



**ONTARIO COLLEGE OF TRADES**  

---

**ORDRE DES MÉTIERS DE L'ONTARIO**

Apprenticeship  
Curriculum Standard

Turf Equipment  
Technician

Level 3

Trade Code: 421C

Development Date: 2006



**Please Note:**

Apprenticeship Training and Curriculum Standards were developed by the Ministry of Training, Colleges and Universities (MTCU). As of April 8<sup>th</sup>, 2013, the Ontario College of Trades (College) has become responsible for the development and maintenance of these standards. The College is carrying over existing standards without any changes.

However, because the Apprenticeship Training and Curriculum Standards documents were developed under either the *Trades Qualification and Apprenticeship Act* (TQAA) or the *Apprenticeship and Certification Act, 1998* (ACA), the definitions contained in these documents may no longer be accurate and may not be reflective of the *Ontario College of Trades and Apprenticeship Act, 2009* (OCTAA) as the new trades legislation in the province. The College will update these definitions in the future.

Meanwhile, please refer to the College's website ([www.collegeoftrades.ca](http://www.collegeoftrades.ca)) for the most accurate and up-to-date information about the College. For information on OCTAA and its regulations, please visit: [www.collegeoftrades.ca/about/legislation-and-regulations](http://www.collegeoftrades.ca/about/legislation-and-regulations).

**Table of Contents**

Introduction ..... i

Summary of Total Program In-School Training Hours ..... 1

Program Summary of Reportable Subjects

1. Turf Equipment Trade Practices ..... 2

    1.1 - Golf Course Orientation ..... 3

    1.2 - Electronic Information Access and Document Management ..... 6

    1.3 - Metal Fabrication Techniques ..... 9

2. Turf Grass Management ..... 12

    2.1 - Turf Grass Management Techniques ..... 13

3. Turf Equipment Traction Units ..... 17

    3.1 - Turf Traction Unit Systems ..... 18

    3.2 - Cabs Systems, Frames and Operator Protection Devices ..... 22

4. Applied Turf Equipment Electronic Systems ..... 27

    4.1 - Electronic Input Circuit Components ..... 28

    4.2 - Electronic Circuit Schematics ..... 31

    4.3 - Electronic Charging Systems ..... 33

5. Applied Turf Equipment Hydraulic Systems ..... 37

    5.1 - Hydraulic Fluids, Conductors and Fittings ..... 38

    5.2 - Hydraulic & Hydrostatic Drive Systems ..... 42

6. Applied Turf Mowing Equipment ..... 47

    6.1 - Define the fundamentals ..... 48

7. Turf Spraying Equipment ..... 54

    7.1 - Define the fundamentals ..... 55

8. Powered Golf Cars and Utility Vehicles ..... 59

    8.1 - Golf Car and Utility Vehicles ..... 60

    8.2 - Pre-Delivery and Test Run ..... 66

    8.3 - Golf Car Body and Trim Components ..... 68

    8.4 - Damage identification and Repair ..... 70

### INTRODUCTION

This new curriculum standard for the Turf Equipment Technician trade is designed down from the learning outcomes, which were in turn developed from the industry-approved training standard.

The curriculum is organized into 3 **levels** of training, each including reportable subjects containing like or similar learning outcomes to reflect the units of the training standard. The first two levels are common core with the Small Engine Technician and Marine Engine Technician curriculum standards. The hours chart indicates how the curriculum can be delivered in the current block release format and summarizes the hours of training for each reportable by level. Since the reportable subjects are all divisible by three they can be adapted to accommodate flexible training delivery models other than block release.

The reportable subjects are cross-referenced to the training standard for ease of comparison.

Each reportable subject and learning outcome identifies a recommended number of training hours. This hour allotment is broken into hours for instruction in theory and practical application. The division of the curriculum into reportable subjects that follow a natural progression of learning through the levels and branches of training will allow training centres and apprentices flexibility in program delivery while still observing the importance of sequencing learning in a logical progression.

The curriculum is framed by and includes specific references to terminal performance objectives in the Apprenticeship Training Standards for the Turf Equipment Technician trade. However, it identifies only the learning that takes place off the job, in a training centre. The in-school program focuses primarily on the theoretical knowledge required to master the performance objectives of the Training Standards. Employers are expected to extend the apprentice's knowledge and skills through appropriate practical training on the work site. Regular evaluations of the apprentice's knowledge and skills is conducted throughout training to assure that all apprentices have achieved the learning outcomes identified in the curriculum standard. The balance between theoretical and practical evaluation is identified for each unit of learning outcomes.

**Implementation date:**

October 2006

## Summary of Total Program In-School Training Hours Level 3

<b>Reportable Subjects</b>	<b>Total</b>	<b>Theory</b>	<b>Practical</b>
1. Turf Equipment Trade Practices	18	9	9
2. Turf Grass Management	18	15	3
3. Turf Equipment Traction Units	33	23	10
4. Applied Turf Equipment Electronic systems	27	11	16
5. Applied Turf Equipment Hydraulic Systems	36	22	14
6. Applied Turf Mowing Equipment	51	18	33
7. Turf Spraying Equipment	21	14	7
8. Powered Golf Cars and Utility Vehicles	36	20	16
<b>TOTAL</b>	<b>240</b>	<b>132</b>	<b>108</b>

Number: 1  
Title: Turf Equipment Trade Practices  
Duration: 18 Total Hours Theory: 9 Hours Practical: 9 Hours  
Prerequisites: Level I and Level II, Small Engine Reportable Subjects  
Co-requisites: Level III, Reportable Subject Numbers 2, 3, 4, 5, 6, 7 & 8

---

1.1 - Golf Course Orientation

3 Total Hours Theory: 3 hours Practical: 0 hours

1.2 - Electronic Information Access and Document Management

6 Total Hours Theory: 3 hours Practical: 3 hours

1.3 - Metal Fabrication Techniques

9 Total Hours Theory: 3 hours Practical: 6 hours

1.1 - Golf Course Orientation

Cross-Reference to Learning Outcomes: 1.0, 2.1

Duration:           3 Total Hours    Theory: 3 hours    Practical: 0 hours

General Learning Outcome:

Define Golf Course terminology, Etiquette and Maintenance Equipment requirements.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 1.1.1 Define the basic information and fundamentals of the Golf Course Equipment Industry.
- 1.1.2 Describe the basics of the game of golf and etiquette for maintenance personal.
- 1.1.3 Identify the main types of golf specific turf equipment.
- 1.1.4 Explain the function of golf specific systems and related components.



