**Course Description:**

Student will diagnose and repair vehicle electrical systems, including chassis electrical, charging, starting and lighting systems. Students will learn the fundamentals of direct current (DC) electronics including series, parallel, and series-parallel circuits. Students will use electronic diagnostic tools, read schematics, and use printed and electronic resources to troubleshoot electrical circuits, test components and replace defective modules.

**Strand 1. Business Operations/21st Century Skills**

Learners apply principles of economics, business management, marketing and employability in an entrepreneur, manager and employee role to the leadership, planning, developing and analyzing of business enterprises related to the career field.

**Outcome 1.1. Employability Skills**

Develop career awareness and employability skills (e.g., face‐to‐face, online) needed for gaining and maintaining employment in diverse business settings.

**Competencies**

1.1.1. Identify the knowledge, skills and abilities necessary to succeed in careers.

1.1.2. Identify the scope of career opportunities and the requirements for education, training,

certification, licensure and experience.

1.1.3. Develop a career plan that reflects career interests, pathways and secondary and

postsecondary options.

1.1.4. Describe the role and function of professional organizations, industry associations and

organized labor and use networking techniques to develop and maintain professional

relationships.

1.1.5. Develop strategies for self‐promotion in the hiring process (e.g., filling out job applications,

résumé writing, interviewing skills, portfolio development).

1.1.6. Explain the importance of work ethic, accountability and responsibility and demonstrate

associated behaviors in fulfilling personal, community and workplace roles.

1.1.7. Apply problem‐solving and critical‐thinking skills to work‐related issues when making decisions

and formulating solutions.

1.1.8. Identify the correlation between emotions, behavior and appearance and manage those to

establish and maintain professionalism.

1.1.9. Give and receive constructive feedback to improve work habits.

1.1.10. Adapt personal coping skills to adjust to taxing workplace demands.

1.1.11. Recognize different cultural beliefs and practices in the workplace and demonstrate respect

for them.

1.1.12. Identify healthy lifestyles that reduce the risk of chronic disease, unsafe habits and abusive

behavior.

**Outcome 1.2. Leadership and Communications**

Process, maintain, evaluate and disseminate information in a business. Develop leadership and team building to promote collaboration.

**Competencies**

1.2.1. Extract relevant, valid information from materials and cite sources of information.

1.2.2. Deliver formal and informal presentations.

1.2.3. Identify and use verbal, nonverbal and active listening skills to communicate effectively.

1.2.4. Use negotiation and conflict‐resolution skills to reach solutions.

1.2.5. Communicate information (e.g., directions, ideas, vision, workplace expectations) for an

intended audience and purpose.

1.2.6. Use proper grammar and expression in all aspects of communication.

1.2.7. Use problem‐solving and consensus‐building techniques to draw conclusions and determine

next steps.

1.2.8. Identify the strengths, weaknesses and characteristics of leadership styles that influence

internal and external workplace relationships.

1.2.9. Identify advantages and disadvantages involving digital and/or electronic communications

(e.g., common content for large audience, control of tone, speed, cost, lack of non‐verbal

cues, potential for forwarding information, longevity).

1.2.10. Use interpersonal skills to provide group leadership, promote collaboration and work in a

team.

1.2.11. Write professional correspondence, documents, job applications and resumés.

1.2.12. Use technical writing skills to complete forms and create reports.

1.2.13. Identify stakeholders and solicit their opinions.

1.2.14. Use motivational strategies to accomplish goals.

**Outcome 1.3. Business Ethics and Law**

Analyze how professional, ethical and legal behavior contributes to continuous improvement in organizational performance and regulatory compliance.

**Competencies**

1.3.1. Analyze how regulatory compliance affects business operations and organizational

performance.

1.3.2. Follow protocols and practices necessary to maintain a clean, safe and healthy work

environment.

1.3.3. Use ethical character traits consistent with workplace standards (e.g., honesty, personal

integrity, compassion, justice).

1.3.4. Identify how federal and state consumer protection laws affect products and services.

1.3.5. Access and implement safety compliance measures (e.g., quality assurance information, safety

data sheets [SDSs], product safety data sheets [PSDSs], United States Environmental

Protection Agency [EPA], United States Occupational Safety and Health Administration

[OSHA]) that contribute to the continuous improvement of the organization.

1.3.6. Identify deceptive practices (e.g., bait and switch, identity theft, unlawful door‐to‐door sales,

deceptive service estimates, fraudulent misrepresentations) and their overall impact on

organizational performance.

1.3.7. Identify the labor laws that affect employment and the consequences of noncompliance for both employee and employer (e.g., harassment, labor, employment, employment interview, testing, minor labor laws, Americans with Disabilities Act [ADA], Fair Labor Standards Acts [FLSA], Equal Employment Opportunity Commission [EEOC]).

1.3.9. Identify potential conflicts of interest (e.g., personal gain, project bidding) between personal,

organizational and professional ethical standards.

**Outcome 1.4. Knowledge Management and Information Technology**

Demonstrate current and emerging strategies and technologies used to collect, analyze, record and share information in business operations.

