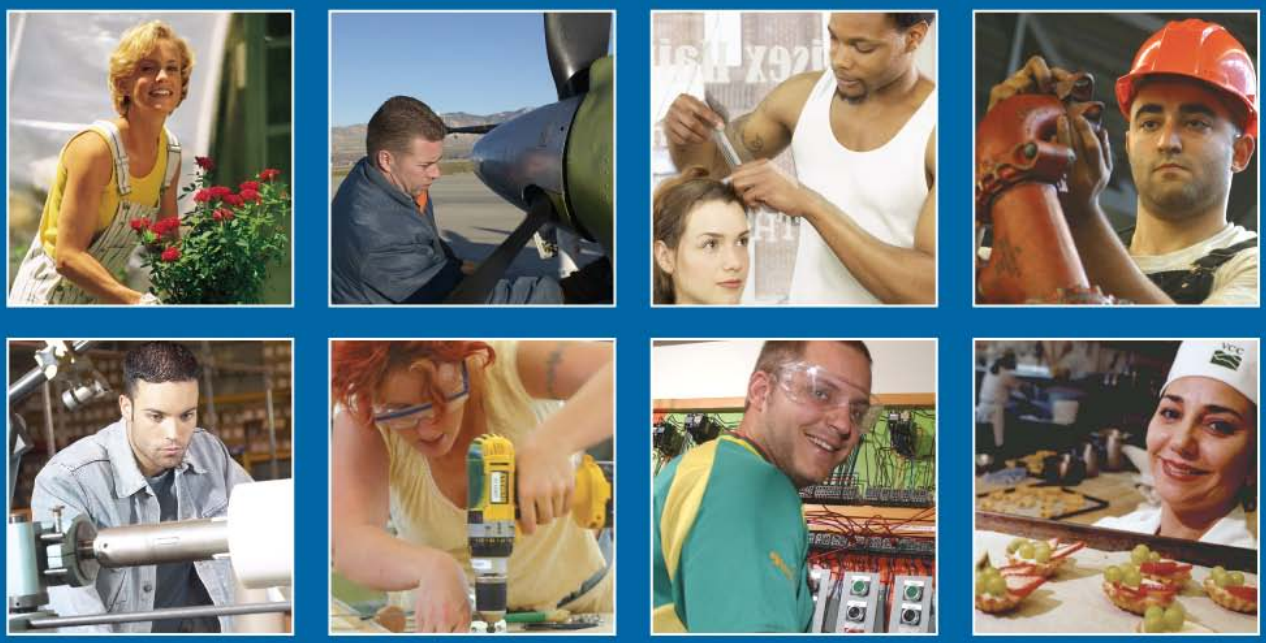
ita
industry training authority

THE RIGHT SKILLS ▶ A PROVEN ADVANTAGE

Horticulture Technician Foundation Program Outline



To order additional copies please contact:
Government Publications Services
PO Box 9452 Stn Prov Govt
Victoria, BC V8W 9V7
Phone: 250 387-6409 or
Toll Free: 1 800 663-6105
Fax: 250 387-1120
www.publications.gov.bc.ca

HORTICULTURE TECHNICIAN FOUNDATION PROGRAM OUTLINE

June, 2007

Developed By
Industry Training Authority
Province of British Columbia

TABLE OF CONTENTS

FOREWORD

The Program Outline presented in this document outlines the Landscape Horticulture Apprenticeship Program. This program represents the new standard for horticulture apprenticeship training in British Columbia. This document and the outlines attached will be used as a guide for instructors in the classroom, laboratories and for practical training.

Since this is a practical trade it is expected that demonstration and student participation will be integrated into all learning activities.

Safe working practices are thematic in this program. Though they are not specified in all competencies and learning tasks, they are implied as part of the program and should be stressed throughout the apprenticeship training.

The program outline also provides facility and instructor requirements as well as textbook recommendations.

SAFETY ADVISORY
Be advised that references to the WorkSafe BC safety regulations contained within these materials do not/may not reflect the most recent Occupational Health and Safety Regulation (the current Standards and Regulation in BC can be obtained on the following website: http://www.worksafebc.com. Please note that it is always the responsibility of any person using these materials to inform him/herself about the Occupational Health and Safety Regulation pertaining to his/her work.

ACKNOWLEDGEMENTS

The Program Outline was prepared with the advice and direction of an industry steering committee convened initially by the BC Landscape and Nursery Association and the by HortEducationBC.

Industry subject matter experts retained to write outlines:

Betty Cunnin
Carol Barnett
Dan Regan
Gary Jones
Kristine Schlamp
Michelle Nakano
PJ Burns
Peter Isaacson
Renee Giardini
Ron Marchuk
Tim Hold
David Davidson
Bruce McTavish

Industry subject matter experts retained as outline reviewers:

Ron Brown, Ron's Landscaping
Mike Chesters, Kwantlen Apprentice
Les Costello, Capilano College
David Davidson, Kwantlen University College
Egan Davies, Kwantlen Apprentice
Brian Fisher, B.C. Hydro
Bill Hardy, Northwest Landscape Supply Ltd.
Stephen Head, BCLNA Education Chair
Dwayne Holder, College of the Rockies
Marcus Janzen, BCGGA Education Chair
John Jouan, BCLNA Landscape Educ. Chair
Douglas Justice, UBC Botanical Garden
Yolanda Leung, BCSLA Continuing Educ.
Todd Major, Park & Tilford Gardens Director Bill Manning, BCRPA Region 2
Bruce McTavish, Kwantlen University College
Glen Minaker, West Vancouver Parks Board
Tom Mulleder, United Flower Growers
Rae Roer, Parks Council Chair
Clyde Snobelen, Camosun College
David Turner, BCRPA Chair Region 2
Rob Welsh, Capilano College
Bob Wick, Western Canada Turfgrass Assoc. Suzanne Wilkinson, Hort. Centre of the Pacific

HortEducationBC Board of Directors:

HEBC Board Chair	Bill Hardy, Northwest Landscape Supply Ltd.
Past Chair	Don Fraser, Northwest Landscape Supply Ltd.
BCLNA Representative	Mary Ann Van Den Berge, Trice Farms Pond & Garden Centre
BCLNA Representative	Cable Baker, RCB Garden Service
BCLNA Representative	Bruce McTavish, Kwantlen University College, and McTavish Resource & Management Consultants Ltd.
BCLNA Representative	Garfield Marshall, Advance Orchard Co. Ltd.
WCTA Representative	Ted de Crom, City of Richmond, Parks & Recreation Department
BCRPA Representative, Treasurer	Gail Szostek, District of Maple Ridge, Parks & Leisure
BCRPA Representative, Vice Chair	Bill Reid, The Corporation of the District of Powell River, Department of Parks, Recreation and Culture
BCRPA Representative	Egan Davis, Vancouver Parks Board
Education Representative	Rob Welsh, Capilano College
Education Representative	Dale Toronitz, Camosun College
Apprentice Representative	Denis Gour, Blasig Landscape Design & Construction Ltd.