Learning Content:

1.1.1 Define the basic information and fundamentals of the Golf Course Equipment Industry.

[.5/0]

- history of the golf course industry
- introduction to the game of golf
- golf course etiquette
- golf specific equipment

1.1.2 Describe the basics of the game of golf and etiquette for maintenance personal.

[.5/0]

- Introduction to the game of golf
  - history
- terminology and parts of the golf course
  - basics of the game
- golf course etiquette
  - importance of following etiquette during turf maintenance activities
  - interaction with golfers

1.1.3 Identify the main types of golf specific turf equipment.

[.5/0]

- Introduction to golf specific equipment
  - aerators
  - fly mowers
  - sod cutters
  - top dressers
  - turf rollers
  - core pulverizers
  - core harvesters
  - verti-cutters, turf groomers
  - reel & rotary mowers
  - hole cutters
  - bulk material handling systems
  - fertilizer spreaders
  - leaf vacuums
  - leaf blowers
  - sand trap rakes

1.1.4 Explain the function of golf specific systems and related components.  
[1.5/0]

- Golf specific equipment
  - Aerators
    - self propelled
    - tractor mount
    - tow behind
    - fairway
    - greens
    - deep tyne
    - hydro-ject/water injection
- tractors/utility vehicles/golf cars
  - sprayers
  - fly mowers
  - sod cutters
  - top dressers
    - walk behind
    - vehicle mounted
    - tractor mounted/tow behind for bulk material systems
    - fertilizer spreaders
      - hand propelled (drop, rotary)
      - tractor/utility vehicle mounted or towed
  - hole cutters
    - pound type
    - twist scalloped type
  - leaf vacuums/sweeper
    - self propelled
    - tractor mount
    - attachments to out front units
  - leaf blowers
    - back pack
    - tractor mount
    - walk behind
  - sand trap rakes
    - cultivator
    - gas/electric
    - tine
    - plow/dozer blades

1.2 - Electronic Information Access and Document Management

Cross-Reference to Learning Outcomes: 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0

Duration:           6 Total Hours    Theory: 3 hours       Practical: 3 hours

General Learning Outcome:

Describe turf equipment electronic information accessing and document management procedures.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 1.2.1 Define the purpose, functions and application of information accessing and communication systems.
- 1.2.2 Locate and navigate turf equipment manufacturer's web sites.
- 1.2.3 Describe the procedures to use spreadsheets and word processing software in service facilities and information management systems.
- 1.2.4 Define the fundamentals of introduction to computer networking.

Learning Content:

1.2.1 Define the purpose, functions and application of information accessing and communication systems.

[1/0]

- Introduction to the Personal Computer (PC).  
Identify the device names and designations
  - hard drives
  - floppy disks
  - CD Rom
  - DVD
  - removable memory devices
- Software Management Format
  - directory
  - file naming
  - copy - save to disc or CD
  - delete
  - rename
  - save to files
  - cut/paste
  - file transfer
  - data backup

1.2.2 Locate and navigate turf equipment manufacturer's web sites.

[1/1]

- Use of search engines
- key words
- sample web sites

1.2.3 Describe the procedures to use spreadsheets and word processing software in service facilities and information management systems.

[1/1]

- Electronic Spread Sheets
  - menu structures
  - naming/saving conventions
  - documentation
  - spreadsheet layout
  - copy/move
  - file/merge/browse
  - search/replace

1.2.4 Define the fundamentals of introduction to computer networking.

[0/1]

- Introduction to computer networking
  - networking etiquette
  - web browsers
  - search engines
  - downloading
  - e-mail
  - attachments
  - links
  - virus protection (security features)

### 1.3 - Metal Fabrication Techniques

Cross-Reference to Learning Outcomes: 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0

Duration: 9 Total Hours Theory: 3 hours Practical: 6 hours

General Learning Outcome:

Perform turf equipment metal fabrication techniques.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

1.3.1 Plan and set up workspace

1.3.2 Select materials from specifications and specific repair requirements.

1.3.3 Perform the assigned fabrication project activities.

Learning Content:

1.3.1 Plan and set up workspace.

[2/0]

- identify the required workspace size
- describe a safe working area
- define adequate lighting needs
- identify ventilation and air-flow requirements
- identify workspace equipment requirements
- identify potential environmental hazards
- identify potential overhead hazards
- describe the desired work process flow

1.3.2 Select materials from specifications and define for specific repair requirements.

[1/1]

- materials
  - flat iron
  - angle iron
  - steel rod
  - sheet metal
- fasteners
  - bolts and nuts
  - washers
  - rivets

1.3.3 Perform the assigned suggested fabrication project activities.

[0/5]

- plan and prepare worksite
- suggested project activities to produce:
  - valve keys
  - brake drum puller
  - work stool
  - flywheel puller
  - valve spring compressor
  - wheel alignment tool

Evaluation Structure:

Theory:	35 %
Practical:	35 %
Final Level Test:	30 %

### Instructional and Delivery Strategies:

Classroom facilities including:

- whiteboard/blackboard
- appropriate audio/visual resources
- computers
- service information

### Minimum Equipment List:

- approved storage and disposal containers
- WHIMS materials
- approved fire extinguishers
- appropriate hand and power tools
- appropriate lifting, rigging and blocking equipment
- compressed air supply equipment
- computers
- grinding equipment
- welding equipment (oxy acetylene, metal inert gas, Arc)
- appropriate and up to date MSDS information
- vices/press
- grinders
- drill press
- parts cleaning equipment (pressure washer/appropriate cleaning solutions and area)
- antifreeze testers
- battery testers
- Original Equipment Manufacturer (OEM) manuals and service specifications



Number: 2

Title: Turf Grass Management

Duration: 18 Total Hours

Theory: 15 Hours Practical: 3 Hours

Prerequisites: Level I and Level II, Small Engine Reportable Subjects

Co-requisites: Level III, Reportable Subject Numbers 1, 3, 4, 5, 6, 7 & 8

---

### 2.1 - Turf Grass Management Techniques

18 Total Hours Theory: 15 hours Practical: 3 hours

## 2.1 - Turf Grass Management Techniques

Cross-Reference to Learning Outcomes: 1.0, 4.0, 6.0

Duration:           18 Total Hours    Theory: 15 hours    Practical: 3 hours

General Learning Outcome:

Describe the procedures to manage turf grass.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 2.1.1 Define the fundamentals of turf grass management.
- 2.1.2 Describe the reason for and theory behind turf management procedures.
- 2.1.3 Explain the principles of turf management procedures.
- 2.1.4 Describe the fundamentals of turf grass maintenance.

Learning Content:

2.1.1 Define the fundamentals of turf grass management.

[1/0]

- history and definition of turf management
- define turf management terms
  - mowing
  - aerating / compaction / thatch control
  - top dressing
  - grooming/verti-cutting
  - fertilizing
  - spraying
  - irrigation

2.1.2 Describe the function and types of turf management systems.

[3/0]

- maintenance practices
  - mowing
  - irrigation practices
  - irrigation systems
  - spraying
  - aerification
  - top dressing
  - grooming/verti-cutting
  - fertilizing
- introduction to turf
  - species
  - growth habits
  - growth medium
  - application and uses
  - stress factors

2.1.3 Explain the principles of operation of turf management.

[6.5/3]

- maintenance practices
  - mowing
    - frequency
    - HOC (Height of Cut)
    - Q of C (Quality of Cut) - affects on turf
    - mowing patterns - direction

- irrigation practices
  - frequency
  - quantity
  - water quality
  - affects on turf
- irrigation systems
  - pumps/required routine maintenance
  - piping
  - valves
  - heads
  - control systems
- winterizing irrigation systems
  - pressure blowing plumbing system
  - adding antifreeze
  - protecting pumps and valves
  - spring season recharge
- aerification
  - purposes
  - tine selection
- top dressing
  - purposes
  - materials
- fertilizing
  - purposes
  - granular/soluble/ foliar
- grooming/verti-cutting
  - purposes
  - affects on turf

2.1.4 Describe the fundamentals of turf grass.

[4.5/0]

- Species
  - creeping bent grass
  - annual bluegrass
  - fescue / fine fescue
  - Kentucky bluegrass
  - ryegrass
- Growth habits
  - stoloniferous
  - rhizomatous
  - bunch type

