

Apprenticeship and Industry Training

Glazier

Apprenticeship Course Outline

2507.1 (2007)

**Government
of Alberta** ■



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**Glazier
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Course Outline

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Apprenticeship

Apprenticeship is post-secondary education with a difference. Apprenticeship begins with finding an employer. Employers hire apprentices, pay their wages and provide on-the-job training and work experience. Approximately 80 per cent of an apprentice's time is spent on the job under the supervision of a certified journeyman or qualified tradesperson. The other 20 per cent involves technical training provided at, or through, a post-secondary institution – usually a college or technical institute.

To become certified journeymen, apprentices must learn theory and skills, and they must pass examinations. Requirements for certification—including the content and delivery of technical training—are developed and updated by the Alberta Apprenticeship and Industry Training Board on the recommendation of Glazier Provincial Apprenticeship Committee.

The graduate of the Glazier apprenticeship program is a certified journeyman who will be able to:

- be skilful in cutting, preparing, fabricating or other handling of all glass materials for buildings, fixtures and other uses
- do the glazing, setting, attachment, installation, removal of all types of glass material for buildings, fixtures and other uses
- be capable of doing the installation, fitting fabrication and attachment of architectural metals or related products for all types of buildings
- use efficiently and safely all hand and power operated equipment used by tradespeople
- be able to produce from blueprints and working drawings the type of products made and use by the industry
- relate to the work of other tradesmen in affiliated trades
- carry out damaged light removal procedures, installations and sealing of new parts - understand use of specialised tools, lubricants and sealants
- understand and be able to use the National Auto Glass Specifications Parts Book including identification and selection of bent glass parts - heat treated or laminated - cutting and edgework procedures for laminated flat glass to N.A.G. specifications
- perform assigned tasks in accordance with quality and production standards required by industry

Apprenticeship and Industry Training System

Industry-Driven

Alberta's apprenticeship and industry training system is an industry-driven system that ensures a highly skilled, internationally competitive workforce in more than 50 designated trades and occupations. This workforce supports the economic progress of Alberta and its competitive role in the global market. Industry (employers and employees) establishes training and certification standards and provides direction to the system through an industry committee network and the Alberta Apprenticeship and Industry Training Board. The Alberta government provides the legislative framework and administrative support for the apprenticeship and industry training system.

Alberta Apprenticeship and Industry Training Board

The Alberta Apprenticeship and Industry Training Board provides a leadership role in developing Alberta's highly skilled and trained workforce. The board's primary responsibility is to establish the standards and requirements for training and certification in programs under the Apprenticeship and Industry Training Act. The board also provides advice to the Minister of Advanced Education and Technology on the needs of Alberta's labour market for skilled and trained workers, and the designation of trades and occupations.

The thirteen-member board consists of a chair, eight members representing trades and four members representing other industries. There are equal numbers of employer and employee representatives.

Industry Committee Network

Alberta's apprenticeship and industry training system relies on a network of industry committees, including local and provincial apprenticeship committees in the designated trades, and occupational committees in the designated occupations. The network also includes other committees such as provisional committees that are established before the designation of a new trade or occupation comes into effect. All trade committees are composed of equal numbers of employer and employee representatives. The industry committee network is the foundation of Alberta's apprenticeship and industry training system.

Local Apprenticeship Committees (LAC)

Wherever there is activity in a trade, the board can set up a local apprenticeship committee. The board appoints equal numbers of employee and employer representatives for terms of up to three years. The committee appoints a member as presiding officer. Local apprenticeship committees:

- monitor apprenticeship programs and the progress of apprentices in their trade, at the local level
- make recommendations to their trade's provincial apprenticeship committee (PAC) about apprenticeship and certification in their trade
- promote apprenticeship programs and training and the pursuit of careers in their trade
- make recommendations to the board about the appointment of members to their trade's PAC
- help settle certain kinds of disagreements between apprentices and their employers
- carry out functions assigned by their trade's PAC or the board

Provincial Apprenticeship Committees (PAC)

The board establishes a provincial apprenticeship committee for each trade. It appoints an equal number of employer and employee representatives, and, on the PAC's recommendation, a presiding officer - each for a maximum of two terms of up to three years. Most PACs have nine members but can have as many as twenty-one. Provincial apprenticeship committees:

- Make recommendations to the board about:
 - standards and requirements for training and certification in their trade
 - courses and examinations in their trade
 - apprenticeship and certification
 - designation of trades and occupations
 - regulations and orders under the Apprenticeship and Industry Training Act
- monitor the activities of local apprenticeship committees in their trade
- determine whether training of various kinds is equivalent to training provided in an apprenticeship program in their trade
- promote apprenticeship programs and training and the pursuit of careers in their trade
- consult with other committees under the Apprenticeship and Industry Training Act about apprenticeship programs, training and certification and facilitate cooperation between different trades and occupations
- consult with organizations, associations and people who have an interest in their trade and with employers and employees in their trade
- may participate in resolving certain disagreements between employers and employees
- carry out functions assigned by the board

Glazier PAC Members at the Time of Publication

Mr. R. Greenland.....	Calgary	Presiding Officer
Mr. K. Jarvis	Calgary	Employer
Mr. T. Ward	Calgary	Employer
Mr. D. Holben	Edmonton.....	Employer
Mr. D. Berlin	Calgary	Employee
Mr. M. Blakney	Calgary	Employee
Mr. G. Hofer.....	Edmonton.....	Employee
Mr. D. Gough.....	Edmonton.....	Employee

Alberta Government

Alberta Advanced Education and Technology works with industry, employer and employee organizations and technical training providers to:

- facilitate industry's development and maintenance of training and certification standards
- provide registration and counselling services to apprentices and employers
- coordinate technical training in collaboration with training providers
- certify apprentices and others who meet industry standards

Technical Institutes and Colleges

The technical institutes and colleges are key participants in Alberta's apprenticeship and industry training system. They work with the board, industry committees and Alberta Advanced Education and Technology to enhance access and responsiveness to industry needs through the delivery of the technical training component of apprenticeship programs. They develop lesson plans from the course outlines established by industry and provide technical training to apprentices.