SECTION 1

OCCUPATION ANALYSIS CHART

Horticulture Technician Foundation Program
Occupation Analysis Chart

Demonstrate the ability to identify plants and describe their use. A	Identify a wide range of plants, morphological characteristics, growing requirements, use and availability. A1	Practice plant identification skills to identify plants used in all segments of horticulture. Identify plants suitable for planting in difficult situations. A2
Demonstrate effective supervision. B	Demonstrate supervisory skills based on time and stress management, ethics, communication, power and teams. B1	Demonstrate supervisory sills based on leadership, motivation, and delegation. Describe safety management and managing in a diverse workplace. B2
Practice equipment maintenance and safety. C	Practice maintenance on small one-cylinder engines and horticulture hand tools. Demonstrate personal safety in the workplace and identify fire types and extinguishing methods. C1	Practice maintenance on multiple cylinder engines. Describe safe operating procedures for horticulture equipment. C2
Describe plant science as it applies to horticulture. D	Explain plant morphological characteristics, life cycles, and adaptations as they apply to plant identification, plant propagation, arboriculture and turf maintenance. D1	Examine the internal anatomy of stems, roots and leaves as they related to photosynthesis, respiration, and transpiration. D2
Describe plant health and pest management. E	Identify signs and symptoms of living and non-living factors that cause plant stress. E1	Examine biological characteristics of weeds, plant feeders and pathogens and list control strategies. E2
Manage soils. F	Describe physical and biological characteristics of soil, and soil-less media. F1	Describe chemical characteristics of soil and soil-less media. F2
Practice horticultural skills H	Demonstrate basic horticultural skills. H1	Assess plant quality and demonstrate plant-handling requirements. H2

SECTION 2

HORTICULTURE TECHNICIAN FOUNDATION PROGRAM

PROGRAM OUTLINE

SUGGESTED SCHEDULE OF TIME ALLOTMENT FOR HORTICULTURE TECHNICIAN FOUNDATION PROGRAM

LINE A Demonstrate the ability to identify plants and describe their use.

		Lecture	Practical	Page
A1	Identify a wide range of plants, morphological characteristics, growing requirements, use and availability.	6	18	7
A2	Practice plant identification skills to identify plants used in all segments of horticulture. Identify plant suitable for planting in difficult situations.	6	18	18

LINE B Demonstrate effective supervision.

		Lecture	Practical	Page
B1	Demonstrate supervisory skills based on time and stress management, ethics, communication, power and teams.	9	9	8
B2	Demonstrate supervisory skills based on leadership, motivation and delegation. Describe safety management and managing in a diverse workplace.	9	9	19

LINE C Practice equipment maintenance and safety.

		Lecture	Practical	Page
C1	Practice maintenance on small one-cylinder engines and horticulture hand tools. Demonstrate personal safety in the workplace and identify fire types and extinguishing methods.	6	12	9
C2	Practices maintenance on multiple cylinder engines. Describe safe operating procedures for horticulture equipment.	6	12	20

LINE D Describe plant science as it applies to horticulture.

		Lecture	Practical	Page
D1	Explain plan morphological characteristics, life cycles, and adaptations as they apply to plant identification, plant propagation, arboriculture, and turf maintenance.	12	18	10
D2	Examine the internal anatomy of stems, roots, and leaves as they relate to photosynthesis, respiration and transpiration.	12	18	21

LINE E Describe plant health and pest management.

		Lecture	Practical	Page
E1	Identify signs and symptoms of living and non-living factors that cause plant stress.	12	18	12
E2	Examine the internal anatomy of stems, roots, and leaves as they relate to photosynthesis, respiration and transpiration.	12	18	23

LINE F Manage soils.

		Lecture	Practical	Page
F1	Describe physical and biological characteristics of soil, and soil-less media.	12	18	14
F2	Describe chemical characteristics of soil and soil-less media.	12	18	24

LINE H Practice horticultural skills.

PROGRAM OUTLINE
FOR
LEVEL 1

LINE A: IDENTIFY PLANTS AND DESCRIBE THEIR USE

Competency: A1 Identify a wide range of plants, morphological characteristics, growing requirements, use and availability.

Learning Objectives:

1 Apprentices will practice skills that will enable them to identify a wide range of plants used in all segments of horticulture including examples of trees
2 Apprentices will study the important plant characteristics of leaves

Learning Tasks	Content
1 Identify and describe 50 woody and non-woody plants	• identify and describe, using botanical terms, 50 woody and non-woody plants • identify and describe each plant according to its cultural and maintenance requirements
2 Employ correct naming and plant identification terminology	• use binomial nomenclature and botanical terminology to correctly name plants according to the Royal Horticultural Society standard for nomenclature
3 Name the plant family for each plant identified	• correctly name the plant family for each plant identified according to the Royal Horticultural Society standard for nomenclature
4 Use a dichotomous key for plant identification purposes	• use a dichotomous key for the identification of both deciduous and coniferous plants
5 Recognize a range of plant materials commonly used in commercial horticulture	• recognize the plant material common to nursery, landscape, and floriculture
6 Recognize and describe bud, bark, foliage, flower and fruit characteristics	• describe bud characteristics, such as, morphology, type (vegetative or flower), and arrangement • describe bark characteristics, such as, furrowed, smooth, plate-like, etc. • describe leaves using botanical terminology and distinguish a range of inflorescence type and fruit to aid in plant identification

Achievement Criteria:
Given 20 plants (wide range) the apprentice will identify and describe using family, botanical, and common names. Will correctly identify 14 or more plants.

LINE B: DEMONSTRATE EFFECTIVE SUPERVISION

Competency: B1 Demonstrate supervisory skills based on time and stress management, ethics, communication, power and teams.