- Growth medium
  - sand
  - silt
  - clay
- Application and uses
  - greens
  - tees
  - fairways
  - rough
- Stress factors
  - drought/heat
  - traffic/compaction
  - divots
  - over watering
  - pests

### Evaluation Structure:

Theory Testing:	50 %
Application Experiences:	20 %
Final Assessment:	30 %

### Instructional and Delivery Strategies:

Classroom facilities including:

- whiteboard/blackboard
- appropriate audio/visual resources

### Minimum Equipment List:

- approved storage and disposal containers
- WHIMS materials
- approved fire extinguishers
- appropriate hand and power tools
- compressed air supply equipment
- soil sampler
- hand lenses (visual reference)

Number: 3

Title: Turf Equipment Traction Units

Duration: 33 Total Hours Theory: 23 Hours Practical: 10 Hours

Prerequisites: Level I and Level II, Small Engine Reportable Subjects

Co-requisites: Level III, Reportable Subject Numbers 1, 2, 4, 5, 6, 7 & 8

---

3.1 - Turf Equipment Traction Unit Systems

22 Total Hours Theory: 17 hours Practical: 5 hour

3.2 - Cab Systems, Frames and Operator Protection Devices

11 Total Hours Theory: 6 hours Practical: 5 hours

### 3.1 - Turf Equipment Traction Unit Systems

Cross-Reference to Learning Outcomes: 1.0, 2.0, 3.0, 7.0

Duration:           22 Total Hours    Theory: 17 hours    Practical: 5 hours

General Learning Outcome:

Perform inspection, testing, maintenance and recommend repairs to Turf Equipment Traction Unit Systems.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 3.1.1 Define the fundamentals of Turf Traction Unit systems and components.
- 3.1.2 Describe the function, composition and construction features of Turf Traction Unit systems and components.
- 3.1.3 Explain the principles of operation of Turf Traction Unit Systems and components.
- 3.1.4 Perform inspection, testing and diagnostic procedures on Turf Traction Unit Systems and components.
- 3.1.5 Perform maintenance and repair procedures on Turf Traction Unit Systems and components.

Learning Content:

3.1.1 Define the fundamentals of Turf Equipment Traction Unit systems and components.

[2.5/0]

- history, purpose types, and applications
- fundamentals
  - terms
  - engine types and relationship to traction units
  - diagnose running issues
  - 2wd/3wd/4wd applications, configurations and combinations
  - engine power requirements

3.1.2 Describe the function, composition and construction features of Turf Equipment Traction Unit systems and components.

[5/0]

- Drive system configuration
  - 2 wheel
  - 3 wheel
  - 4 wheel
- Engine types
  - gasoline
  - diesel
  - electric
- drive systems
  - 4 axles
  - special function
    - traction speed
    - reel speed
- brake systems
  - dynamic braking
- implement attachments and mountings
- implement drives
- tires
- steering
- seats/belts



3.1.3 Explain the principles of operation of Turf Equipment Traction Unit Systems and components.

[6/0]

- safety circuits
- lift style principles
  - purpose
  - function
  - reason for applications
- operator training programs
  - purpose
  - features
  - access/format/delivery modes
  - assessment
- operation of drive units
  - start up procedures
  - running procedures
  - shut down procedures

3.1.4 Perform inspection, testing and diagnostic procedures on Turf Equipment Traction Unit Systems and components.

[2/2]

- inspect engine systems for:
  - oil and coolant leaks
  - broken or loose components
  - corrosion
  - fluid levels
- test engine systems for:
  - cylinder balance
  - compression/leak down
  - vacuum
- diagnose engine system problems
  - abnormal noise
  - low power
  - poor starting
  - overheating
- perform gasoline and diesel engine exhaust smoke analysis
  - blue smoke
  - white smoke
  - black smoke
- trouble shoot engine related electrical problems
  - misfiring
  - poor or no starting
  - sensors defects
- unit failure detection/identification/prevention

3.1.5 Perform maintenance and repair procedures on Turf Equipment Traction Unit Systems and components.

[1.5/3]

- perform winterizing and storage maintenance procedures
  - changing fluids
  - changing filters
  - antifreeze testing analysis
  - lubricating components
  - fogging procedures
  - fuel stabilization

### 3.2 - Cab Systems, Frames and Operator Protection Devices

Cross-Reference to Learning Outcomes: 1.0, 5.4

Duration: 11 Total Hours Theory: 6 hours Practical: 5 hours

General Learning Outcome:

Perform inspection, testing, maintenance and recommend repairs to Turf Equipment Traction Unit Cab Systems, Frames and Rollover Protection Devices (ROPD).

Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 3.2.1 Define the fundamentals of Cab Systems, Frames and ROPD and components.
- 3.2.2 Describe the function, composition and construction features of Cab Systems, Frames and ROPD.
- 3.2.3 Explain the principles of operation of Cab Systems, Frames and ROPD.
- 3.2.4 Perform inspection, testing and diagnostic procedures on Cab Systems, Frames and ROPD.
- 3.2.5 Describe maintenance and repair procedures on Cab Systems, Frames and ROPD.

Learning Content:

3.2.1 Define the fundamentals of Cab Systems, Frames and ROPD and components.

[1/0]

- history, purpose types, and applications
- fundamentals
  - terms
  - counter weighting
    - geometric calculations
    - battery counter weighting
    - frame counter weighting
  - ROPD
  - Falling Object Protection System (FOPS)
  - Operator Restraint Systems
  - noise control
  - Operators' Compartment Shielding Devices
  - fire extinguishers

3.2.2 Describe the function, composition and construction features of Cab Systems, Frames and ROPD.

[2/0]

- Counter weight devices
  - positions and supports
  - battery counter weights
  - frame counter weights
- ROPD
  - positions and supports
- FOPS
  - positions and supports
- Operator Protection Devices (OPS)
  - positions and supports
  - restraint devices
- Operators' Compartment Shielding Devices
  - positions and supports
- fire extinguisher
  - positions and supports

3.2.3 Explain the principles of operation of Cab Systems, Frames and ROPD.  
[3/0]

- Counter weight devices
  - positions and supports
  - battery counter weights
  - frame counter weights
- ROPD
  - positions and supports
- FOPD
  - positions and supports
- OPD
  - positions and supports
  - restraint devices
- Operators' Compartment Shielding Devices
  - positions and supports

3.2.4 Perform inspection, testing and diagnostic procedures on Cab Systems, Frames and Operator Protection Devices.  
[0/2]

- perform inspection procedures for:
  - counter weighting
    - frame counter weighting
    - fastener torque
    - alterations
    - additions
  - ROPD
    - fastener torque
    - alteration restrictions
    - additions
  - FOPS
    - fastener torque
    - alterations
    - additions
- OPD
  - positions and supports
  - restraint devices
- Operators' Compartment Shielding Devices
  - positions and supports
- fire extinguisher
  - positions and supports

- perform the diagnostic procedures to determine:
  - wear
  - distortion
  - fractures
  - corrosion
  - defective or incorrectly installed components

### 3.2.5 Describe maintenance and repair procedures on Cab Systems, Frames and Operator Protection Devices (OPD).

[0/3]