Apprenticeship Safety

Safe working procedures and conditions, incident/injury prevention, and the preservation of health are of primary importance in apprenticeship programs in Alberta. These responsibilities are shared and require the joint efforts of government, employers, employees, apprentices and the public. Therefore, it is imperative that all parties are aware of circumstances that may lead to injury or harm.

Safe learning experiences and healthy environments can be created by controlling the variables and behaviours that may contribute to or cause an incident or injury. By practicing a safe and healthy attitude, everyone can enjoy the benefit of an incident and injury free environment.

Alberta Apprenticeship and Industry Training Board Safety Policy

The Alberta Apprenticeship and Industry Training Board (board) fully supports safe learning and working environments and emphasizes the importance of safety awareness and education throughout apprenticeship training- in both on-the- job training and technical training. The board also recognizes that safety awareness and education begins on the first day of on-the-job training and thereby is the initial and ongoing responsibility of the employer and the apprentice as required under workplace health and safety training. However the board encourages that safe workplace behaviour is modeled not only during on-the-job training but also during all aspects of technical training, in particular, shop or lab instruction. Therefore the board recognizes that safety awareness and training in apprenticeship technical training reinforces, but does not replace, employer safety training that is required under workplace health and safety legislation.

The board has established a policy with respect to safety awareness and training:

The board promotes and supports safe workplaces, which embody a culture of safety for all apprentices, employers and employees. Employer required safety training is the responsibility of the employer and the apprentice, as required under legislation other than the *Apprenticeship and Industry Training Act*.

The board's complete document on its 'Apprenticeship Safety Training Policy' is available at www.tradesecrets.gov.ab.ca; access the website and conduct a search for 'safety training policy'.

Implementation of the policy includes three common safety learning outcomes and objectives for all trade course outlines. These common learning outcomes ensure that each course outline utilizes common language consistent with workplace health and safety terminology. Under the title of 'Standard Workplace Safety', this first section of each trade course outline enables the delivery of generic safety training; technical training providers will provide trade specific examples related to the content delivery of course outline safety training.

Addendum

As immediate implementation of the board’s safety policy includes common safety learning outcomes and objectives for all course outlines, this trade’s PAC will be inserting these safety outcomes into the main body of their course outline at a later date. In the meantime the addendum below immediately places the safety outcomes and their objectives into this course outline thereby enabling technical training providers to deliver the content of these safety outcomes.

STANDARD WORKPLACE SAFETY

A. Safety Legislation, Regulations & Industry Policy in the Trades

Outcome: *Describe legislation, regulations and practices intended to ensure a safe work place in this trade.*

1. Demonstrate the ability to apply the Occupational Health and Safety Act, Regulation and Code.
2. Explain the role of the employer and employee in regard to Occupational Health and Safety (OH&S) regulations, Worksite Hazardous Materials Information Systems (WHMIS), fire regulations, Workers Compensation Board regulations, and related advisory bodies and agencies.
3. Explain industry practices for hazard assessment and control procedures.
4. Describe the responsibilities of workers and employers to apply emergency procedures.
5. Describe positive tradesperson attitudes with respect to housekeeping, personal protective equipment and emergency procedures.
6. Describe the roles and responsibilities of employers and employees with respect to the selection and use of personal protective equipment (PPE).
7. Select, use and maintain appropriate PPE for worksite applications.

B. Climbing, Lifting, Rigging and Hoisting

Outcome: *Describe the use of personal protective equipment (PPE) and safe practices for climbing, lifting, rigging and hoisting in this trade.*

1. Select, use and maintain specialized PPE for climbing, lifting and load moving equipment.
2. Describe manual lifting procedures using correct body mechanics.
3. Describe rigging hardware and the safety factor associated with each item.
4. Select the correct equipment for rigging typical loads.
5. Describe hoisting and load moving procedures.

C. Hazardous Materials & Fire Protection.....

Outcome: *Describe the safety practices for hazardous materials and fire protection in this trade.*

1. Describe the roles, responsibilities features and practices related to the workplace hazardous materials information system (WHMIS) program.
2. Describe the three key elements of WHMIS.
3. Describe handling, storing and transporting procedures when dealing with hazardous material.
4. Describe safe venting procedures when working with hazardous materials.
5. Describe fire hazards, classes, procedures and equipment related to fire protection.

Workplace Health and Safety

A tradesperson is often exposed to more hazards than any other person in the work force and therefore should be familiar with and apply the Occupational Health and Safety Act, Regulations and Code when dealing with personal safety and the special safety rules that apply to all daily tasks.

Workplace Health and Safety (Alberta Employment, Immigration and Industry) conducts periodic inspections of workplaces to ensure that safety regulations for industry are being observed.

Additional information is available at www.worksafely.org

Technical Training

Apprenticeship technical training is delivered by the technical institutes and many colleges in the public post-secondary system throughout Alberta. The colleges and institutes are committed to delivering the technical training component of Alberta apprenticeship programs in a safe, efficient and effective manner. All training providers place great emphasis on safe technical practices that complement safe workplace practices and help to develop a skilled, safe workforce.

The following institutions deliver Glazier apprenticeship technical training:
Southern Alberta Institute of Technology (Main Campus)

Procedures for Recommending Revisions to the Course Outline

Advanced Education and Technology has prepared this course outline in partnership with the Glazier Provincial Apprenticeship Committee.