Learning Objectives:

1 Apprentices will study the basic theories of supervision and demonstrate the skills associated with effective supervision. These include: time management, dealing with stress, ethics and social responsibility in the workplace, effective communication, use of power, and characteristics of effective teams.

Learning Tasks	Content
1 Manage time	• demonstrate ability to manage personal and work time effectively
2 Manage stress	• demonstrate ability to use stress management techniques on the job
3 Recognize ethical and social responsibility issues in the work place	• determine the ethical and social consequences of work-place practices
4 Communicate effectively	• identify and use verbal and non-verbal communication techniques
5 Manage conflict	• manage job site conflicts between team members, businesses, and clientele
6 Apply the concept of power in an organization and practice power relationships	• recognize power structure in the organization and how to apply power within the organization
7 Describe characteristics of an effective team	• recognize characteristics of team members and how they relate to high-performance teams

Achievement Criteria:

The apprentice will correctly answer 7 or more multi-choice questions out of 10 on the skills associated with effective management. The apprentice will also be evaluated on the ability to illustrate supervisory skills through in class case examples and achieve a 70% or higher assessment.

LINE C: PRACTICE EQUIPMENT MAINTENANCE AND SAFETY

Competency: C1 Practice maintenance on small one-cylinder engines and horticulture hand tools. Demonstrate personal safety in the workplace and identify fire types and extinguishing methods.

Learning Objectives:

1 Apprentices will learn basic maintenance on small one-cylinder engines and equipment as applied to horticulture. They will be introduced to engine designs and functions.

2 Apprentices will apply safe work practices as to related horticulture equipment. They must successfully complete the WHMIS certificate to pass this course.

Learning Tasks	Content
1 Describe the Workers Compensation Act in the work place (WorkSafeBC)	• summarize basic WorkSafeBC core requirements
2 Summarize Workplace Hazardous Material Information System (WHMIS)	• complete an on-line WHMIS certificate
3 Describe and demonstrate personal safety in the workplace	• demonstrate personal safety and the use of personal protective equipment
4 Identify fire types and extinguishing methods	• examine water, foam, or chemical extinguishing methods • distinguish between paper, oil and gas, or electrical fires.
5 Use hand tools to maintain horticulture equipment	• use sockets and wrenches to remove and install parts • show competency in using an ignition tester, tachometer, torque wrench, and feeler gauges
6 Identify engine components and function	• identify the differences of a two-stroke, four-stroke, and hybrid four-stroke engines • identify the carburetor, ignition system, starter components, piston, and compression.
7 Practice preventive maintenance and troubleshooting procedures	• tune up equipment and diagnose worn or defective parts.
8 Describe safe operating procedures for horticulture equipment	• safely operate string trimmers, lawnmowers, and backpack blowers • practice starting, stopping, and adjusting equipment

Achievement Criteria:

Given a 15 question quiz, the apprentice will be able to demonstrate the knowledge of maintenance, design and function of a small one-cylinder engines and equipment as applied to horticulture, by answering correctly 11 or more questions.

The apprentice will also be required to successfully complete and pass the WHMIS certificate.

LINE D: DESCRIBE PLANT SCIENCE AS IT APPLIES TO HORTICULTURE

Competency: D1 Explain plant morphological characteristics, life cycles, and adaptations as they apply to plant identification, plant propagation, arboriculture and turf maintenance.

Learning Objectives:

1 Apprentices will examine various shapes and arrangements of stems, leaves, flowers, and fruits. Botanically descriptive terms commonly used in horticulture will be used.

2 They will cover the life cycle of a temperate flowering plant. Stem, root, and leaf modifications and adaptations to environmental conditions will be studied.

3 They will acquire basic horticulture botanical knowledge that will assist them with their studies in plant identification, plant propagation, arboriculture and turf maintenance.

	Learning Tasks	Content
1	Describe the external parts of herbaceous and woody stems	• use the features of a stem (leaf scar shape, bud shape and position, etc.) to assist with identification of that plant • locate the appropriate parts of a stem or branch for pruning, propagation (grafting, cuttings) and other horticultural purposes
2	Describe the parts of a leaf and variations in shape	• identify the difference between simple and compound leaves and the arrangement of leaflets within a compound leaf • group plants into specific plant families and aid in plant identification by recognizing the arrangement of veins within each leaf or leaflet
3	Describe parts of the flower	• identify the basic parts of a flower in preparation for the study of sexual reproduction of flowering plants
4	Identify typical inflorescences	• categorize inflorescence types as an aid in plant identification
5	Identify typical fruits	• separate fruit types into botanical categories as an aid in plant identification
6	Describe the stages in the life cycle of a flowering plant	• describe the events that lead to development of hybrid or open-pollinated seed
7	Describe parts of a seed and seedling	• identify viable seed that produce healthy and vigorous seedlings
8	Identify stem, root, and leaf modifications	• recognize various plant types, often grouped in the category “bulbs”, that are commonly available for gardens and nurseries and are propagated vegetatively • identify atypical stem and leaf features for plant identification purposes
9	Identify plant adaptations to environmental effects	• recognize plant growth habits or modifications that are specifically adapted to certain environments

	Learning Tasks	Content
10	Describe basic growth responses to plant hormones	• recognize plant growth responses as a result of change in environment, horticultural practice, or plant development • identify the hormone that is most likely responsible for a particular growth response.

Achievement Criteria:
Given a 20 question/diagram quiz, the apprentice will be able to illustrate their basic botanical knowledge by answering 14 or more correctly.

LINE E: DESCRIBE PLANT HEALTH AND PEST MANAGEMENT

Competency: E1 Identify signs and symptoms of living and non-living factors that cause plant stress.

Learning Objectives:

1 Apprentices will study the main types of plant stress and their causes. They will identify signs and symptoms of living and nonliving factors on plants including the environmental conditions that are conducive to plant stress.
2 Apprentices will inspect and describe pest, disease and weed samples.
3 Apprentices will be introduced to Integrated Pest Management (IPM) and its use in the horticulture industry.