**Competencies**

1.4.1. Use office equipment to communicate (e.g., phone, radio equipment, fax machine, scanner,

public address systems).

1.4.2. Select and use software applications to locate, record, analyze and present information (e.g.,

word processing, e‐mail, spreadsheet, databases, presentation, Internet search engines).

1.4.3. Verify compliance with security rules, regulations and codes (e.g., property, privacy, access,

accuracy issues, client and patient record confidentiality) pertaining to technology specific to

the industry pathway.

1.4.4. Use system hardware to support software applications.

1.4.5. Use information technology tools to maintain, secure and monitor business records.

1.4.6. Use an electronic database to access and create business and technical information.

1.4.7. Use personal information management and productivity applications to optimize assigned

tasks (e.g., lists, calendars, address books).

1.4.8. Use electronic media to communicate and follow network etiquette guidelines.

**Outcome 1.5. Global Environment**

Evaluate how beliefs, values, attitudes and behaviors influence organizational strategies and goals.

**Competencies**

1.5.3. Use cultural intelligence to interact with individuals from diverse cultural settings.

1.5.4. Recognize barriers in cross‐cultural relationships and implement behavioral adjustments.

1.5.5. Recognize the ways in which bias and discrimination may influence productivity and

profitability.

1.5.7. Use intercultural communication skills to exchange ideas and create meaning.

**Outcome 1.6. Business Literacy**

Develop foundational skills and knowledge in entrepreneurship, financial literacy and business operations.

**Competencies**

1.6.1. Identify business opportunities.

1.6.2. Assess the reality of becoming an entrepreneur, including advantages and disadvantages (e.g., risk versus reward, reasons for success and failure).

1.6.5. Describe organizational structure, chain of command, the roles and responsibilities of the organizational departments and interdepartmental interactions.

1.6.8. Identify the features and benefits that make an organization’s product or service competitive.

1.6.9. Explain how the performance of an employee, a department and an organization is assessed.

1.6.12. Describe classifications of employee benefits, rights, deductions and compensations.

**Outcome 1.7. Entrepreneurship/Entrepreneurs**

Analyze the environment in which a business operates and the economic factors and opportunities associated with self-employment.

**Competencies**

1.7.10. Describe techniques for obtaining experience (e.g., apprenticeship, co-operative [co-op] education, work placement, internship, job shadowing) related to an entrepreneurial objective.

**Outcome 1.8. Operations Management**

Plan, organize and monitor an organization or department to maximize contribution to organizational goals and objectives.

**Competencies**

1.8.4. Identify alternative actions to take when goals are not met (e.g., changing goals, changing strategies, efficiencies).

1.8.5. Use inventory and control systems to purchase materials, supplies and equipment (e.g., Last In, First Out [LIFO]; First In, First Out [FIFO]; Just in Time [JIT]; LEAN).

1.8.6. Identify the advantages and disadvantages of carrying cost and Just-in-Time [JIT] productions systems and the effects of maintaining inventory (e.g., perishable, shrinkage, insurance) on profitability.

1.8.8. Identify routine activities for maintaining business facilities and equipment.

1.8.10. Analyze how business management and environmental management systems (e.g., health, safety) contribute to continuous improvement and sustainability.

**Outcome 1.10. Sales and Marketing**

Manage pricing, place, promotion, packaging, positioning and public relations to improve quality customer service.

**Competencies**

1.10.2. Determine the customer’s needs and identify solutions.

1.10.3. Communicate features, benefits and warranties of a product or service to the customer.

1.10.4. Identify the company policies and procedures for initiating product and service improvements.

1.10.5. Monitor customer expectations and determine product/services satisfaction by using measurement tools.

1.10.10. Demonstrate sales techniques.

**Strand 2. Safety, Tools and Maintenance**

Learners apply principles of safety and use of tools to maintain equipment and the environment to prevent accidents and mitigate hazards.

**Outcome 2.1. Facility Safety**

Handle materials, prevent accidents and mitigate hazards.

**Competencies**

2.1.1. Use Occupational Safety and Health Administration (OSHA)-defined procedures for identifying employer and employee responsibilities, situations that require working in confined spaces and safety labeling.

2.1.2. Identify and communicate hazards associated with slippery surfaces and lighting.

2.1.6. Identify and eliminate workplace clutter and maintain clearance and boundaries.

2.1.8. Identify procedures for handling, storage and disposal of hazardous materials.

2.1.9. Identify locations and describe use of emergency flush showers, eyewash fountains, Safety Data Sheets (SDSs), fire alarms and exits.

2.1.11. Select and operate fire extinguishers based on the class of fire.

2.1.12. Conduct safety inspection of a workspace.

2.1.13. Identify the types of ergonomic workflow and the need for them.

**Outcome 2.2. Personal Safety**

Practice personal safety.

**Competencies**

2.2.1. Interpret personal safety rights according to the employee Right-to-Know plan.

2.2.2. Describe the risk factors associated with working under the influence of drugs, alcohol and stimulants and how it increases the risk of accident, lowers productivity, raises insurance costs and reduces profits.