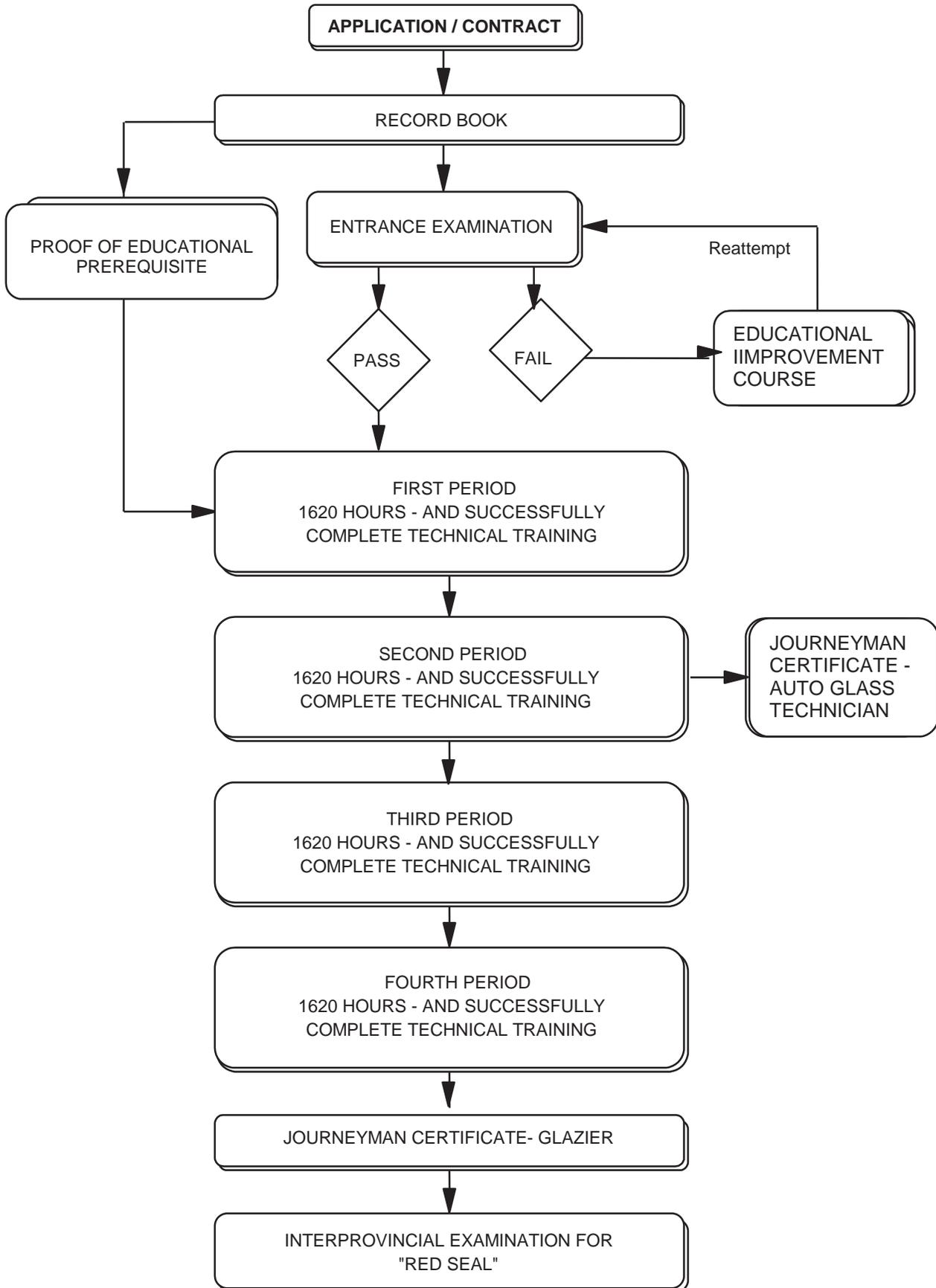
This course outline was approved on June 22, 2007 by the Alberta Apprenticeship and Industry Training Board on a recommendation from the Provincial Apprenticeship Committee. The valuable input provided by representatives of industry and the institutions that provide the technical training is acknowledged.

Any concerned individual or group in the province of Alberta may make recommendations for change by writing to:

Glazier Provincial Apprenticeship Committee
c/o Industry Programs and Standards
Apprenticeship and Industry Training
Advanced Education and Technology
10th floor, Commerce Place
10155 102 Street NW
Edmonton AB T5J 4L5

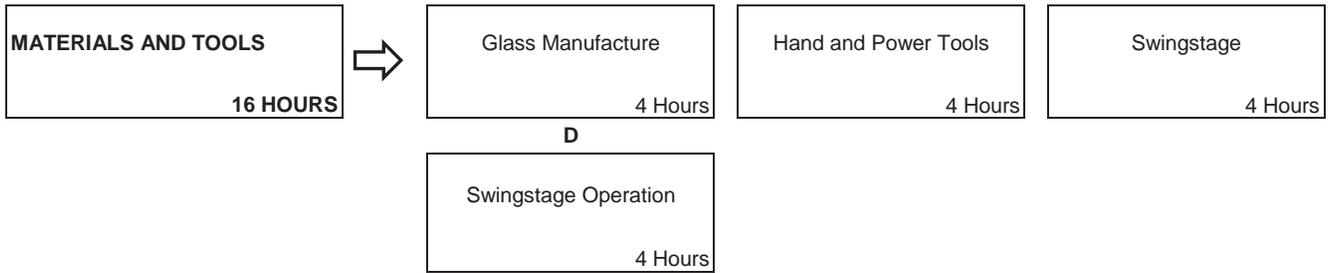
It is requested that recommendations for change refer to specific areas and state references used. Recommendations for change will be placed on the agenda for regular meetings of the Glazier Provincial Apprenticeship Committee.