	Learning Tasks	Content
1	Define plant stress	• able to identify a range of symptoms of plant stress and begin to link symptoms to either abiotic or biotic causes
2	Describe conditions that lead to plant stress	• able to identify a range of symptoms of plant stress and begin to link symptoms to either abiotic or biotic causes
3	Distinguish between biotic and abiotic causes of plant stress	• able to identify a range of symptoms of plant stress and begin to link symptoms to either abiotic or biotic causes
4	Recognize common indicators of abiotic plant stress	• able to identify a range of symptoms of plant stress and begin to link symptoms to either abiotic or biotic causes
5	Identify the major plant pest types including plant feeding pests, diseases, and weeds	• categorize plant pest types and broadly associate the symptoms of biotic plant stress with the type of plant pest
6	Recognize damage caused by various pests	• categorize plant pest types and broadly associate the symptoms of biotic plant stress with the type of plant pest
7	Describe life stages of example pests	• outline the lifecycle of typical pests with a focus on damaging stages and stages where effective controls can be implemented
8	Describe basic arthropod morphology	• describe basic arthropod morphology using appropriate terminology and identify typical examples of arthropods to order
9	Identify eight orders of insects	• describe basic arthropod morphology using appropriate terminology and identify typical examples of arthropods to order
10	Identify four types of plant-pathogens (viruses, fungi, bacteria, and nematodes)	• link signs and symptoms to the different categories of pathogens
11	Describe the characteristics that make plants weeds	• list the characteristics that result in the plants being treated as weeds in horticultural operations
12	Describe established methods for controlling pests (IPM)	• outline the steps and processes in an integrated pest management program

Achievement Criteria:
Given 10 plant and pest samples, the apprentice will successfully answer 7 or more correctly by identifying the signs and symptoms of living and non-living factors conducive to plant stress.

LINE F: MANAGE SOILS

Competency: F1 Describe physical and biological characteristics of soil, and soil-less media.

Learning Objectives:

1 Apprentices will recognize soil and soil management as keys to the successful practice of horticulture.
2 They will study soil formation, the physical and biological properties of soils, and soilless media as they relate to use, soil quality, and plant growth.
3 They will examine soils, assess some physical and biological properties of soils and interpret test results.

Learning Tasks	Content
1 Define soil	• define a natural soil body and contrast it to soil material or soilless media • natural soil bodies are the result of soil forming processes (additions, losses, transformations and translocations) as influenced by soil forming factors (climate, time, biota, parent material, topography) • define soil from a variety of perspectives particularly as a medium for plant growth
2 Define soil quality	• define soil quality and discuss the importance of soil quality, relative to plant growth and environmental sustainability
3 Describe a soil profile	• use colour, structure, texture, rooting, and consistence to describe the soil horizons that comprise a soil profile • discuss the differences between layers of soil materials and soil horizons
4 Explain the physical properties soil and soilless media	• assess soil physical properties (texture, structure, density, porosity) and discuss soil physical properties and their alteration relative to plant growth and soil quality • the role of particle size and particle size distribution is emphasized.
5 Describe the behaviour of water in soil	• measure soil water content and assess the soil's capacity to retain and transmit water relative to plant growth and soil quality
6 Outline the key soil biological processes and their effects on plant growth and soil quality	• discuss the importance of the abundance, distribution, and activity of the major groupings of soil organisms relative to plant growth and soil quality

	Learning Tasks	Content
7	Explain the role of organic matter in soil	• describe the basic composition of soil organic matter and the key roles of soil organic matter relative to soil chemical and physical behaviour
8	Describe composting methods	• describe the composting process and the characteristics and uses of quality compost in horticulture

Achievement Criteria:
The apprentice will examine soil samples and describe physical and biological properties of soils and their effects on plant growth by achieving a passing grade of 70% on a combination written/practical assessment

LINE H: PRACTICE HORTICULTURAL SKILLS

Competency: H1 Demonstrate basic horticultural skills.

Learning Objectives:

1 Apprentices will be introduced to and practice basic skills used in general horticulture.
2 They will learn procedures for identifying, selecting, using, and maintaining hand tools.
3 Apprentices will develop safe work habits and apply practical skills by maintaining beds, borders, lawns, nurseries, and containers on campus.
4 They will practice safe operation of common power equipment.
5 Apprentices will identify levels of landscape maintenance and plant standards stated in the BC Landscape Standard.

Learning Tasks	Content
1 Identify hand tools used in basic horticulture	• Identify hand tools used in basic horticulture
2 Select and use hand tools in horticulture	• Select and use hand tools in horticulture
3 Perform basic horticulture tasks	• Perform basic horticulture tasks
4 Operate horticulture power equipment safely and effectively	• Operate horticulture power equipment safely and effectively
5 Recognize a range of workplace hazardous	• Recognize a range of workplace hazardous
6 Apply appropriate safety procedures when practicing horticulture operations	• Apply appropriate safety procedures when practicing horticulture operations
7 Demonstrate safe work practices when lifting and bending	• Demonstrate safe work practices when lifting and bending
8 Demonstrate the importance of cooperative work methods	• Demonstrate the importance of cooperative work methods
9 Perform basic calculations	• Perform basic calculations

Achievement Criteria:

The apprentice will demonstrate knowledge of safe work habits and apply practical horticulture skills by maintaining beds, borders, lawns, nurseries, and containers on campus. They will achieve a passing grade of 70% or higher on a practical assessment.

PROGRAM OUTLINE
FOR
LEVEL 2

LINE A: DEMONSTRATE THE ABILITY TO IDENTIFY PLANTS AND DESCRIBE THEIR USE

Competency: A2 Practice plant identification skills to identify plants used in all segments of horticulture. Identify plants suitable for planting in difficult situations.

Learning Objectives:

1 Apprentices will practice skills that will enable them to identify a wide range of plants used in all segments of horticulture including examples of trees, shrubs, vines, groundcovers, bedding plants house plants, cut flowers, weeds, and invasive plants.

2 They will study the important plant characteristics of leaves, buds, flowers, fruits, plant shapes, and branching patterns, and will learn about species suitable for planting in difficult situations.

