COURSE OUTLINE: AST613 - ELEC & EMISSIONS SYS

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Course Code: Title	AST613: ELECTRICAL/ELECTRONIC & EMISSIONS SYSTEM
Program Number: Name	6067: AUTO SERV TN LEVEL I
Department:	MOTIVE POWER APPRENTICESHIP
Academic Year:	2024-2025
Course Description:	Multiple topic areas will be covered in Electrical/Electronic and emission systems. You will gain the ability to explain the terminology, and the principles of operation of electricity. Practical use of various types of electrical test equipment will be taught as well as electrical circuit calculations. Electromagnetic devices and basic electronics will be studied. The purpose, construction and principles of operation of batteries will be studied and you will perform inspection, maintenance and testing of batteries. You will demonstrate knowledge of wiring schematics, basic electrical diagnosis and circuit repair. Conventional and alternate fuels, intake, exhaust and fuel delivery systems will be studied as well as the principles of combustion and exhaust emissions. Basic hybrid theory will be discussed with an emphasis on hybrid safety precautions.
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:	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 9 Interact with others in groups or teams that contribute to effective working relationships and the achievement of goals.

Course Evaluation:	Passing Grade: 50%, D A minimum program GPA of 2.0 or higher where program specific standards exist is required for graduation.
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.
Books and Required Resources:	Automotive technology a systems approach by Erjavec RestoleErjavec/Restoule/Leroux/Thompson Publisher: Cengage Edition: 4th Canadian Edition ISBN: 0-17-679617-7

Course Outcomes and Learning Objectives:

Course Outcome 1	Learning Objectives for Course Outcome 1
Upon successful completion the student will have the ability to explain the terminology, and principles of operation of electricity according to sound scientific principles.	1.1 Identify basic electrical terms. - atomic structure - conventional and electron theory - A/C, D/C - conductors, insulators & semi-conductors - magnetism - electromagnetism - voltage - resistance - power - current 1.2 Identify sources of electricity. - heat - pressure - static - chemical - light - magnetism 1.3 Explain the principles of Ohms` Law & Watts` Law. 1.4 Identify Systems International (S.I.) units of measurement. (e.g. mega, kilo, milli, micro) 1.5 Identify electrical circuit characteristics. - series / parallel

	- basic symbols
Course Outcome 2	**Learning Objectives for Course Outcome 2**
Upon successful completion the student will have the ability to select, measure and use various types of electrical test equipment according to manufacturers` instructions.	2.1 Explain the types of electrical test equipment. - Digital Multimeter (DMM) - inductive clamp 2.2 Explain equipment setup, calibration and techniques used to measure. - voltage - resistance - amperage 2.3 Perform the following measurements using electrical test equipment: - voltage - resistance - amperage - continuity
Course Outcome 3	**Learning Objectives for Course Outcome 3**
Upon successful completion the student will have the ability to explain the purpose, construction, principles of operation, perform inspection and testing of batteries according to manufacturers` standards	3.1 Explain the purpose and principles of operations of batteries: - battery chemical action during charging and discharging - temperature effect on charging and internal resistance ratings 3.2 Explain the construction, types, styles and applications of batteries. - lead acid - low maintenance - absorbed glass mat - maintenance-free batteries 3.3 Explain battery ratings. - hot cranking amps (HCA) - amp-hour rating (AH) - cranking amps (CA) - reserve capacity (RC) - cold cranking amps (CCA) 3.4 Describe precautions for servicing and charging. - temperature adjustments - conductance testing - refractometer - hydrometer 3.5 Perform inspect and testing on batteries. - visually inspect - test state-of-charge - perform surface discharge - perform load test - perform parasitic draw 3.6 Perform assigned operations on batteries. - clean battery and terminals - charge - activation - removal and replacement
Course Outcome 4	**Learning Objectives for Course Outcome 4**

Perform circuit calculations to verify Ohms` and Watts` Laws.	4.1 Perform circuit calculations to verify Ohms` and Watts` Laws. - series circuits - parallel circuits 4.2 Perform assigned testing to determine voltage, current and resistance for the following circuits: - circuit board exercises - vehicle electrical circuits - perform comparisons between measured and calculated circuit performances
Course Outcome 5	**Learning Objectives for Course Outcome 5**
Upon successful completion the student will have the ability to demonstrate knowledge of wiring schematics, component identification and ability to trace electrical circuits according to accepted trade standards.	5.1 Explain the purpose and fundamentals of electrical wiring schematics. - electrical symbols - circuit identification methods - color codes - circuit number codes gauge and metric wire sizes - types of connectors 5.2 Explain the function, construction and styles of wiring diagrams. - layout - interpretation - variations by different manufacturers 5.3 Locate electrical components and trace electrical circuits of vehicle systems. - perform on-vehicle verification of wiring diagram circuits - locate power sources and grounds
Course Outcome 6	**Learning Objectives for Course Outcome 6**
Upon successful completion the student will have the ability to describe the purpose, construction and principles of operations of circuit protection devices and perform circuit repairs according to accepted trade standards.	6.1 Perform circuit analysis to identify. - open circuits - short circuits - grounds - unintentional grounds - high resistance connections - temperature effects - safety when repairing electrical circuits 6.2 Explain the construction and application of circuit repairs. - wiring and terminals - wire size - terminal connectors - soldering - shielding - twisted pairs 6.3 Explain the principles of operation of circuit protection devices. - fuses - circuit breakers - fusible links 6.4 Perform circuit analysis to identify - shorts