- demonstrate counter weighting
  - frame counter weighting
  - fastener torque procedures
- demonstrate the replacement procedures for:
  - ROPD
    - fastener torque
  - FOPS
    - fastener torque
  - noise control
  - OPD
    - fastener torque
    - interlock systems
  - Operators' Compartment Shielding Devices
  - fire extinguishers
  - operator restraint systems

### Evaluation Structure:

Theory Testing:	40 %
Application Experiences:	30 %
Final Assessment:	30 %

### Instructional and Delivery Strategies:

Classroom facilities including:

- whiteboard/blackboard
- appropriate audio/visual resources

### Minimum Equipment List:

- approved storage and disposal containers
- WHIMS materials
- approved fire extinguishers
- appropriate hand and power tools
- appropriate lifting, rigging and blocking equipment
- compressed air supply equipment
- traction units
- OPS
- FOPS
- related OEM Manuals/Service information
- computers
- grinding equipment
- welding equipment (oxy/ acetylene, metal inert gas, arc)
- appropriate and up to date MSDS information
- vices/press
- drill press
- parts cleaning equipment (pressure washer/appropriate cleaning solutions and area)
- antifreeze testers
- battery testers
- battery chargers
- electronic test equipment (VOM,AMP, Digital Multi-meters)

Number: 4

Title: Applied Turf Equipment Electronic Systems

Duration: 27 Total Hours Theory: 11 Hours Practical: 16 Hours

Prerequisites: Level I and Level II, Small Engine Reportable Subjects

Co-requisites: Level III, Reportable Subject Numbers 1, 2, 3, 5, 6, 7 & 8

---

4.1 - Electronic Input Circuit Components

8 Total Hours Theory: 5 hours Practical: 3 hours

4.2 - Electronic Circuit Schematics

6 Total Hours Theory: 2 hours Practical: 4 hours

4.3 - Electronic Charging Systems

13 Total Hours Theory: 4 hours Practical: 9 hours



#### 4.1 - Electronic Input Circuit Components

Cross-Reference to Learning Outcomes: 1.0, 5.2, 6.3, 7.4

Duration:           8 Total Hours    Theory: 5 hours    Practical: 3 hours

General Learning Outcome:

Perform inspection, testing, maintenance and recommend repairs to electronic input circuit components.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 4.1.1 Define the fundamentals of electronic input circuit components.
- 4.1.2 Describe the function, construction features, types and application of electronic input circuit components.
- 4.1.3 Explain the principles of operation of electronic input circuit components.
- 4.1.4 Perform inspection, testing and diagnostic procedures on electronic input circuit components.
- 4.1.5 Perform maintenance and repair procedures on electronic input circuit components.

Learning Content:

4.1.1 Define the fundamentals of electronic input circuit components.

[1/0]

- history and purpose
- fundamentals
  - terms
  - electronics
  - computer basics
  - electronic schematic interpretation

4.1.2 Describe the function, construction features, types and application of electronic input circuit components.

[1/0]

- reference voltage
- thermistor
- potentiometer
- variable capacitance sensors
- wheel pulse generators
- hall effect sensors
- switches
- semi-conductors
- optical sensors
- gasoline exhaust gas sensors
- piezoelectric
- piezo-resistive

4.1.3 Explain the principles of operation of electronic input circuit components.

[3/0]

- reference voltage
- thermistor
- potentiometer
- variable capacitance sensors
- wheel pulse generators
- hall effect sensors
- switches
- semi-conductors
- optical sensors
- gasoline exhaust gas sensors
- piezoelectric
- piezo-resistive

4.1.4 Perform inspection, testing and diagnostic procedures on electronic input circuit components.

[0/2]

- inspect input circuit components, wiring and connections
- test functional and malfunctioning input component circuits
- diagnose performance conditions produced by malfunctioning input circuit components

4.1.5 Perform maintenance and repair procedures on electronic input circuit components.

[0/1]

- outline procedures to replace defective input circuit components
- perform operational tests on replaced input circuit components

## 4.2 - Electronic Circuit Schematics

Cross-Reference to Learning Outcomes: 1.0, 2.5, 5.2, 6.3, 7.4

Duration:           6 Total Hours    Theory: 2 hours    Practical: 4 hours

General Learning Outcome:

Perform inspection, testing and recommend repairs to turf equipment electronic systems using electronic circuit schematics.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 4.2.1 Define the fundamentals of electronic circuit schematics.
- 4.2.2 Describe the function, construction features, types and application of electronic circuit schematics.
- 4.2.3 Explain the principles of operation of electronic circuit schematics.
- 4.2.4 Perform inspection, testing and diagnostic procedures using electronic circuit schematics.
- 4.2.5 Perform maintenance and repair procedures using electronic circuit schematics.

Learning Content:

4.2.1 Define the fundamentals of electronic circuit schematics.

[.5/0]

- fundamentals  
electricity  
electronics  
circuit types  
electronic schematic symbols

4.2.2 Describe the function, construction features, types and application of electronic circuit schematics.

[.5/0]

- OEM electrical schematics
- digital schematics

4.2.3 Explain the principles of operation of electronic circuit schematics.

[1/0]

- symbols
- valley forge
- linear systems

4.2.4 Perform inspection, testing and diagnostic procedures using electronic circuit schematics.

[0/3]

- perform a circuit analysis using an OEM schematic
- test operational and malfunctioning electronic circuit schematics
- diagnose common electronic circuit malfunctions

4.2.5 Perform maintenance and repair procedures using electronic circuit schematics.

[0/1]

- access and interpret OEM circuit schematics
  - CD-ROM
  - OEM Data base
  - Service manuals
  - aftermarket electronic information systems

### 4.3 - Electronic Charging Systems

Cross-Reference to Learning Outcomes: 1.0, 2.5, 5.2, 6.3, 7.4, 8.3

Duration: 13 Total Hours Theory: 4 hours Practical: 9 hours

General Learning Outcome:

Perform the inspection, testing and recommend repairs to turf equipment electronic charging systems.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 4.3.1 Define the fundamentals of electronic charging systems.
- 4.3.2 Describe the construction features, types and applications of electronic charging systems and components.
- 4.3.3 Explain the operating principles of electronic charging systems.
- 4.3.4 Perform inspection, testing and diagnostic procedures of electronic charging systems and components.
- 4.3.5 Perform service procedures on electronic charging systems and components.

Learning Content:

4.3.1 Define the fundamentals of electronic charging systems.

[1/0]

A/C generators

voltage regulation

electromagnetic induction principles

electron theory

Ohm's, Watt's and Lenz's Law

factors affecting voltage induction and amperage output

- battery condition and temperature
- circuit condition
- engine speed
- electrical loads

inductive reactance

impedance

4.3.2 Describe the construction features, types and applications of electronic charging systems and components.

[1.5/0]

A/C generators

- rectifier
- diodes
- stator, delta, wye, double wye
- rotor
- field winding, poles, slip rings
- brush assemblies
- case
- bearings
- pulleys
- fans
- idlers and tensioners

charging systems by field control

brushless alternators

computer-controlled charging system

- alternator field
- ambient temperature sensing
- battery voltage sensing
- battery temperature sensing
- electronic regulator
- zener diode and voltage control transistors
- field current switching

4.3.3 Explain the operating principles of electronic charging systems.

[1.5/0]

- A/C generators
  - externally regulated
  - integrally regulated
  - computer controlled
- electronic voltage regulators
  - low voltage and high amperage output
  - high voltage and low amperage output
- charge indicators  
voltmeter / ammeter
- field circuit control
  - external voltage regulators / modules
  - internal voltage regulators / modules

4.3.4 Perform inspection, testing and diagnostic procedures of electronic charging systems and components.

[0/6]

- perform charging system visual inspection
  - belt tension and alignment
  - connections and wiring
  - battery and A/C generator capacity
- outline the recommended testing sequence to determine the overall condition of the charging systems
- identify and isolate faulty charging system components by utilizing the recommended troubleshooting procedures and test equipment
- perform battery maintenance and load test (and three-minute charge tests when applicable)
- perform charging system current and voltage output tests
- analyze test results
- disassemble, test and reassemble alternator
  - rotor field tests
  - rectifier diodes
  - stator
- perform A/C generator bench testing for output current
- perform voltage regulator bench tests



4.3.5 Perform service procedures on electronic charging systems and components.

[0/3]

- verify the A/C generator output capacity to the specified electrical load requirements.
- adjust the A/C generator drive belt tension and check alignment.

