Electrical/Electronic Systems and Heating Ventilation Air Conditioning (HVAC)

Career Cluster	Transportation Distribution and Logistics
Course Code	20105
Prerequisite(s)	Introduction to Vehicle Systems and Maintenance or Maintenance and Light Repair - Recommended
Credit	1
Program of Study and Sequence	Foundational courses – Introduction to Vehicle Systems and Maintenance or Maintenance and Light Repair – **Electrical/Electronic Systems and HVAC** – Capstone Experience
Student Organization	SkillsUSA
Coordinating Work-Based Learning	NA
Industry Certifications	NA
Dual Credit or Dual Enrollment	NA
Teacher Certification	Transportation, Distribution & Logistics Cluster Endorsement; Automotive Technology Pathway Endorsement; *Automotive Technology
Resources	

Course Description:

Students in Electrical/Electronic Systems and Heating Ventilation Air Conditioning (HVAC) will learn theory and operation as well as diagnosis and repair of Electrical/Electronic and HVAC systems. Completion of this course will aid students as they continue their education at the post-secondary level or in the workforce and in the preparation for their ASE certification test. (The examples are NATEF (National Automobile Technician Education Foundation) tasks that the student may complete for ASE (Automotive Service Excellence) certification.)

Program of Study Application

Electrical/Electronic Systems and Heating Ventilation Air Conditioning (HVAC) is an advanced pathway course in the transportation, distribution and logistics career cluster, automotive technology pathway.

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Course Standards

EEHVAC 1 Students will demonstrate automotive technology safety practices, including Occupational Safety and Health Administration (OSHA) and Environmental Protection Agency (EPA) requirements, for an automotive repair facility.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	EEHVAC 1.1 Demonstrate automotive technician safety practices Examples: • Use protective clothing and safety equipment according to OSHA and EPA requirements. • Summarize the proper use of safety data sheet (SDS) • Demonstrate the proper use of hand and power tools • Examine basic shop safety using OSHA standards • Maintain a portfolio of successfully completed safety and equipment exams	• NATEF tasks that apply to sub-indicators

Notes

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EEHVAC 2 Students will perform maintenance, diagnostic and repair procedures of electrical/electronic systems.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 3: Strategic Thinking	EEHVAC 2.1 Demonstrate knowledge of the vehicle electrical system Examples: • Research vehicle service information including vehicle service history, service precautions, and technical service bulletins. P-1 • Demonstrate knowledge of electrical/electronic series, parallel, and series and parallel circuits using principles of electricity (Ohm's Law). P-1 • Demonstrate proper use of a digital multimeter (DMM) when measuring source voltage, voltage drop (including grounds), current flow, and resistance. P-1 • Demonstrate knowledge of the causes and effects from shorts, grounds, opens, and resistance problems in electrical/electronic circuits. P-1 • Identify electrical/electronic system components and configuration. P-1	• NATEF tasks that apply to sub-indicators
Level 2: Skill/Concept	EEHVAC 2.2 Test and repair electrical problems Examples: • Use a test light to check operation of electrical circuits. P-2 • Use fused jumper wires to check operation of electrical circuits. P-2 • Measure key-off battery drain (parasitic draw). P-1 • Inspect and test fusible links, circuit breakers, and fuses; determine necessary action. P-1 • Repair and/or replace connectors, terminal ends, and wiring of electrical/electronic systems (including solder repair) P-1 • Use wiring diagrams to trace electrical/electronic circuits. P-1	• NATEF tasks that apply to sub-indicators

Notes: P-1, P-2, P-3 refers to levels of difficulty under NATEF tasks (P-1 lowest)

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EEHVAC 3 Students will perform maintenance, diagnostic and repair procedures of the battery systems.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 1: Recall	EEHVAC 3.1 Identify battery requirements Examples: • Identify safety precautions for high voltage systems on electric, hybrid electric, and diesel vehicles. P-2 • Identify electrical/electronic modules, security systems, radios, and other accessories that require reinitialization or code entry after reconnecting vehicle battery. P-1 • Identify hybrid vehicle auxiliary (12v) battery service, repair, and test procedures. P-2	• NATEF tasks that apply to sub-indicators
Level 2: Skill/Concept	EEHVAC 3.2 Service battery Examples: • Perform battery state-of-charge test; determine necessary action. P-1 • Confirm proper battery capacity for vehicle application; perform battery capacity and load test; determine necessary action. P-1 • Maintain or restore electronic memory functions. P-1 • Inspect and clean battery; fill battery cells; check battery cables, connectors, clamps, and hold-downs. P-1 • Perform slow/fast battery charge according to manufacturer's recommendations. P-1 • Jump-start vehicle using jumper cables and a booster battery or an auxiliary power supply. P-1	• NATEF tasks that apply to sub-indicators