	- opens - grounds - unintentional grounds - high resistance - dynamic circuit testing and voltage drops 6.5 Perform circuit repairs on the following components - wiring and connectors - weather proofing - circuit protection - fuses - circuit breakers - fusible links - repair wiring - clean - splice - crimp - solder - corrosion protection 6.6 Perform tests to verify the correct operation of the following circuit protection devices - fuses - circuit breakers - fusible links
Course Outcome 7	**Learning Objectives for Course Outcome 7**
Upon successful completion the student will have the ability to describe the purpose, construction and principles of operations of electromagnetic devices according to sound scientific principles.	7.1 Explain the purpose and fundamentals of electromagnetic devices. - magnetism - electromagnetism - current flow and magnetic fields applied to relays, solenoids and motors - right and left-hand rules - counter-electromotive force effect 7.2 Explain the construction, types and principles of operations of electromagnetic devices. - voltage generation alternators generators - electric motors - solenoids - relays - coils - stepper motors 7.3 Inspect, test and diagnose electromagnetic devices for proper performance. - electric motors - solenoids - relays - coils - stepper motors
Course Outcome 8	**Learning Objectives for Course Outcome 8**

Upon successful completion the student will have the ability to explain the purpose, function, construction and applications of electronic devices according to sound scientific principles.	8.1 Explain the purpose, function, construction and application of electronic devices. - power supplies - voltage regulators - voltage limiters - resistors fixed variable potentiometer thermistors capacitors - semiconductor devices - diodes rectifying zener light emitting photo 8.2 Specify the precautions necessary when working with electronic circuits and components. - voltage spike - static electricity buildup - electrostatic discharge - maintaining correct safe shielding and grounding
Course Outcome 9	**Learning Objectives for Course Outcome 9**
Upon successful completion the student will have the ability to describe the purpose, function and principles of operation of fuel system components according to manufacturers` standards.	9.1 Explain the purpose and fundamentals of fuels. - engine theory - thermodynamics - combustion ratios - fuels chemistry 9.2 Describe the function, composition and properties of fuels. - gasoline fuel volatility octane rating additives hydrocarbons atomization heat energy / calorific value - diesel fuel volatility cetane number viscosity additives sulfur content, etc. - alternate fuels Ethanol, E10, E85, biodiesel propane, natural gas and alcohol boiling points volatility pressure requirements 9.3 Explain the combustion principles of fuels. - oxidation reactions - products of combustion

	HC CO CO2 NOX - air fuel ratios - atomization / vaporization - detonation - pre-ignition 9.4 Locate and identify fuel delivery system components. - tanks - filters - lines - pumps - pressure regulators - injectors
Course Outcome 10	**Learning Objectives for Course Outcome 10**
Upon successful completion the student will have the ability to explain the purpose, construction, principles of operations and perform inspection / testing of intake & exhaust systems according to manufacturers` standards.	10.1 Explain the purpose and fundamentals of intake and exhaust systems. - volumetric efficiency - scavenging - manifold vacuum and exhaust back pressure - ported vacuum - thermal expansion and contraction - Boyle`s Law, Charles Law, and Bernoulli`s Theorem 10.2 Explain the construction, types, operation, styles and application of intake and exhaust systems. - air cleaners - intake and exhaust manifolds - exhaust pipes - resonators and mufflers - intake manifold heating 10.3 Inspect and test intake and exhaust systems. - visually inspect intake and exhaust systems restrictions noise leaks - perform: test exhaust back pressure test intake manifold vacuum
Course Outcome 11	**Learning Objectives for Course Outcome 11**
Upon successful completion the student will have the ability to explain the basic operation of emission control systems according to manufacturers` standards.	11.1 Explain the basics of emission control systems. - combustion of fuels - combustion bi-products - Properties of carbon monoxide, hydrocarbons, oxides of nitrogen. - photo-chemicals, smog, acid rain, greenhouse effect - emission standards and model year compliance - legal consequences of emission equipment tampering - air / fuel ratio - temperature of combustion

	- thermal expansion and contraction 11.2 Explain the basic operation of the emission control components. - evaporative emission systems - exhaust gas re-circulation systems - positive crankcase ventilation - catalytic converters - air injection systems 11.3 Locate and identify emission control system components. - manifold heating devices - evaporative emission systems - exhaust gas re-circulation systems - positive crankcase ventilation - catalytic converters/air injection systems
Course Outcome 12	**Learning Objectives for Course Outcome 12**
Upon successful completion the student will have the ability to explain the purpose, operation and safe working practices associated with hybrid vehicles according to manufacturers` recommendations.	12.1 Explain the basic hybrid 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 12.2 Explanation and identification of hybrid systems. - high voltage / intermediate voltage - cooling Internal Combustion Engine (I.C.E.) Inverter - braking - accessory - air conditioning 12.3 Explain safe hybrid working practices. - high voltage / intermediate voltage - personal safety - area safety - protective equipment - meter requirements - disconnect procedures - driving the vehicle into or out of the shop - lifting / hoisting - pushing or moving a hybrid

Evaluation Process and Grading System:

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

Date: November 12, 2024

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