Evaluation Structure:

Theory Testing:	30 %
Application Experiences:	40 %
Final Assessment:	30 %

Instructional and Delivery Strategies:

Classroom facilities including:

- whiteboard/blackboard
- appropriate audio/visual resources

Minimum Equipment List:

- approved storage and disposal containers
- WHIMS materials
- approved fire extinguishers
- appropriate hand and power tools
- appropriate lifting, rigging and blocking equipment
- compressed air supply equipment
- electronic system devices
- electronic test equipment (VOM,AMP, Digital Multi-meters)
- battery test equipment
- battery charging equipment

Number: 5

Title: Applied Turf Equipment Hydraulic Systems

Duration: 36 Total Hours Theory: 22 Hours Practical: 14 Hours

Prerequisites: Level I and Level II, Small Engine Reportable Subjects

Co-requisites: Level III, Reportable Subject Numbers 1, 2, 3, 4, 6, 7 & 8

---

5.1 - Hydraulic fluids, conductors and fittings

14 Total Hours Theory: 8 hours Practical: 6 hours

5.2 - Hydraulic & Hydrostatic Drive Systems

22 Total Hours Theory: 14 hours Practical: 8 hours

## 5.1 - Hydraulic Fluid Conductors and Fittings

Cross-Reference to Learning Outcomes: 1.0, 7.5, 7.6

Duration: 14 Total Hours Theory: 8 hours Practical: 6 hours

General Learning Outcome:

Inspect, test, diagnose and replace hydraulic fluid conductors and fittings.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 5.1.1 Define the purpose and fundamental information of hydraulic fluid conductors and fittings.
- 5.1.2 Describe the types and construction features of oil, hydraulic fittings.
- 5.1.3 Explain the principles of operation for hydraulic fluid conductors and fittings.
- 5.1.4 Perform inspection, testing and diagnostic procedures and perform assigned operations for hydraulic fluid conductors and fittings.
- 5.1.5 Recommend reconditioning or repairs of for hydraulic fluid conductors and fittings.

Learning Content:

5.1.1 Define the purpose and fundamental information of hydraulic fluid conductors and fittings.

[1/0]

- fundamentals
  - line stresses
  - effect of line length and diameter
  - line materials
  - fitting threads
  - fitting materials
- purpose
- pipes
- tubes
- hoses
- fittings
- adapters
- Society of Automotive Engineers (SAE)
- System International Units (SI)

5.1.2 Describe the types and construction features of oil, hydraulic fittings.

[4/0]

- oils
  - types
  - purpose
  - function
  - affects on turf
- pipe
  - schedules
  - threading
  - sizing
- tubing
  - plastic
  - steel
  - sizing
  - bending
  - fabricating

- hoses
  - sizing
  - pressure rating
    - braiding types
    - spiral wraps
  - fittings
  - permanent
  - reusable
  - hose assembly
- adapters
  - thread form
  - sealing element
- fitting identification
  - Society of Automotive Engineers (SAE)
  - Joint Industry Conference (JIC)
  - O-Ring Face Seal (ORFS)
  - National Pipe (NP)

5.1.3 Explain the principles of operation for hydraulic fluid conductors and fittings.

[3/0]

- sealing methods
- minimum bend radius
- operating pressure ratings
- burst pressure ratings

5.1.4 Perform inspection, testing and diagnostic procedures and perform assigned operations for hydraulic fluid conductors and fittings.

[0/3]

- perform inspection and testing of hydraulic fluid conductors
  - cracks
  - leaks
  - wear
  - crushed
- describe diagnostic procedures for hydraulic fluid conductor failures.
  - fractures
  - restrictions
  - correct applications

5.1.5 Recommend reconditioning or repairs of for hydraulic fluid conductors and fittings.

[0/3]

- demonstrate the repair and replacement procedures of hydraulic fluid conductors.
  - hose replacement
  - fitting torque
  - routing and mounting
  - line bending techniques

## 5.2 - Hydraulic & Hydrostatic Drive Systems

Cross-Reference to Learning Outcomes: 1.0, 7.5, 7.6

Duration:           22 Total Hours      Theory: 14 hours      Practical: 8 hours

General Learning Outcome:

Diagnose and recommend repairs to hydraulic & hydrostatic drive systems.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 5.2.1 Define the purpose and fundamentals of hydraulic & hydrostatic drive systems.
- 5.2.2 Describe the construction features, types and applications of hydraulic & hydrostatic drive systems.
- 5.2.3 Explain the principles of operation of hydraulic & hydrostatic drive systems.
- 5.2.4 Perform inspection, testing and diagnostic procedures of hydraulic & hydrostatic drive systems.
- 5.2.5 Recommend reconditioning or repairs of hydraulic & hydrostatic drive systems.

Learning Content:

5.2.1 Define the purpose and fundamentals of hydraulic & hydrostatic drive systems.

[1/0]

- fundamentals
  - line stresses
  - effect of line length and diameter
  - line materials
  - fitting threads
  - fitting materials
  - filtration
- torque multiplication
- hydrodynamic verses hydrostatic drive systems
- charge pump and pump circuits

5.2.2 Describe the construction features, types and applications of hydraulic & hydrostatic drive systems.

[4/0]

- application
  - traction drives
  - non-traction drives
- types
  - open loop circuits
  - closed loop circuits
- hydraulic drive systems
  - pump types
  - controls
  - motors
- hydrostatic drive components
  - variable displacement pumps
  - fixed displacement pumps
  - variable displacement motors
  - fixed displacement motors
- controls
  - flow limiting
  - flow dividing
  - manual displacement control valves
  - electronic displacement control valves
  - hydraulic displacement control valves
  - charge pump
  - charge pump circuits
  - coolers and circuits



5.2.3 Explain the principles of operation of hydraulic & hydrostatic drive systems.

[7/0]

- trace power flow
  - open loop circuits
  - closed loop circuits
- hydraulic drive systems
  - pump types
  - controls
  - motors
- hydrostatic drive components
  - variable displacement pumps
  - fixed displacement pumps
  - variable displacement motors
  - fixed displacement motors
- operation of drive systems in neutral, forward and reverse
- controls
  - flow limiting
  - flow dividing
  - manual displacement control valves
  - electronic displacement control valves
  - hydraulic displacement control valves
  - charge pumps
  - charge pump circuits
  - coolers and circuits
  - leak detection
  - filtration