Apprenticeship Route toward Certification

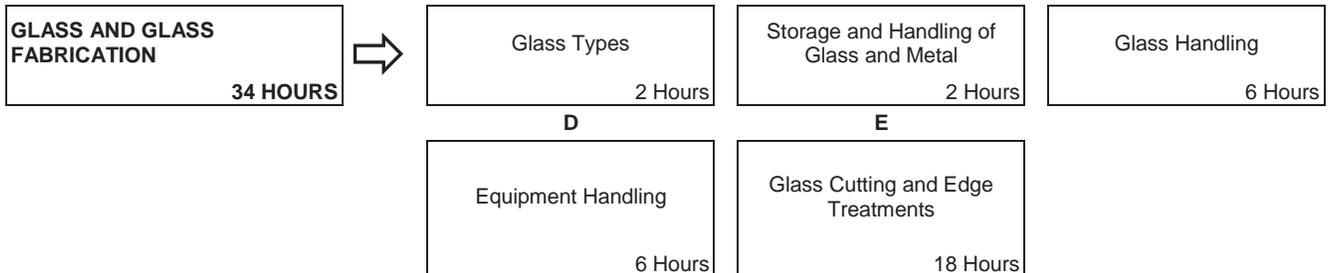


**Glazier Training Profile
FIRST PERIOD
(6 Weeks 30 Hours per Week – Total of 180 Hours)**

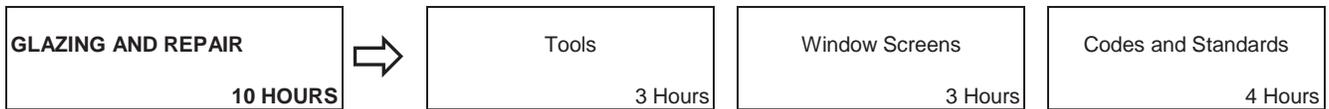
SECTION ONE



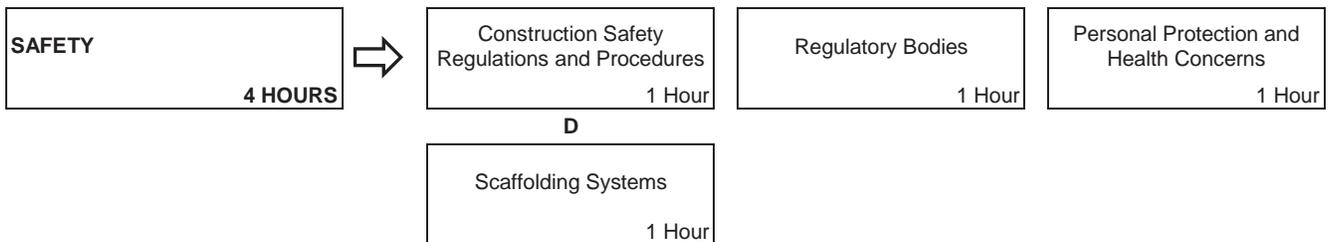
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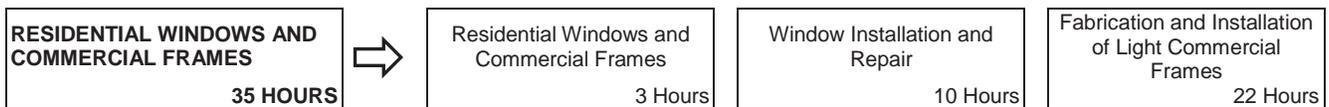
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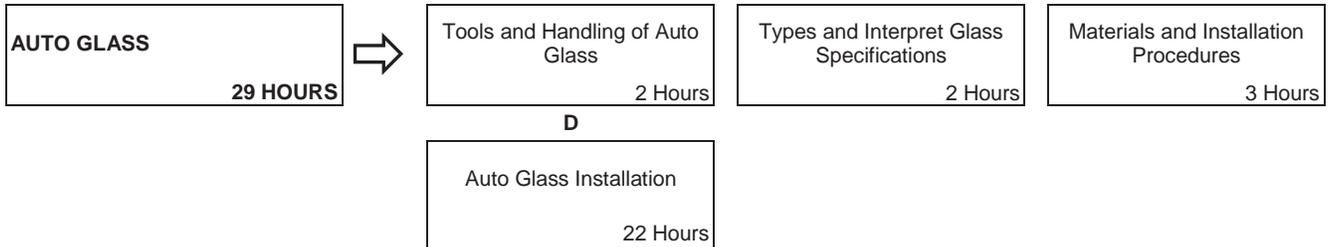
SECTION FOUR



SECTION FIVE



SECTION SIX



SECTION SEVEN

ESTIMATING AND PLANS
52 HOURS



A

Mathematic Functions
2 Hours

B

Perimeters and Areas
4 Hours

C

Ratio, Proportion and
Percentage
2 Hours

D

Quantity Calculations for
Glazing Materials
6 Hours

E

Basic Drawing
14 Hours

F

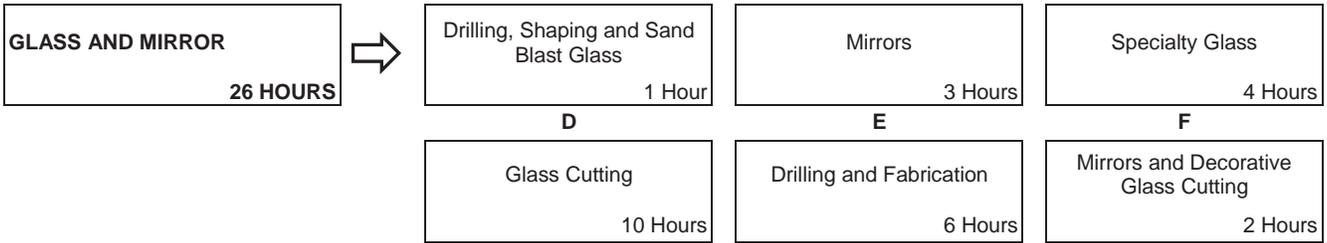
Residential and Light
Commercial Blueprints
16 Hours

