhering to required safety procedures - pressure (pop) opening, spray pattern, leakage, leak-back, chatter - describe low and high-pressure fuel priming procedures and fuel filters - describe the replacement procedures for fuel filters
Course Outcome 8	Learning Objectives for Course Outcome 8
Emissions Control Diagnosis and Repair	<p>Explain the government standards and regulations for exhaust emissions and different methods used for annual emissions inspections.</p> <ul style="list-style-type: none"> - IM240 - RG240

- ASM
- carbon monoxide
- carbon dioxide
- hydrocarbons
- oxides of nitrogen
- oxygen

Explain the effects of component malfunctions on exhaust emissions.

- exhaust gas recirculation
- evaporative emission systems
- catalytic convertor
- positive crankcase ventilation
- air injection systems
- ignition system

Inspect, test and analyze emission control devices using scan tools, gas analyzers, oscilloscopes, smoke generator and temperature probes.

- exhaust gas recirculation valves
- air injection pump
- catalytic converters
- spark timing control devices
- oxygen sensors
- evaporative emission controls

Course Outcome 9

Learning Objectives for Course Outcome 9

Hybrid Systems

Explain code extraction, diagnostic routines, diagnosis and testing procedures associated with hybrid fuel and electrical system types.

- hybrid system types
- Toyota
- Synergy system
- Honda
- Integrated Motor Assist (IMA)
- General Motors / Saturn
- Belt Alternator Starter (BAS)
- General Motors / Chrysler / BMW
- Dual Mode
- high voltage disconnect
- meter use
- high and intermediate voltage drive systems
- start up
- idle stop
- inverter
- transmission pump operation
- vacuum pump operation

Evaluation Process and Grading System:

Evaluation Type	Evaluation Weight
Assignments	10%
Shop	30%
Tests	60%



Date: June 20, 2019

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