2.2.3. Select, use, maintain and dispose of Personal Protective Equipment (PPE) appropriate to job tasks, conditions and materials.

**Outcome 2.3. Tool and Equipment Preventative Maintenance**

Identify, use, clean, maintain and perform planned preventative maintenance on tools and equipment.

**Competencies**

2.3.1. Identify the types of hand tools, power tools and stationary equipment and describe their function.

2.3.2. Identify potential hazards and limitations related to the use of hand tools, power tools and stationary equipment.

2.3.3. Operate power tools and stationary equipment in accordance with established procedures and safety standards.

**Outcome 2.4. General Maintenance**

Provide general maintenance to mechanical systems.

**Competencies**

2.4.15. Inspect and service battery and battery cables, connectors, clamps and hold down.

2.4.16. Inspect interior and exterior lamps and sockets.

2.4.17. Verify operation of instrument panel gauges and warning/indicator lights and reset maintenance indicators.

2.4.22. Inspect, repair or replace fasteners.

**Strand 4. Systems Performance**

Learners apply principles of brake systems, electrical and electronic systems and heating, ventilation and air conditioning (HVAC) systems to diagnose and repair malfunctions.

**Outcome 4.5. Electrical and Electronic Systems**

Diagnose the electrical and electronic integrity of series, parallel and series-parallel circuits using principles of electricity (e.g., Ohm’s Law, Watt’s Law).

**Competencies**

4.5.1. Describe basic electrical theory.

4.5.2. Interpret wiring diagrams of electrical circuits.

4.5.3. Describe static (open circuit) and dynamic (closed circuit) testing principles.

4.5.4. Measure the source voltage and perform voltage drop and current draw tests in electrical and electronic circuits.

4.5.5. Measure current, continuity and resistance.

4.5.6. Describe the principles of capacitance and inductance.

4.5.7. Identify and describe the functions of non-suppressed, suppressed, and bistable relays.

4.5.8. Inspect and test switches, connectors, relays, solenoid and wires of electrical and electronic circuits.

4.5.9. Remove, identify manufacturer, and repair or replace terminal connectors.

4.5.10. Perform solder repair of electrical wiring.

4.5.11. Locate shorts, grounds, opens and resistance problems in electrical and electronic circuits.

4.5.12. Measure and diagnose the causes of excessive key-off battery drain (parasitic draw).

4.5.13. Inspect, test and replace or reset fusible links, circuit breakers and fuses.

**Outcome 4.6. Batteries**

Diagnose and service batteries.

**Competencies**

4.6.1. Identify battery construction and principles of operation.

4.6.2. Test battery performance using state-of-charge and conductance tests and record results.

4.6.3. Confirm battery capacity for vehicle application and perform a battery capacity test.

4.6.4. Maintain or restore electronic memory functions.

4.6.5. Perform a battery charge.

4.6.6. Start a vehicle using jumper cables and a battery or auxiliary power supply using manufacturer’s jumping techniques and precautions.

4.6.7. Perform battery maintenance and repairs.

4.6.8. Remove and replace a battery.

**Outcome 4.7. Starting and Charging Systems**

Identify, inspect and replace starting and charging system components.

**Competencies**

4.7.1. Differentiate between electrical and engine mechanical problems that cause a slow crank or no crank condition.

4.7.2. Inspect, test and replace low and high current side components.

4.7.3. Perform charging system output tests to identify causes of undercharge, no charge and overcharge conditions.

4.7.4. Inspect and adjust or replace alternator drive belts, pulleys and tensioners and check pulley and belt alignment.

4.7.5. Remove, inspect and install an alternator and starter.

4.7.6. Identify the high voltage circuit of electric or hybrid electric vehicles and related safety precautions.

**Outcome 4.8. Lighting and Accessories**

Identify, inspect and replace electrical and electronic components of lighting systems and accessories.

**Competencies**

4.8.1. Identify the cause of brighter than normal, intermittent, dim, or no light operations.

4.8.2. Inspect, replace and aim headlights and bulbs.

4.8.3. Identify and inspect incorrect turn signal or hazard light operation.

4.8.4. Identify and inspect brake light circuit switches, wiring and connectors.

4.8.5. Identify system voltage and safety precautions associated with high-intensity discharge headlights.

4.8.6. Inspect and test gauges and gauge sending units for causes of abnormal gauge readings.

4.8.7. Identify incorrect horn operation.

4.8.8. Identify incorrect wiper and washer operation and replace.

4.8.9. Identify incorrect operation of motor-driven accessories.

4.8.10. Identify incorrect heated glass, mirror, or seat operation and repair.

4.8.11. Identify incorrect lock operation and repair.

4.8.12. Identify airbag supplemental restraint system (SRS) concerns.

4.8.13. Identify safety concerns for disarming and enabling the airbag system for vehicle service.

4.8.14. Identify advance driver assistance systems (ADAS) and recommended procedures before inspecting or replacing components.