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EEHVAC 4 Students will perform maintenance, diagnostic and repair procedures of starting systems.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 1: Recall	EEHVAC 4.1 Explain starting system operation Examples: • Demonstrate knowledge of an automatic idle-stop/start-stop system. P-3	• NATEF tasks that apply to sub-indicators
Level 2: Skill/Concept	EEHVAC 4.2 Inspect and repair starting system Examples: • Perform starter current draw test; determine necessary action. P-1 • Perform starter circuit voltage drop tests; determine necessary action. P-1 • Inspect and test starter relays and solenoids; determine necessary action. P-2 • Remove and install starter in a vehicle. P-1 • Inspect and test switches, connectors, and wires of starter control circuits; determine necessary action. P-2	• NATEF tasks that apply to sub-indicators

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EEHVAC 5 Students will perform maintenance, diagnostic and repair procedures of the charging system.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	EEHVAC 5.1 Remove, inspect, and replace charging system components Examples: • Perform charging system output test; determine necessary action. P-1 • Inspect, adjust, and/or replace generator (alternator) drive belts; check pulleys and tensioners for wear; check pulley and belt alignment. P-1 • Remove, inspect, and/or replace generator (alternator). P-2 • Perform charging circuit voltage drop tests; determine necessary action. P-2	• NATEF tasks that apply to sub-indicators

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EEHVAC 6 Students will identify and perform repair procedures of electrical systems.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	EEHVAC 6.1 Identify and inspect lighting, instrument cluster, driver information, and body electrical systems and verify operation Examples: • Identify system voltage and safety precautions associated with high-intensity discharge headlights. P-2 • Inspect interior and exterior lamps and sockets including headlights and auxiliary lights (fog lights/driving lights); replace as needed. P-1 • Verify operation of instrument panel gauges and warning/indicator lights; reset maintenance indicators. P-1 • Verify windshield wiper and washer operation; replace wiper blades. P-1 • Describe the operation of keyless entry/remote-start systems. P-3	• NATEF tasks that apply to sub-indicators
Level 2: Skill/Concept	EEHVAC 6.2 Perform the following repair operations • Aim headlights. P-2 • Disable and enable supplemental restraint system (SRS) and verify indicator lamp operation. P-1 • Remove and reinstall door panel. P-1	• NATEF tasks that apply to sub-indicators

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EEHVAC 7 Students will research and identify heating, ventilation, and air conditioning components.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 1: Recall	EEHVAC 7.1 Obtain vehicle service information on heating and air conditioning components Examples: • Research vehicle service information, including refrigerant/oil type, vehicle service history, service precautions, and technical service bulletins. P-1 • Identify heating, ventilation and air conditioning (HVAC) components and configuration. P-1	• NATEF tasks that apply to sub-indicators

Notes

EEHVAC 8 Students will perform repair procedures for the refrigeration system.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	EEHVAC 8.1 Inspect and repair refrigeration system components Examples: • Inspect and replace A/C compressor drive belts, pulleys, and tensioners; visually inspect A/C components for signs of leaks; determine necessary action. P-1 • Identify hybrid vehicle A/C system electrical circuits and the service/safety precautions. P-2 • Inspect A/C condenser for airflow restrictions; determine necessary action. P-1	• NATEF tasks that apply to sub-indicators

Notes

EEHVAC 9 Students will perform repair procedures for the heating and cooling system.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	EEHVAC 9.1 Analyze heating and engine cooling systems problem Example: • Inspect engine cooling and heater systems hoses and pipes; determine necessary action. P-1	• NATEF tasks that apply to sub-indicators

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EEHVAC 10 Students will perform inspection and identification procedures for the heating, ventilation and air conditioning (HVAC) system.

Webb Level	*Sub-indicator*	*Integrated Content*
Level 2: Skill/Concept	EEHVAC 10.1 Inspect and identify operating systems and related controls Examples: • Inspect A/C-heater ducts, doors, hoses, cabin filters, and outlets; determine necessary action. P-1 • Identify the source of A/C system odors. P-2	• NATEF tasks that apply to sub-indicators

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