G

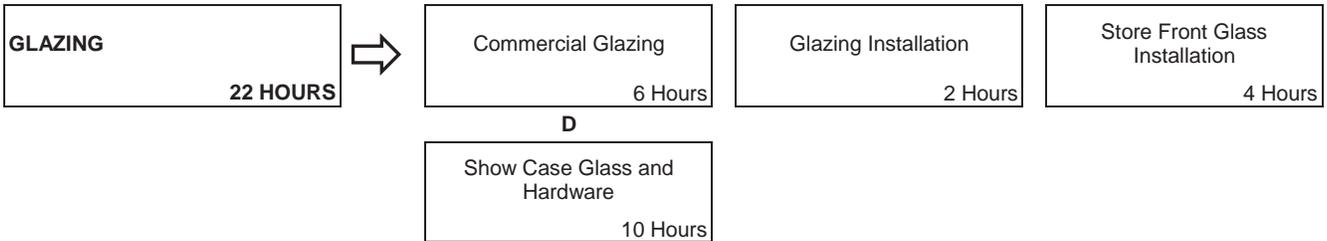
Estimating Materials from
Residential Blueprints
8 Hours

SECOND PERIOD
(6 Weeks 30 Hours per Week – Total of 180 Hours)

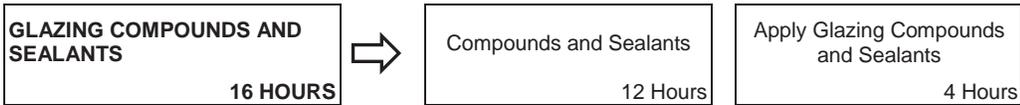
SECTION ONE



SECTION TWO



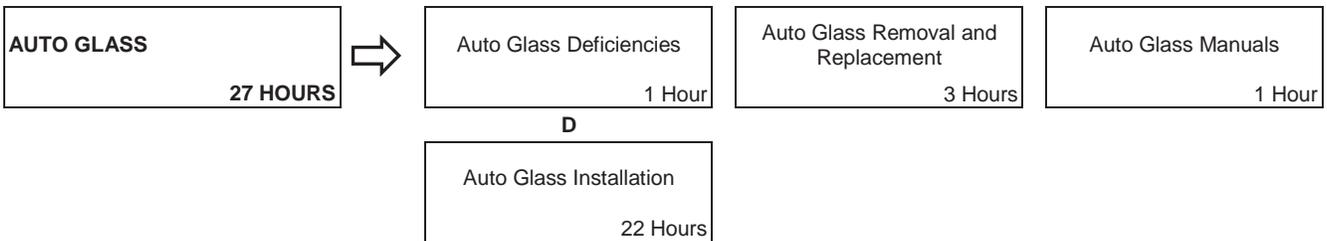
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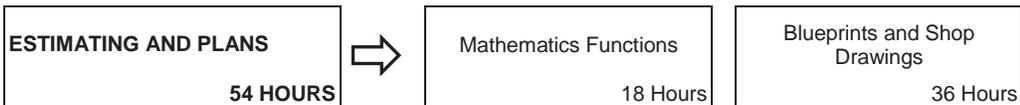
SECTION FOUR



SECTION FIVE

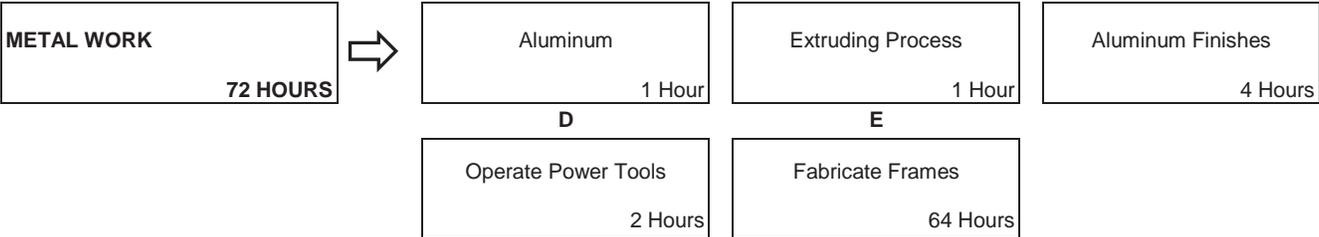


SECTION SIX



THIRD PERIOD
(6 Weeks 30 Hours Per Week – Total of 180 Hours)

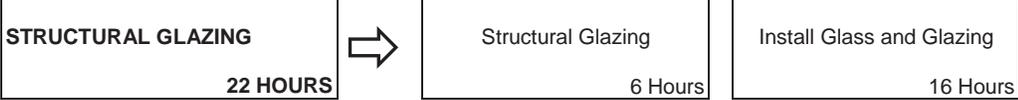
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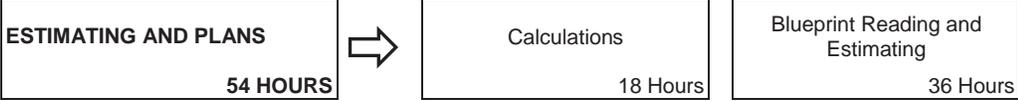
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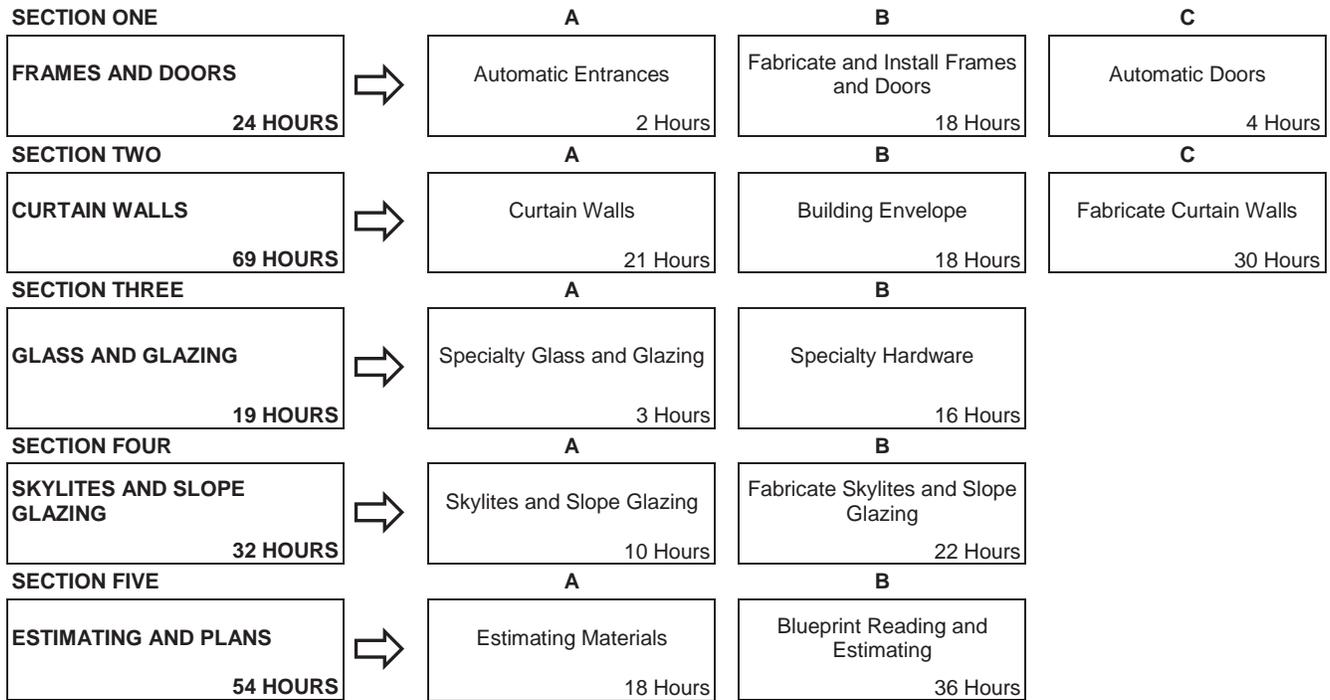
SECTION THREE