Learning Tasks	Content
1 Identify and describe 75 woody and non-woody plants	• identify and describe, using botanical terms, 75 woody and non-woody plants • identify and describe each plant according to its cultural and maintenance requirements
2 Employ correct naming and plant identification terminology	• use binomial nomenclature and botanical terminology to correctly name plants according to the Royal Horticultural Society standard for nomenclature
3 Name the plant family for each plant identified	• correctly name the plant family for each plant identified according to the Royal Horticultural Society standard for nomenclature
4 Recognize a range of plant materials commonly used in commercial horticulture	• recognize the plant material common to nursery, landscape, and floriculture
5 Recognize plants suitable for planting in difficult situations	• recognize plant material suitable for planting in difficult situations such as, shady, poorly drained, and droughty, locations
6 Recognize and describe bud, bark, foliage, flower, and fruit characteristics	• describe bud characteristics, such as, morphology, type (vegetative or flower), and arrangement • describe bark characteristics, such as furrowed, smooth, plate-like, etc. • describe leaves using botanical terminology and distinguish a range of inflorescence type and fruit to aid in plant identification

Achievement Criteria:

Given 20 plants (wide range) the apprentice will identify and describe using family, botanical, and common names. Will correctly identify 14 or more plants.

LINE B: **DEMONSTRATE BASIC SUPERVISION**

Competency: **B2** **Demonstrate supervisory skills based on leadership, motivation, and delegation. Describe safety management and managing in a diverse workplace.**

Learning Objectives:

1 Apprentices will study the basic theories of supervision and demonstrate the skills associated with effective supervision. These include: leadership, motivation, delegation, safety management, and managing in a diverse workplace.

	Learning Tasks	Content
1	Practice leadership in the organization	• lead a workplace team by the effective use of motivation, delegation, and team management
2	Apply motivational techniques	• motivate workers under their direction
3	Describe safety culture	• describe the safety culture of their organization
4	Manage a diverse work-place	• recognize and manage diversity
5	Interpret the employment standards act	• describe the impacts of the Employment Standards Act on horticultural operations

Achievement Criteria:

The apprentice will correctly answer 14 or more multi-choice questions out of 20 on the skills associated with effective management. The apprentice will also be evaluated on the ability to illustrate supervisory skills through in class case examples and achieve a 70% or higher assessment.

LINE C: PRACTICE EQUIPMENT MAINTENANCE AND SAFETY

Competency: C2 Practice maintenance on multiple cylinder engines. Describe safe operating procedures for horticulture equipment.

Learning Objectives:

1 Apprentices will learn basic maintenance on larger multiple cylinder engines and equipment as applied to horticulture.
2 They will be introduced to engine designs and functions.
3 They will apply safe work practices as to related horticulture equipment.

Learning Tasks	Content
1 Describe and demonstrate safe lifting and moving techniques	• lift batteries from floor to the engine compartment • remove and rotate tires
2 Describe and demonstrate personal safety as related to large multiple cylinder equipment	• demonstrate entry onto and exit from machinery using the three point contact • wear appropriate safety equipment.
3 Recognize workplace hazards	• recognize workplace hazards and mitigate the risk of accident and injury
4 Use hand tools to maintain horticulture equipment	• use sockets and wrenches to remove and reinstall parts • demonstrate the use of a multimeter, battery charger, tire gauge, and hydrometer
5 Identify engine components and function	• identify the differences between a diesel engine and a 2-stroke or 4-stroke engine • identify the carburetor, alternator, radiator, piston, and compression.
6 Practice preventive maintenance and troubleshooting procedures	• tune up equipment and diagnose worn or used parts
7 Describe safe operating procedures for Horticulture equipment	• operate a skid steer and zero turn walk behind machine • practice connecting attachments

Achievement Criteria:

Given a 20 question quiz, the apprentice will be able to demonstrate the knowledge of safety, maintenance, design and function on multiple cylinder engines and equipment as applied to horticulture, by answering correctly answering 14 or more questions.

LINE D: **DESCRIBE PLANT SCIENCE AS IT APPLIES TO HORTICULTURE**

Competency: D2 **Examine the internal anatomy of stems, roots and leaves as they related to photosynthesis, respiration, and transpiration.**

Learning Objectives:

1 Apprentices will examine the internal anatomy of stems, roots, and leaves in order to appreciate their function.
2 They will relate the processes of photosynthesis, respiration, and transpiration to environmental influences commonly found in landscapes and production facilities.
3 Various growth responses to external stimuli, such as gravity and photoperiod, will also be studied.

Learning Tasks	Content
1 Describe the internal anatomy of stems, roots, and leaves	• identify the vascular cambium within a woody stem • recognize root hairs on newly formed root tips, locate tissues which conduct water up stems to the leaves and transport sugars down to the roots for storage or to the growing tips for new cell development • recognize tissues (leaves and green stems) that photosynthesize
2 Describe the movement of sap through a plant and the effects of environment on the rate of flow	• follow the flow of water from the root tips to the stomata openings in leaves • appreciate that transpirational flow is a “pull” mechanism and distributes water and nutrients throughout the plant • recognize the effects of environmental conditions on water use by the plant
3 Describe the flow of sugars, produced in photosynthesis, through the plant	• follow the flow of sugar from the leaves to various parts of the plant to be stored as starch in the roots or to be used immediately for cell maintenance and growth
4 Explain the influence of temperature, water availability, and light on the rates of photosynthesis and respiration	• appreciate the conversion of sunlight to sugar via photosynthesis and the subsequent release of energy via respiration to be used in plant growth and cell maintenance • relate the effects of environmental conditions (day length, light intensity, temperature, air flow, availability of water, relative humidity) on the rates of photosynthesis, respiration, and transpiration • discuss how the rates of those processes affect growth

	Learning Tasks	Content
5	Describe the growth response to external stimuli	• recognize plant growth responses to external stimuli such as gravity and photoperiod

Achievement Criteria:
Given a 20 question/diagram quiz, the apprentice will be able to illustrate their basic botanical anatomy knowledge by answering 14 or more correctly.

LINE E: DESCRIBE PLANT HEALTH AND PEST MANAGEMENT

Competency: E2 Examine biological characteristics of weeds, plant feeders and pathogens and list control strategies.

Learning Objectives:

1 Apprentices will study the three major plant pest types (weeds, plant-feeders, and pathogens).

2 They will examine the biological characteristics of pests, their effects on plants, and list various integrated strategies available for controlling them. These strategies will include an overview of cultural, biological, and chemical control tactics for each of the plant pest types.

