Manitoba Grade 12A Automotive Technology Electrical Fundamentals and Services (Course Code 8700)
Course Outline

Course Description

This course provides students with the foundational knowledge and practical skills required to diagnose, service, and repair automotive electrical and electronic systems. Students develop an understanding of electrical theory, circuit operation, wiring systems, batteries, starting systems, charging systems, and electronic components used in modern vehicles. The course aligns with the Manitoba Senior Years Technology Education Program and incorporates learning outcomes from Apprenticeship Manitoba Level 1 Automotive Service Technician training.

Course Objectives

- Demonstrate safe work practices when servicing electrical systems.
- Explain and apply basic electrical theory.
- Interpret electrical symbols, wiring diagrams, and schematics.
- Use electrical testing equipment safely and accurately.
- Diagnose electrical circuit faults.
- Service and test vehicle batteries.
- Diagnose and repair charging system concerns.
- Diagnose and repair starting system concerns.
- Perform electrical wiring repairs and connector servicing.
- Demonstrate employability skills and professional workplace practices.

Course Units

Unit 1: Shop Safety and Electrical Safety

Estimated Time: 8-10 hours

Topics:

- WHMIS and PPE requirements
- Electrical hazards
- Safe handling of batteries
- Lock-out procedures
- Shop housekeeping

- Environmental considerations

Assessment: Safety quiz; shop participation; safety inspection activities

Unit 2: Electrical Theory Fundamentals

Estimated Time: 12-15 hours

Topics:

- Atomic structure
- Electrons and current flow
- Voltage, current, resistance
- Ohm's Law
- Power calculations
- Series, parallel and combination circuits

Assessment: Theory test, lab exercises, calculation assignments

Unit 3: Electrical Components and Circuits

Estimated Time: 15-20 hours

Topics:

- Conductors and insulators
- Fuses and circuit breakers
- Relays and solenoids
- Switches
- Wiring and connectors
- Sensors and actuators
- Ground circuits

Assessment: Lab performance, component identification test

Unit 4: Electrical Testing Equipment and Diagnostics

Estimated Time: 12-15 hours

Topics:

- Digital multimeter operation
- Test lights
- Continuity, voltage, resistance and current testing
- Diagnostic procedures

Assessment: Diagnostic lab and practical skills evaluation

Unit 5: Battery Systems

Estimated Time: 10-12 hours

Topics:

- Battery construction
- Battery types
- Battery ratings
- State of charge testing
- Maintenance and replacement procedures

Assessment: Practical evaluation and written test

Unit 6: Starting Systems

Estimated Time: 15-20 hours

Topics:

- Starter motor operation
- Starter circuits
- Solenoid operation
- Voltage drop diagnosis
- Common faults

Assessment: Diagnostic exercise and practical evaluation

Unit 7: Charging Systems

Estimated Time: 15-20 hours

Topics:

- Alternator operation
- Voltage regulators
- Charging circuits
- Testing and diagnostics

Assessment: Practical evaluation and unit test

Unit 8: Wiring Diagrams and Electrical Repair

Estimated Time: 12-15 hours

Topics:

- Reading wiring diagrams
- Electrical symbols
- Connector identification

- Wire repair procedures
- Soldering techniques
- Heat shrink applications

Assessment: Wiring project and practical test

Assessment Breakdown

Component	Weight
Theory Tests & Quizzes	25%
Practical Shop Skills	35%
Labs & Assignments	20%
Major Diagnostic Project	10%
Employability & Safety Practices	10%

Required Tools and Equipment

- Digital Multimeter (DMM)
- Battery Tester
- Scan Tool
- Test Light
- Wire Strippers
- Crimping Tools
- Soldering Equipment
- Automotive Service Information Systems

Employability Skills

- Workplace safety
- Problem-solving
- Critical thinking
- Communication
- Teamwork
- Time management
- Professional conduct
- Career awareness within the automotive service industry

Culminating Project

Students will complete a comprehensive electrical diagnostic project requiring wiring diagram interpretation, diagnosis of an assigned fault, development of a repair plan, completion of the repair, verification of proper operation, and professional documentation of findings.

Recommended Prerequisite

Grade 11 Automotive Technology (Engine Fundamentals and Services or equivalent coursework).