SECTION FOUR



FOURTH PERIOD
(6 Weeks 30 Hours Per Week – Total of 180 Hours)



NOTE: The hours stated are for guidance and should be adhered to as closely as possible. However, adjustments must be made for rate of apprentice learning, statutory holidays, registration and examinations for the training establishment and Apprenticeship and Industry Training.

**FIRST PERIOD TECHNICAL TRAINING
GLAZIER TRADE
COURSE OUTLINE**

UPON SUCCESSFUL COMPLETION OF THIS PROGRAM THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

SECTION ONE:.....MATERIALS AND TOOLS..... 16 HOURS

A. Glass Manufacture 4 Hours

Outcome: ***Identify and describe the manufacturing of glass.***

1. Describe current methods and materials used to manufacture glass for:
 - a) float glass
 - b) soda ash
 - c) limestone
 - d) cullet
 - e) silica sand
 - f) safety laminated glass
 - g) tempered glass
 - h) wire glass
 - i) specialty type glasses and coatings
 - j) Low-E
 - k) Low Iron

2. List the standard dimensions, glazing safety, and edge clearance and bites of glass:
 - a) 2 mm
 - b) 3 mm
 - c) 4 mm
 - d) 5 mm
 - e) 6 mm
 - f) sealed units

B. Hand and Power Tools..... 4 Hours

Outcome: ***Identify and describe the typical tools used and their correct application.***

1. Identify and describe the typical tools / machines used in the glazier trade and the correct application for each:
 - a) measurement and layout tools
 - b) alignment tools
 - c) squaring and marking tools
 - d) assembly and dismantling tools
 - e) boring and drilling tools / machines
 - f) glass edging machines
 - g) laser levels

2. Describe the safe operation and maintenance of the tools and equipment used to treat the edges of glass:
 - a) belt machines
 - b) edging machines
 - c) refer to manufacturer's manual for maintenance
 - d) potential electrical hazards and sources
3. Describe the products used to treat the edges of glass:
 - a) abrasives
 - b) coolants

C. Swingstage..... 4 Hours

Outcome: Identify and describe the use of swingstages.

1. Identify and describe types of swingstages.
2. Identify and describe swingstage components.
3. Identify and describe safety features of a swingstage.
4. Identify and describe the requirements for tie back components.
5. Identify and describe fall arrest equipment used when operating a swingstage.
6. Interpret safety codes and regulations related to swingstages.

D. Swingstage Operation..... 4 Hours

Outcome: Demonstrate the safe operation and inspection of a swingstage.

1. Demonstrate safety features of a swingstage.
2. Demonstrate the safe working procedures in setting up and working on platforms.
3. Demonstrate the safe use of fall arrest equipment.
4. Demonstrate the maintenance and inspection of equipment before use.
5. Perform checklist procedures.

SECTION TWO:..... GLASS AND GLASS FABRICATION 34 HOURS

A. Glass Types..... 2 Hours

Outcome: Identify and describe glass types.

1. Identify and describe glass types, composition and typical use for:
 - a) lime / every day glass (normal)
 - b) wire / fire retardant
 - c) laminated / safety glazing
 - d) tempered / safety glazing
 - e) heat strengthened / spandrel panels
 - f) glare reducing / picture frame
 - g) heat absorbing / heat reflective / energy efficient
 - h) lead / x-ray rooms
 - i) specialty coatings / frits
 - j) ceramic (high heat)
 - k) bent glass
 - l) acid etched glass

2. List the types of business involved in the glass industry and their function:
 - a) auto glass
 - b) contract glazing
 - c) residential / flat glass
 - d) manufacturer

B. Storage and Handling of Glass and Metal2 Hours

Outcome: *Describe the procedures to store and handle glass and metal.*

1. Describe the structural requirements of racks:
 - a) size
 - b) shape
 - c) structural integrity
 - d) manufacturer's specifications
2. Describe the handling of glass:
 - a) suction cups
 - b) glass dolly's
 - c) methods of carrying glass solo or partnering
3. Describe the proper packaging and protection of products:
 - a) crating
 - b) wrapping
 - c) transporting

C. Glass Handling.....6 Hours

Outcome: *Demonstrate storage and handling of glass and metal.*

1. Determine the allocation of glass and metal distribution or storage on job site or shop:
 - a) store and removal from storage
 - b) weight and point loading
 - c) accessibility of materials to expedite work schedule
2. Comply with OH&S General Safety Regulations.
3. Keep shop area clean and tidy.