Learning Tasks	Content
1 Describe and distinguish between the major plant pest types (weeds, plant-feeders & pathogens)	• report on the characteristics that result in organisms being categorized as pests
2 Describe characteristics that make plants weeds	• report on the characteristics that result in organisms being categorized as pests
3 Describe characteristics that make vertebrates pests	• report on the characteristics that result in organisms being categorized as pests
4 Describe characteristics that make invertebrates pests	• report on the characteristics that result in organisms being categorized as pests
5 Describe characteristics that make pathogens pests	• report on the characteristics that result in organisms being categorized as pests
6 Describe the principles of cultural, biological and chemical control methods as applied to horticultural plant pests	• report on the principles (advantages and disadvantages) of pest control • classify a variety of control measures as belonging to the broad categories of cultural, biological, or chemical pest control
7 Describe the integrated strategies and tactics for the control of major plant pest types	• link strategies for integrated control to the tactics of pest control • discuss the nature and complexity of integration (the effects of specific tactics on non-target pests and other organisms)

Achievement Criteria:

Given a 20 questions quiz, the apprentice will successfully answer 14 or more correctly by identifying biological characteristics of pests, the cultural, biological and chemical control methods applied to pests.

LINE F: MANAGE SOILS

Competency: F2 Describe chemical characteristics of soil and soil-less media.

Learning Objectives:

1 Apprentices will continue their studies of soil and soil management in horticulture.
2 They will study the chemical properties of soil and soilless media (soil reaction, soil salinity, soil fertility).
3 Apprentices will sample soils.

	Learning Tasks	Content
1	Describe how soil colloids (silicate clays, oxide clays, humus) determine soil chemical properties	• describe the basic kinds of soil colloids and recognize the role that soil colloids play in soil fertility and nutrient behaviour • discuss the relationship between cation exchange capacity and inherent fertility.
2	Measure soil reaction	• measure soil pH using a variety of techniques including potentiometric and colourimetric methods
3	Manage soil reaction	• examine the relationship of soil composition and soil pH to the lime requirement of acid soils • select liming materials based on calcium carbonate equivalent and fineness of the liming material • calculate application rates of lime given soil test information
4	Explain how soil reaction relates to soil fertility	• discuss the impact of soil reaction on nutrient availability and on plant growth • identify the key soil management operations that alter soil pH
5	Measure and manage salinity and sodicity	• measure electrical conductivity of soils and soilless media • classify soils according to electrical conductivity and sodium content
6	Explain how soil salinity and sodicity affect soil properties	• describe the impact of salinity and sodicity (poor drainage, high electrical conductivity, poor soil structure) on soil quality and plant growth • outline the strategies that can ameliorate soil salinity problems
7	Discuss the behaviour of nutrients, particularly nitrogen, phosphorus, and potassium, in the soil	• list the available forms of nutrients in the soil and the main pools or sources of nutrients • examine the nitrogen cycle from the standpoint of plant available nitrogen and environmental quality

	Learning Tasks	Content
8	Identify the processes by which plants acquire nutrients	• describe the methods of nutrient movement to plant roots and the influences of soil properties on nutrient uptake
9	Discuss nutrient management	• describe the main sources of nutrient loss from soils and the impacts on plant growth and environmental quality • discuss strategies for minimizing nutrient loss
10	Sample soils	• design a sampling plan and collect samples for testing
11	Interpret soil test information	• read a soil report and implement recommendations
12	Interpret fertilizer label information	• determine nutrient sources, fertilizer ratios, fertilizer application rates, and recommended method of applying fertilizer from the label and by calculation

Achievement Criteria:
The apprentice will examine soil samples and identify the chemical properties and achieve a passing grade of 70% on a combination written/lab assessment.

LINE H: PRACTICE HORTICULTURAL SKILLS

Competency: H2 Assess plant quality and demonstrate plant-handling requirements.

Learning Objectives:

1 Apprentices will gain practical experience in basic landscape and production nursery stock operations.
2 They will study plant quality assessment and handling requirements for common ornamental plant material used in the landscape and nursery industries.
3 Apprentices will practice loading and unloading, sorting, grading, and other types of handling of ornamental plant material.

Learning Tasks	Content
1 Perform plant-grading according to the Canadian Standard for Nursery Stock and the British Columbia Landscape Standard	• assess and grade plants according to plant foliage density, calliper, height, and width ratios according to the standards
2 Identify containers used for growing and shipping ornamental plant material	• calculate container volume and compare results to the standards
3 Describe standards for root ball sizing	• calculate root ball sizes for containers and field grown stock
4 Prepare balled and burlapped plants	• demonstrate digging, wrapping, and tying of root balls • safely and efficiently lift and carry plant material to avoid physical damage to themselves and the plants • discuss different methods of harvesting plant material for field grown stock
5 Securely load plant material	• safely load, unload, and secure plant material on a truck
6 Demonstrate proper planting procedures	• determine the appropriate depth and width of the planting hole • place the plant in the hole and back fill with the appropriate soil material • discuss appropriate post-planting maintenance requirements
7 Safely operate truck and trailer	• demonstrate how to safely couple the truck / tractor and trailer and operate either combination in reverse and securely park the vehicle • perform these operations in compliance with the guidelines established in the Certified Horticulture Technician Program (CHT)

Achievement Criteria:

The apprentice will demonstrate knowledge of safe work habits and apply practical horticulture skills by handling a range of ornamental plant material. They will achieve a passing grade of 70% or higher on a practical assessment.

SECTION 3

TRAINING PROVIDER STANDARDS

FACILITY REQUIREMENTS LEVEL 1:

- Classroom
- Access to live ‘in situ’ plant material as well as herbaria, and visual samples (slides, photographic databases, etc.)
- Access to tools and equipment listed in Section 3
- Access to a service bay and a site for equipment operation
- Botany or Science teaching lab outfitted with compound and dissecting microscopes
- Microscope slides of showing root, stem and leaf anatomy (monocot and dicot)
- Microscope slides showing woody stem growth
- Handlens (10X)
- Glassware, lamps, stir plate (with heating capacity)
- Refrigerator and microwave
- Collection of arthropods, disease organisms, and examples of plant stress
- Soil Science or Chemistry teaching lab
- Glassware, lamps, stir plate (with heating capacity)
- Refrigerator, drying oven and microwave
- Nested sieves, shakers, scales
- Hydrometers and sedimentation cylinders
- Munsell colour books
- Access to the range of hand and power tools common to the horticulture industry and a landscape and nursery site for their use and operation as listed in Section 3