5.2.4 Perform inspection, testing and diagnostic procedures of hydraulic & hydrostatic drive systems.

[1/4]

- inspect hydraulic & hydrostatic drive systems
  - oil leaks
  - loose or damaged components
- test pressures, record and compare readings to manufacturer's specifications
- verify the recommended operation of hydraulic & hydrostatic drive systems
- describe the diagnostic procedures to identify abnormal noises, directional control problems and other malfunctions
- test and verify recommended operating temperatures
  - cooler restrictions
  - filter restrictions

5.2.5 Recommend reconditioning or repairs of hydraulic & hydrostatic drive systems.

[1/4]

- describe the field adjustments for hydraulic & hydrostatic drive systems
- identify the recommended oil levels and grade
- outline the recommended removal and replacement procedures for hydraulic & hydrostatic drive system:
  - assemblies
  - motors
  - pumps
  - coolers
  - filters
  - fluids

Evaluation Structure:

Theory Testing:	40 %
Application Experiences:	30 %
Final Assessment:	30 %

Instructional and Delivery Strategies:

Classroom facilities including:

- whiteboard/blackboard
- appropriate audio/visual resources

Minimum Equipment List:

- approved storage and disposal containers
- WHIMS materials
- approved fire extinguishers
- appropriate hand and power tools
- appropriate lifting, rigging and blocking equipment
- compressed air supply equipment
- rigging equipment
- turf equipment hydraulic drive systems
- turf equipment hydrostatic drive systems
- hydraulic pressure test kits
- flow meters
- hose crimping tools
- computers
- appropriate and up to date MSDS information
- parts cleaning equipment (pressure washer/appropriate cleaning solutions and area)
- antifreeze testers
- battery testers

- OEM manuals and service specifications

Number: 6

Title: Applied Turf Mowing Equipment

Duration: 51 Total Hours Theory: 18 Hours Practical: 33 Hours

Prerequisites: Level I and Level II, Small Engine Reportable Subjects

Co-requisites: Level III, Reportable Subject Numbers 1, 2, 3, 4, 5, 7 & 8

---

### 6.1 - Turf Mowing Equipment

51 Total Hours Theory: 18 hours Practical: 33 hours

## 6.1 – Turf Mowing Equipment

Cross-Reference to Learning Outcomes: 1.0, 2.1, 4.0

Duration:            51 Total Hours    Theory: 18 hours    Practical: 33 hours

General Learning Outcome:

Perform the diagnostic, maintenance and repair procedures for turf mowing equipment.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 6.1.1 Define the fundamentals of turf mowing equipment.
- 6.1.2 Describe the function, construction features, types and applications of turf mowing equipment
- 6.1.3 Explain the principles of operation of turf mowing equipment.
- 6.1.4 Dismantle, inspect, test and diagnose turf mowing equipment.
- 6.1.5 Maintain and repair turf mowing equipment.

Learning Content:

6.1.1 Define the fundamentals of turf mowing equipment.

[4/0]

- history, purpose and function
- fundamentals
  - mowing equipment terms
  - acronyms
  - overview of turf cutting process and importance of correct sharpening techniques
  - adjustments
    - tip speed
    - clip rate
  - blade hardness (Rockwell settings)
  - identify mowing equipment
    - rotary
    - reels
    - flail
    - riders
    - walker
    - hovers
    - verti-cut
    - groomer
  - attachments and hookup styles
  - tow behind and three point hitch
  - drive systems
    - Power Take Off (PTO)
    - Hydraulic
    - Belt
    - Chain
    - Ground
    - Gear box

6.1.2 Describe the construction features, types and applications of turf mowing equipment

[3/0]

- reel mowers
  - reels
  - bed knives
  - bearings
  - seals

- rotary mowers
  - blades
  - decks
  - spindles
  - belt drive
  - hydraulic drive
  - direct drive
- types and construction features of cutting units
  - reels
  - flail
  - verti-cut
  - groomers
  - rollers
  - frame components
- single system walker mowers
- multi systems
  - gang mowers
  - tri plex, five plex, seven plex, nine plex
- reel mowers
  - blades
    - hydraulic
    - belt
    - chain
  - adjustment types
- attachments
  - three point
  - front
  - rear
  - under
- roller

6.1.3 Explain the principles of operation of turf mowing equipment.  
[6/0]

- operating principles of:
  - rotary mowers
  - reel mowers
  - flail mowers
  - verti-cut mowers
  - groomer mowers
- type of areas used
- operating safety precautions
  - all guards in place
  - safety inter lock systems

- Height Of Cut (HOC) set as required
  - measuring tools
  - hoc bar
  - go - no go bar
  - dial indicator gauge bar
  - bench setting vs. actual (hoc)
- multi blade systems
  - gang mowers
- related safety devices/manual or electric
  - shields
  - guards
  - limit switches
  - braking systems
- explain recommended operating limits for each mower type
- explain clip tip speed

### 6.1.4 Dismantle, inspect, test and diagnose turf mowing equipment. [2/16]

- outline and perform dismantling procedures
- identify the recommended mower inspection procedures
  - loose or broken components
  - alignment
  - fluid leaks
  - wear
  - corrosion
- diagnose cutting appearance and relate to equipment condition
- identify mower wear patterns and causes
- identify mower service limits
- set up and produce a preventative maintenance schedule
- perform the recommended equipment cleaning procedures
- identify most common areas of equipment failures or malfunctions
- access manufacturers' service information

### 6.1.5 Maintain and repair turf mowing equipment. [3/17]

- perform regular maintenance procedures for:
  - belts
  - blades
  - gear boxes
  - ground attachments
  - chains
  - reels
  - bearings
  - rollers
  - seals



- perform the recommended blade sharpening procedures:
  - spin
  - relief
  - bed knife
  - back lapping
  - rotary
  - use of grinders
- dismantle, repair and replace:
  - bearings
  - seals
  - belts
  - chains
  - blades
- perform mower set up procedures for:
  - Height of Cut (HOC)
  - drive belt tension
  - drive chain tension
  - reel to bed knife adjustment

### Evaluation Structure:

Theory Testing:	20 %
Application Experiences:	50 %
Final Assessment:	30 %

### Instructional and Delivery Strategies:

Classroom facilities including:

- whiteboard/blackboard
- appropriate audio/visual resources

### Minimum Equipment List:

- approved storage and disposal containers
- WHIMS materials
- approved fire extinguishers
- appropriate hand and power tools
- appropriate lifting, rigging and blocking equipment
- compressed air supply equipment
- rigging equipment
- turf mowing equipment
- grinder (reel and bed knife sharpening equipment)
- rotary blade grinder
- balancing equipment
- measuring equipment
- back lappers

- bed knife facer
- computers
- welding equipment (oxy acetylene, metal inert gas, arc)
- appropriate and up to date MSDS information
- vices/press
- reel and bed knife sharpening equipment
- bench grinders
- drill press
- parts cleaning equipment (pressure washer/appropriate cleaning solutions and area)
- OEM manuals and service specifications

Number : 7

Title: Turf Spraying Equipment

Duration: 21 Total Hours Theory: 14 Hours Practical: 7 Hours

Prerequisites: Level I and Level II, Small Engine Reportable Subjects

Co-requisites: Level III, Reportable Subject Numbers 1, 2, 3, 4, 5, 6, & 8

---

### 7.1 - Turf Spraying Equipment

21 Total Hours Theory: 14 hours Practical: 7 hours

## 7.1 - Turf Spraying Equipment

Cross-Reference to Learning Outcomes: 1.0, 2.0, 6.0

Duration:           21 Total Hours    Theory: 14 hours    Practical: 7 hours

General Learning Outcome:

Describe the diagnostic, maintenance and repair procedures for turf spraying equipment.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 7.1.1 Define the fundamentals of turf spraying equipment.
- 7.1.2 Describe the function, construction features, types and applications of turf spraying equipment.
- 7.1.3 Explain the principles of operation of turf spraying equipment.
- 7.1.4 Inspect, test and diagnose turf spraying equipment.
- 7.1.5 Maintain and repair turf spraying equipment.