D. Equipment Handling.....6 Hours

Outcome: *Demonstrate equipment handling when installing glass.*

1. Work safely from ladder and scaffolding.
2. Demonstrate the awareness of scaffolding safety rules and safety harness's including maintenance and inspection:
 - a) fall restraint
 - b) fall arrest
3. Demonstrate the use of suction cups:
 - a) maintenance
 - b) minor repair
4. Demonstrate the use of rolling blocks.

E. Glass Cutting and Edge Treatments..... 18 Hours**Outcome: Demonstrate glass cutting, shaping and edge treatments.**

1. Demonstrate the use of different glass cutting tools:
 - a) cutters
 - b) straight edge and lip rule
 - c) circle and oval cutters
 - d) types of cutting wheels
2. Cut float, flat safety and pattern glass to straight lines, circles and patterns including incuts.
3. Treat the edges of float, thick float, laminated, mirror and wire glass with a/an ground, arrised, polished and seamed edge:
 - a) using upright belt machine
 - b) using hand belt machine
 - c) choosing the correct belt
4. Cut and finish glass sliding showcase doors:
 - a) measure finished opening
 - b) determine type of track system
 - c) polish exposed edges
 - d) install lock

SECTION THREE: GLAZING AND REPAIR..... 28 HOURS**A. Tools 3 Hours****Outcome: Identify and describe the tools and equipment used to glaze.**

1. List and describe the tools and equipment used to glaze wood, aluminum and steel sash:
 - a) putty knives
 - b) point gun
 - c) glazier's hammer
 - d) chisels
 - e) gasket rollers
 - f) suction cups
 - g) glazing bar
 - h) glass lifters
 - i) screw drivers
 - j) heat gun

B. Window Screens..... 3 Hours**Outcome: Describe the products of window screen.**

1. Describe the products of window screen:
 - a) screen bar
 - b) screen spline / lace
 - c) fibre or metal screen
 - d) solar screen
 - e) screen hardware

C. Codes and Standards..... 4 Hours

Outcome: Interpret codes and standards for glazing.

1. Interpret building codes and hazardous products:
 - a) building codes, size, thickness and types of glass
 - b) describe fire retardant glazing
 - c) describe safety glazing for mirror doors
 - d) describe safety glazing for shower doors and bath tub enclosures
 - e) describe over head safety glazing
 - f) describe safety glazing for public entrance ways
 - g) describe safety glazing for hand rails
 - h) describe safety glazing for residential doors and side lights

SECTION FOUR: SAFETY 4 HOURS

A. Construction Safety Regulations and Procedures 1 Hour

Outcome: Identify safety regulations and code as they apply to the safe work practices.

1. Define selected terms in Occupational Health and Safety (O.H. & S.) Act, regulations and codes.
2. Describe selected general provisions and use of safeguards.
3. Describe minimum requirements of ladders.
4. Describe minimum requirements of personal protective equipment.
5. Describe scaffolding requirements.
 - a) awareness of hazardous materials:
 - b) asbestos
 - c) mold
6. Describe the scope of the Workplace Hazardous Materials Information System (W.H.M.I.S.) in the workplace.
7. Describe the use of hazardous assessment documentation and procedures.

B. Regulatory Bodies 1 Hour

Outcome: Demonstrate the ability to interpret and comply with the various regulatory bodies.

1. Discuss the origin and purpose of the National and Provincial Building Codes.
2. Recognize American Society for Testing and Materials (ASTM) and American National Standards Institute (ANSI) specifications related to Glazier trade.
3. Interpret the Occupational Health and Safety Act, Regulation and Code.

C. Personal Protection and Health Concerns 1 Hour

Outcome: Identify and describe potential industrial health hazards and the use of personal protection.

1. Describe noise induced hearing loss.
2. Describe back problems and proper lifting techniques.
3. Describe knee and elbow problems and preventative measures.

4. Describe reactions to chemicals and respiratory protection from gases, vapours, fumes and dust.
5. Describe air quality and ventilation.
6. Identify the causes of eye damage.
7. Describe breathing hazards and breathing apparatus.
8. Describe fall-arrest systems:
 - a) lanyards
 - b) lifelines
 - c) safety nets
 - d) travel-restraint
 - e) full body harness
 - f) rope grab
9. Describe compressed air-hazards.
10. Describe the operating of pneumatic equipment.
11. Describe the proper rapport between the Glazier and his employer and the customer:
 - a) professional ethics
 - b) conduct
 - c) appearance
 - d) dress
 - e) deportment

D. Scaffolding Systems 1 Hour

Outcome: Use scaffold systems.

1. Define scaffold systems and structures:
 - a) rolling
 - b) swingstage
2. Describe scaffold components and materials.
3. Describe scaffold safety and access.
4. Describe tying and bracing scaffolds.
5. Describe base conditions for scaffolds.
6. Describe erection and dismantling of scaffolds.
7. Describe powered elevation work platforms:
 - a) scissor lifts
 - b) articulated lifts
8. Describe scaffold identification tagging (red, yellow and green).