FACILITY REQUIREMENTS LEVEL 2:

- Classroom
- Access to live ‘in situ’ plant material as well as herbaria, and visual samples (slides, photographic databases, etc.)
- Access to tools and equipment listed in Section 3
- Access to a service bay and a site for equipment operation
- Botany or Science teaching lab outfitted with compound and dissecting microscopes
- Microscope slides of showing root, stem and leaf anatomy (monocot and dicot)
- Microscope slides showing woody stem growth
- Hand Lens (10X)
- Glassware, lamps, stir plate (with heating capacity)
- Collection of arthropods, disease organisms, and examples of plant stress
- Soil Science or Chemistry teaching lab
- Glassware, lamps, stir plate (with heating capacity)
- Refrigerator, drying oven and microwave
- Nested sieves, shakers, scales
- pH meters
- Soil sampling equipment
- Access to container nursery stock
- Access to field grown stock/plant material that can be prepared for transplanting
- Trailer and tractor nursery equipment
- Access to large tree transplanting equipment
- Nursery hand carts and tree dollys
- Multiple nursery stock containers
-

FACULTY CREDENTIAL AND EXPERIENCE REQUIREMENTS LEVEL 1:

All Course Outlines

- Subject matter competence as demonstrated by a Horticulture Trades Qualification/Apprentice Certificate or Horticulture Diploma.
- Teaching competence as demonstrated by successful completion of Provincial Instructor Diploma (PIDP) or equivalent or regular faculty status at an institution which has a defined faculty review process (as specified by institutional policy) or contract faculty who have at least completed the Instructional Skills Workshop (PIDP 3102) or equivalent.
- Two years relevant industry experience.

Additional Credentials and Experience for Specific Outlines

A1

- Subject matter competence as demonstrated by a Horticulture Trades Qualification/Apprentice Certificate or Horticulture Diploma or Baccalaureate Degree in Horticulture and 2 years of plant identification experience.

B1

- Subject matter competence as demonstrated by a Business Diploma with Human Resource or Organizational Behaviour specialty or Baccalaureate Degree in with a minor in Business or Certified Landscape Professional.
- Two years supervisory or management experience in a private or public organization.

C1

- Subject matter competence as demonstrated by a Outdoor Power Equipment Trades Qualification/Apprentice Certificate.
- 2 years of relevant industry experience.

D1

- Subject matter competence as demonstrated by a or Baccalaureate Degree in Horticulture, Botany, Agronomy, Plant Biology, Forestry, or Crop Science and/or a Diploma in Horticulture, Agriculture or Forestry with a minimum of 5 years experience in teaching the subject matter.

E1

- Subject matter competence as demonstrated by a Horticulture Diploma or Baccalaureate Degree in Horticulture, Agronomy, Forestry, Crop Science, or Pest Management and/or a Diploma in Agriculture or Forestry with a minimum of 5 years experience in teaching the subject matter.

F1

- Subject matter competence as demonstrated by a Baccalaureate Degree in Soil Science Horticulture, Agronomy, Forestry, or Crop Science and/or a Diploma in Horticulture, Agriculture or Pest Management with a minimum of 5 years experience in teaching the subject matter.

H1

- Subject matter competence as demonstrated by a Horticulture Trades Qualification/Apprentice Certificate or Horticulture Diploma or Baccalaureate Degree in Horticulture and 2 years of practical landscape or nursery experience

FACULTY CREDENTIAL AND EXPERIENCE REQUIREMENTS LEVEL 2:

All Course Outlines

- Subject matter competence as demonstrated by a Horticulture Trades Qualification/Apprentice Certificate or Horticulture Diploma.
- Teaching competence as demonstrated by successful completion of Provincial Instructor Diploma (PIDP) or equivalent or regular faculty status at an institution which has a defined faculty review process (as specified by institutional policy) or contract faculty who have at least completed the Instructional Skills Workshop (PIDP 3102) or equivalent.
- Two years relevant industry experience.

Additional Credentials and Experience for Specific Outlines

A2

- Subject matter competence as demonstrated by a Horticulture Trades Qualification/Apprentice Certificate or Horticulture Diploma or Baccalaureate Degree in Horticulture and 2 years of plant identification experience.

B2

- Subject matter competence as demonstrated by a Horticulture Trades Qualification/Apprentice Certificate or Horticulture Diploma or Baccalaureate Degree in with a minor in Business or Certified Landscape Professional.
- Two years supervisory or management experience in a private or public organization.

C2

- Subject matter competence as demonstrated by a Outdoor Power Equipment Trades Qualification/Apprentice Certificate or equivalent within Horticulture training or education, with a minimum of 2 years of relevant industry experience.

D2

- Subject matter competence as demonstrated by a or Baccalaureate Degree in Horticulture, Botany, Agronomy, Plant Biology, Forestry, or Crop Science and/or a Diploma in Horticulture, Agriculture or Forestry with a minimum of 5 years experience in teaching the subject matter.

E2

- Subject matter competence as demonstrated by a Horticulture Diploma or Baccalaureate Degree in Horticulture, Agronomy, Forestry, Crop Science, or Pest Management and/or a Diploma in Agriculture or Forestry with a minimum of 5 years experience in teaching the subject matter.

F2

- Subject matter competence as demonstrated by a Baccalaureate Degree in Soil Science Horticulture, Agronomy, Forestry, or Crop Science and/or a Diploma in Horticulture, Agriculture or Pest Management with a minimum of 5 years experience in teaching the subject matter.

H2

- Subject matter competence as demonstrated by a Horticulture Trades Qualification/Apprentice Certificate or Horticulture Diploma or Baccalaureate Degree in Horticulture and 2 years of practical landscape or nursery experience

REQUIRED TEXTBOOKS AND MANUALS LEVEL 1:

- A-Z Encyclopedia of Garden Plants - Latest edition. Brickel, C. and T. Cole. Dorling Kindersley, Toronto, ON.
- Kwantlen University College School of Horticulture Plant identification Database, www.kwantlen.ca/horticulture/
- Training in Management Skills Canadian Edition - Latest edition. Hunsaker, P. and D. Dilamarter. Pearson Education Canada.
- Outdoor Power Equipment - Latest edition. Webster, Jay. Nelson Canada, Scarborough, ON.
- WorkSafeBC Website (WCB Internet)
- Equipment Manufacturers Websites (Internet)
- Botany for Gardeners - Latest edition. Capon, Brian. Timber Press, Portland, OR.
- Competency C-06 Explain the Effects of Hormones on Plant Growth and Development - Ministry of Education, Skills and Training and the Ministry of Labour and the Centre for Curriculum and Professional Development. 1996. Province of British Columbia.
- Soil Science and Management - Latest edition. Plaster J. Edward. Thomson/Delmar Learning, Clifton Park, NY.
- British Columbia Landscape Standard - Latest edition. BC Landscape and Nursery Association and the British Columbia Association of Landscape Architects, Surrey, B.C.
- Grounds Keepers Safety Guide - Latest edition. Hamilton Canadian Centre for Occupational Health and Safety., ON.