Learning Content:

7.1.1 Define the fundamentals of turf spraying equipment.

[1/0]

- history, purpose and function
- fundamentals
  - spraying system terms
  - acronyms
- safety issues:
  - preparation
  - WHMIS
    - MSDS up to date
  - personal protection equipment
- spray application rates
  - uniformity
  - over spray
- government regulations
  - Ontario Health and Safety Act (OHSA)
  - storage requirements

7.1.2 Describe the function, construction features, types and applications of turf spraying equipment.

[5/0]

- pumps
  - centrifugal
  - diaphragm
  - roller
- control systems
  - electric
  - manual
- booms
  - height
  - open
  - covered
  - marking systems
  - nozzles and screens
- filters
  - coarse
  - fine
- tanks
- valves and fittings
- electronic system flow meters

7.1.3 Explain the principles of operation of turf spraying equipment.  
[7/0]

- application rates
  - ground speed
  - pressure
  - nozzles
  - weather conditions
- operation of spray equipment components and interrelationships
- system calibration procedures
  - controller
  - flow meter
  - speed sensor

7.1.4 Inspect, test and diagnose turf spraying equipment.  
[0/4]

- describe the disassembly procedures
  - sequence
- outline the inspection and testing procedures for:
  - pumps
  - controllers
  - marking system components
  - boom lift actuators
  - nozzles
  - filters
  - reservoirs
  - valves
  - flow meters
  - hoses/fittings
  - leaks
- describe the diagnostic procedures for:
  - poor spray patterns
  - excessive spray application rates
  - no spray condition

7.1.5 Maintain and repair turf spraying equipment.  
[1/3]

- describe the maintenance procedures:
  - cleaning
  - lubricating
  - storage
  - winterizing/start-up

- system calibration procedures
  - controller
  - flow meter
  - speed sensor
  - output
- describe the repair procedures for:
  - pumps
  - controllers
  - marking system components
  - boom lift actuators
  - nozzles
  - filters
  - reservoirs
  - valves
  - flow meters
  - hoses/fittings

### Evaluation Structure:

Theory Testing:	40 %
Application Experiences:	30 %
Final Assessment:	30 %

### Instructional and Delivery Strategies:

Classroom facilities including:

- whiteboard/blackboard
- appropriate audio/visual resources

### Reference Material:

### Minimum Equipment List:

- approved storage and disposal containers
- WHIMS materials
- approved fire extinguishers
- appropriate hand and power tools
- appropriate lifting, rigging and blocking equipment
- compressed air supply equipment
- rigging equipment
- turf spraying equipment
- calibration kit
- computers
- appropriate and up to date MSDS information
- parts cleaning equipment (pressure washer/appropriate cleaning solutions and area)
- electronic test equipment (VOM,AMP, Digital Multi-meters)
- OEM manuals and service specifications

Number: 8  
Title: Powered Golf Cart and Utility Vehicles  
Duration: 36 Total Hours Theory: 20 Hours Practical: 16 Hours  
Prerequisites: Level I and Level II, Small Engine Reportable Subjects  
Co-requisites: Level III, Reportable Subject Numbers 1, 2, 3, 4, 5, 6, & 7

---

8.1 - Golf Cars and Utility Vehicles

18 Total Hours Theory: 11 hours Practical: 7 hours

8.2 - Pre-delivery and Test Run

6 Total Hours Theory: 3 hours Practical: 3 hours

8.3 - Car Body and Trim Components

6 Total Hours Theory: 3 hours Practical: 3 hours

8.4 - Damage Identification and Repair

6 Total Hours Theory: 3 hours Practical: 3 hours



## 8.1 - Golf Cars and Utility Vehicles

Cross-Reference to Learning Outcomes: 1.0, 5.0

Duration: 18 Total Hours Theory: 11 hours Practical: 7 hours

General Learning Outcome:

Describe the fundamentals of golf cars and utility vehicles.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 8.1.1 Define the fundamentals of golf cars and utility vehicles.
- 8.1.2 Describe the function, construction features, types and applications of golf cars and utility vehicles.
- 8.1.3 Explain the principles of operation of golf cars and utility vehicles.
- 8.1.4 Inspect, test and diagnose golf cars and utility vehicles.
- 8.1.5 Maintain and repair golf cars and utility vehicles.

Learning Content:

8.1.1 Define the fundamentals of golf cars and utility vehicles.

[2/0]

- history, purpose and function
- fundamentals of golf cars
  - terms and definitions
  - acronyms
  - load capacities
  - driving speeds
  - fleet rotation
- safety issues:
  - preparation for start up
  - driving techniques
  - disclaimers
  - documentation
- fundamentals of utility vehicles
  - terms and definitions
  - acronyms
  - load capacities
  - driving speeds

8.1.2 Describe the construction features, types and applications of golf cars and utility vehicles.

[4/0]

- types of golf cars
  - manual pull cart
  - gasoline powered
  - electric powered
- applications of golf cars
  - manual pull carts
  - gasoline powered
  - electric powered
- construction features of golf cars
  - manual pull carts
    - frame
    - wheel assemblies
    - handles

- gasoline powered golf cars
  - frame
  - wheel assemblies
  - motors
  - drive systems
    - Continuously Variable Transmission (CVT)
  - brake systems
    - manual
    - hydraulic
    - cable
  - steering mechanism
    - linkage
    - wheel assemble
    - alignment
    - steering boxes
    - rack/pinion
  - starting and charging systems
    - starter/generator
    - battery
- electric powered golf cars
  - frame
  - wheel assemblies
    - rim/tires/tread
  - Direct Current Motors
    - series and shunt wound
    - cumulative wound
    - differential compound
  - motor controllers
    - resistor control (rheostat)
    - silicon control rectifier
    - directional switching devices
    - mechanical
  - drive systems
    - CVT
    - Manual transmission
    - Automatic transmission
  - brake systems
    - manual
    - hydraulic
    - cable

- steering mechanism
  - linkage
  - wheel assemble
  - alignment
  - steering boxes
  - rack/pinion
- starting and charging systems
  - starter/generator
  - battery
  - battery chargers
- accessories
  - tops
  - Global Positioning System (GPS)
  - bag covers
  - divot bottle holders
  - wind screen
- types of utility vehicles
  - beverage unit
  - equipment trailers
  - utility box
- construction features of utility units
  - beverage unit
    - frame
    - wheel assemblies
    - hitch assemblies
- equipment trailers
  - frame
  - wheel assemblies
  - hitch assemblies
  - accessories
    - capacities
    - lifts
    - cooler

8.1.3 Explain the principles of operation of golf cars and utility vehicles.  
[3/2]

- gasoline powered golf cars
  - motors
  - drive systems
    - CVT
  - brake systems
    - manual
    - hydraulic
    - cables