RECOMMENDED TEXTBOOKS, PAPERS AND MANUALS LEVEL 1:

- Abiotic Disorders of Landscape Plants : A Diagnostic Guide - Costello, Laurence Raleigh. 2003. University of California, Agriculture and Natural Resources, Oakland, CA.
- Integrated Pest Management Manual for Landscape Pests in British Columbia. Gilkeson, Linda A. 2000. Pollution and Remediation Branch, Victoria, BC. (Also available online at http://wlapwww.gov.bc.ca/epd/epdpa/ipmp/ipm-manuals.htm).
- Ball Identification Guide to Greenhouse Pests and Beneficials - Gill, Stanton. 1998. Ball Publication, Batavia, Ill.
- Field Guide to Noxious and Other Selected Weeds of British Columbia - Cranston, Roy. 2002. Ministry of Agriculture, Food and Fisheries; Ministry of Forests, Victoria, BC (Also available online at [http://www.agf.gov.bc.ca/cropprot/weedguid/weedguid.htm).
- Pacific Northwest; Plant Disease Management Handbook - 2000. Extension Services of Oregon State University, Washington State University, and the University of Idaho.
- Soil Management Handbook for the Lower Fraser Valley - Bertrand, R.A., G.A. Hughes-Games, and B.C. Nikkel. 1991. Ministry of Agriculture, Fisheries & Food, Abbotsford, B.C.
- Western Fertilizer Handbook - Soil Improvement Committee, California Fertilizer Association. Latest edition.(Horticulture ed.) Interstate Pub Inc., Danville, Illinois.

Personal Apprentice Equipment

- CSA-approved steel-toed footwear(*Required)
- Rainwear (*Recommended)
- Calculator(*Recommended)
- Workgloves(*Recommended)
- Hand Lens (10X) (*Recommended)

REQUIRED TEXTBOOKS AND MANUALS LEVEL 2:

Textbooks or other Resources

- A-Z Encyclopedia of Garden Plants - Latest edition. Brickel, C. and T. Cole. Dorling Kindersley, Toronto, ON.
- Kwantlen University College School of Horticulture Plant identification Database, www.kwantlen.ca/horticulture/
- Training in Management Skills Canadian Edition - Latest edition.Hunsaker, P. and D. Dilamarter.
- Outdoor Power Equipment - Webster, Jay. 2001. Nelson Canada, Scarborough, ON.
- Botany for Gardeners - Capon, Brian. Latest edition. Timber Press, Portland, OR.
- Competency C-06 Explain the Effects of Hormones on Plant Growth and Development - Ministry of Education, Skills and Training and the Ministry of Labour and the Centre for Curriculum and Professional Development. 1996. Province of British Columbia.
- Integrated pest management manual for landscape pests in British Columbia - Gilkeson, Linda A. 2000. Pollution and Remediation Branch, Victoria, BC. (Also available online at http://wlapwww.gov.bc.ca/epd/epdpa/ipmp/ipm-manuals.htm).
- Weeds of Canada - 1970. Agriculture Canada Publication No. 948.
- Soil Science and Management - Latest edition. Plaster J. Edward. Thomson/Delmar Learning, Clifton Park, NY.
- British Columbia Landscape Standard - Latest edition. BC Landscape and Nursery Association, BC Society of Landscape Architects, BC.
- Canadian Standards for Nursery Stock - Latest edition. Canadian Nursery and Landscape Association.

RECOMMENDED TEXTBOOKS, PAPERS AND MANUALS LEVEL 2:

- WorkSafeBC Website (WCB Internet)
- Equipment Manufacturers Websites (Internet)
- Field guide to noxious and other selected weeds of British Columbia - Cranston, Roy. 2002. Ministry of Agriculture, Food and Fisheries; Ministry of Forests, Victoria, BC (Also available online at [http://www.agf.gov.bc.ca/cropprot/weedguid/weedguid.htm).
- Abiotic disorders of landscape plants: a diagnostic guide - Costello, Laurence Raleigh. 2003. University of California, Agriculture and Natural Resources, Oakland, CA.
- Ball Identification Guide to Greenhouse Pests and Beneficials - Gill, Stanton. 1998. Ball Publication, Batavia, Ill.
- Pacific Northwest; plant disease management handbook - 2000. Extension Services of Oregon State University, Washington State University, and the University of Idaho.
- Handbook for Pesticide Applicators and Pesticide Dispensers - Latest edition. Provincial Ministry of Environment, Province of British Columbia.
- Western Fertilizer Handbook - Soil Improvement Committee, California Fertilizer Association. Latest edition. (Horticulture Ed.) Interstate Pub Inc., Danville, Illinois.
- Soil Fertility Manual - Latest edition. Potash & Phosphate Institute and the Foundation for Agronomic Research. Province of British Columbia Ministry of Skills, Training and Labour and the Centre for Curriculum and Professional Development, Norcross, GA.
- Horticulture Apprenticeship Competency H3, Describe Nutrient Testing Practices and Interpret Results - Ministry of Education, Skills and Training and the Ministry of Labour and the Centre for Curriculum and Professional Development. 1995. Province of British Columbia.
- Horticulture Apprenticeship Competency H4, Describe the Fertilizer Types and Practical Considerations for their use - Ministry of Education, Skills and Training and the Ministry of Labour and the Centre for Curriculum and Professional Development. 1995. Province of British Columbia.

Personal Apprentice Equipment

- CSA-approved steel-toed footwear(*Required)
- Rainwear (*Recommended)
- Calculator(*Recommended)
- Workgloves(*Recommended)
- Hand Lens (10X) (*Recommended)