- wheel assemblies
  - rims/tires/tread
- steering mechanism
  - linkage
  - steering box
  - rack/pinion
  - wheel assembly
- starting and charging systems
  - starter/generator
  - battery
  - battery chargers
- accessories
  - wind screens
  - GPS
  - bag covers
- beverage unit
  - frame
  - wheel assemblies
  - hitch assemblies
- equipment trailers
  - frame
  - wheel assemblies
  - hitch assemblies
- accessories
  - capacities
  - lifts
  - cooler
- electric powered golf cars
  - direct current motors
    - series and shunt wound
    - cumulative wound
    - differential compound
  - motor controllers
    - resistor control (rheostat)
    - silicon control rectifier
    - directional switching devices
    - mechanical
    - electronic
  - battery chargers
    - A/C and D/C
    - types and application of chargers
    - voltage requirements
    - charge amperage settings
    - control devices
  - drive systems
    - CVT

8.1.4 Inspect, test and diagnose golf cars and utility vehicles.  
[0/3]

- describe the disassembly procedures
  - sequence
- perform visual inspection
  - corrosion
  - loose or damaged wiring and connections
  - overheating
  - estimate repair costs / rental issues
- perform service ability testing procedures for:
  - continuity
  - current draw
  - voltage drop
  - bench testing
  - insulation stress test
- perform component failure analysis of:
  - battery defects
  - high resistance connections
  - motor defects
  - controller defects
  - current draw
  - voltage drop

8.1.5 Maintain and repair golf cars and utility vehicles.  
[2/2]

- perform maintenance procedures
  - lubrication
  - battery cleaning
  - battery charging
  - set up and maintain a battery charging schedule
  - oil changes
  - filter changes
  - fleet rotation
- demonstration of repair procedures for:
  - remove and replace motors
  - remove and replace electrical control devices
  - remove and replace batteries
  - remove and replace tires and wheel assemblies
  - remove and replace starter and drive belt assemblies
  - remove and replace primary and secondary clutch assembly
  - remove and replace suspension system components
  - alignment procedures

## 8.2 - Pre-Delivery and Test Run

Cross-Reference to Learning Outcomes: 1.0, 8.4, 8.7

Duration: 6 Total Hours Theory: 3 hours Practical: 3 hours

General Learning Outcome:

Perform golf car and utility vehicles pre-delivery and test run procedures.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

8.2.1 Identify the pre-delivery inspection and set-up procedures for golf cars.

8.2.2 Perform performance testing and evaluation of golf cars.

Learning Content:

8.2.1 Identify the pre-delivery inspection and set-up procedures for golf cars.  
[3/0]

- identify pre-delivery inspection procedures for:
  - overall appearance and cosmetic damage
  - mounting and installation of safety devices, steering systems, instrumentation, controls and accessories
  - engine adjustments including:
    - shift cables
    - steering cable alignment
    - governor speed setting

8.2.2 Perform performance testing and evaluation of golf cars.  
[0/3]

- set-up and monitor test equipment including:
  - charging voltage and amperage
- perform testing procedures for:
  - shift cable operation
  - steering response
  - engine power and torque
  - brake operation
- perform troubleshooting of:
  - engine alignment
  - linkage alignment
  - engine and drive shifting characteristics
  - engine performance
  - speed control operation
  - steering control and response
  - audible alarm
  - braking



### 8.3 - Golf Car Body and Trim Components

Cross-Reference to Learning Outcomes: 1.0, 5.4

Duration:           6 Total Hours    Theory: 3 hours    Practical: 3 hours

General Learning Outcome:

Inspect and describe the installation procedures for golf car body and trim components.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 8.3.1 Define the fundamentals of golf car body and trim components.
- 8.3.2 Describe the construction features, types and applications of golf car body and trim components.
- 8.3.3 Perform inspecting and testing procedures on golf car body and trim components.
- 8.3.4 Describe installation procedures for golf car body and trim components.

Learning Content

8.3.1 Define the fundamentals of golf car bodies and trim components.

[1/0]

- history, purpose and function
- fundamentals of car bodies
  - terms and definitions
  - acronyms
  - weather stripping
  - adhesives
  - fasteners and retainers (trim related)
  - headlamps
  - bumper systems
  - interior and exterior trim
  - convertible tops and sunroofs
  - finish

8.3.2 Describe the construction features, types and applications of golf car body and trim components.

[1/0]

- fasteners and retainers (trim related)
- headlamps
- reflectors
- bumpers
- interior and exterior trim
- convertible tops and sunroofs
- mirrors

8.3.3 Perform inspecting and testing procedures on golf car body and trim components.

[0/2]

- fit (water and dust tight)
- appearance
- identify location of noises (squeaks and rattles)

8.3.4 Describe installation procedures for golf car body and trim components.

[1/1]

- describe installation procedures for:
  - carpeting
  - panels, upholstery, seats, hardware, chrome, moldings
  - windshields
  - isolating and quieting of squeaks and rattles
  - aim headlamps

#### 8.4 - Damage Identification and Repair

Cross-Reference to Learning Outcomes: 1.0, 5.4

Duration:           6 Total Hours    Theory: 3 hours    Practical: 3 hours

General Learning Outcome:

Describe golf car damage identification and repair procedures.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

8.4.1 Describe the main types of golf car damage and maintenance procedures.

8.4.2 Describe golf car damage repair procedures.

Learning Content:

8.4.1 Describe the main types of golf car damage and maintenance procedures.  
[2/0]

- determine condition and maintain components as required:
  - grounding straps
  - clips, continuity washers
  - explain the action of dissimilar metals and the effect of electrolysis
  - determine routine service replacements for a variety of operating conditions
  - outline recommended cleaning procedures

8.4.2 Describe golf car damage repair procedures.  
[1/3]

- describe the manufacturing process and the characteristics of:
  - fibreglass and resins
  - thermo plastics
  - thermo setting plastics
  - epoxy
  - state the applications of fibreglass and plastics common to the industry
  - outline the skills required to repair, refinish and polish:
    - fibreglass
    - thermo plastics
    - thermo-setting plastics
  - identify damaged surface on:
    - fibreglass
    - thermo-plastics
    - non-ferrous metal
    - metal
  - outline the skills required to prepare surface scars for painting:
    - grinding
    - sanding
    - filling with appropriate material
    - puttying
    - polishing
    - cleaning
  - outline the skills required to apply touch-up paints including:
    - primer coat
    - finish coat

### Evaluation Structure:

Theory Testing:	40 %
Application Experiences:	30 %
Final Assessment:	30 %

### Instructional and Delivery Strategies:

Classroom facilities including:

- whiteboard/blackboard
- appropriate audio/visual resources

### Minimum Equipment List:

- approved storage and disposal containers
- WHIMS materials
- approved fire extinguishers
- appropriate hand and power tools
- appropriate lifting, rigging and blocking equipment
- compressed air supply equipment
- rigging equipment
- powered golf cars
- utility vehicles
- computers
- grinding equipment
- welding equipment (oxy/ acetylene, metal inert gas, arc)
- appropriate and up to date MSDS information
- vices/press
- drill press
- parts cleaning equipment (pressure washer/appropriate cleaning solutions and area)
- electronic test equipment (VOM,AMP, Digital Multi-meters)
- battery testers
- battery chargers
- OEM manuals and service specifications