SECTION FIVE: RESIDENTIAL WINDOWS AND COMMERCIAL FRAMES 35 HOURS**A. Residential Windows and Commercial Frames.....3 Hours**

Outcome: ***Identify and describe residential windows and commercial frames.***

1. Describe the standard material used for window sash:
 - a) glass
 - b) framing
 - c) gasket
 - d) sealant
 - e) setting blocks
2. Identify and describe the tools used to fabricate a sash:
 - a) drill
 - b) hammer
 - c) saws
 - d) screw drivers
 - e) files
 - f) combination square
3. Identify commonly used sealants and their uses:
 - a) sealants
 - b) caulking
 - c) glazing tapes and gaskets
4. Recognize the common types of manufactured windows and accessories:
 - a) fixed sash
 - b) double hung
 - c) horizontal sliding
 - d) casement
 - e) awning
 - f) skylights
 - g) bow
 - h) bay
 - i) hopper
 - j) pivot
5. Describe the typical surrounds and head ,jamb, and sill details used in wood frame and masonry structures:
 - a) concrete opening
 - b) steel opening
 - c) brick opening
 - d) wood opening

6. Identify the tools used to install frames:
 - a) leveling and alignment devices
 - b) plumb bob
 - c) measuring tape
 - d) screw drivers
 - e) screw gun
 - f) drill
 - g) hammer
 - h) glazing bar
7. Identify and describe light commercial framing sections:
 - a) head
 - b) sill
 - c) jambs
 - d) vertical and horizontal mullions
 - e) thermally broken framing sections
8. Describe glass replacement:
 - a) perform hazardous assessment
 - b) safely secure area of work for workers and public
 - c) removal of sealants
 - d) removal of glass
 - e) prepare opening for new glass
 - f) install replacement glass
 - g) install window stops
 - h) apply sealants
 - i) clean glass and framing
 - j) clean work area

B. Window Installation and Repair 10 Hours

Outcome: *Glaze and repair light commercial and residential windows.*

1. Glaze wood, PVC and aluminium sash:
 - a) determine edge clearance and measure glass
 - b) choose proper sealants
 - c) remove broken glass
 - d) apply glazing sealant
 - e) set glazing blocks
 - f) install glass
 - g) clean glass and adjacent area
2. Fabricate screens:
 - a) determine size from drawing or order form
 - b) cut screen bar using hacksaw / chop saw
 - c) install corner brackets
 - d) cut screen material, allow proper overlap
 - e) install screen material using spline
 - f) remove excess screen material

3. Apply sealants to wood and metal:
 - a) clean frame and glass
 - b) prime frame and glass
 - c) refer sealant manufacturer's specifications for correct primer and sealant
 - d) apply sealant
 - e) clean glass and work area

C. Fabrication and Installation of Light Commercial Frames22 Hours

Outcome: *Fabricate and install typical exterior ribbon window.*

1. Fabricate windows from commercial metal:
 - a) determine size from shop drawing
 - b) cut material using chop saw
 - c) join material as per specifications
2. Caulk perimeters of windows:
 - a) clean substrate and frame
 - b) prime substrate and frame
 - c) refer sealant manufacturer's specifications for correct primer and sealant
 - d) apply sealant
 - e) clean frame and work area
 - f) head bead
3. Install window frames:
 - a) locate frame position from blueprint
 - b) prepare frame for installation
 - c) level and plumb frame allowing appropriate clearance all around
 - d) fasten frame in place
 - e) prep and apply sealant

SECTION SIX:.....AUTO GLASS..... 29 HOURS

A. Tools and Handling of Auto Glass 2 Hours

Outcome: *Identify and describe the tools and handling of auto glass.*

1. List the tools used to remove and install auto glass:
 - a) release tools
 - b) knives; hand, electric, pneumatic
 - c) insert tools
 - d) spring removers
 - e) windshield wiper arm removers
 - f) molding tools
 - g) vacuum cup
 - h) sealant applicators
2. Describe the proper handling, storage and transportation of auto glass:
 - a) set windshield on rack when preparing for install
 - b) store in proper rack system
 - c) transport in proper rack system on glass truck
 - d) transport individual shield in specified carton (shipping)

B. Types and Interpret Glass Specifications 2 Hours**Outcome: Describe auto glass types and specifications.**

1. Describe the makeup of auto glass for windshields backlight and sidelight:
 - a) AS 1
 - b) AS 2
 - c) tempered glass
 - d) laminated glass
 - e) electronically heated and controlled glass and specialty features
 - f) Heads Up Display (H.U.D.)
2. Interpret the National Auto Glass Specifications:
 - a) NAGS catalogue abbreviations
 - b) domestic
 - c) foreign
 - d) interchange

C. Materials and Installation Procedures 3 Hours**Outcome: Identify and describe materials and specifications related to the installation and repair of auto glass.**

1. Describe bonding agent seals:
 - a) gasket
 - b) butyl
 - c) urethane
 - d) cleaners / primers
2. Describe the installation methods used for gasketless auto glass:
 - a) pinch weld inspection
 - b) full cut-out method
 - c) partial or close cut outs method
3. Describe structural requirements of auto glass relative to recommended federal auto codes:
 - a) O.E.M. specifications
 - b) sealant manufacturer's specifications
 - c) auto glass suppliers specifications
 - d) federal code
4. Describe the performance of auto glass in an accident:
 - a) air bag
 - b) roll over protection
 - c) occupant retention
 - d) out side protection
5. Describe windshield damage and repair methods:
 - a) bulls eye
 - b) partial bulls eye
 - c) star break
 - d) combination break

D. Auto Glass Installation.....22 Hours**Outcome: Demonstrate handling, cutting, installing of auto glass.**

1. Install windshields and back glass:
 - a) identify correct part required using NAGS Book
 - b) determine which method to use
 - c) inspect pinchwelds
 - d) select proper materials (cleaners, primers and sealants)
 - e) place protective covers on customer vehicle
 - f) perform proper installation method, safety first
 - g) clean product to industry standards
2. Hook up "in glass" electrical components:
 - a) test components prior to removal
 - b) perform proper hook up of components
3. Pattern cut laminated safety glass for various applications:
 - a) use existing glass as pattern
 - b) prepare pattern allowing proper clearances
 - c) use pattern as guide for cutting laminated glass
 - d) cut glass with appropriate clearances to allow for edge work
 - e) clean product to industry standards
4. Repair rock chip:
 - a) identify areas to be repaired e.g. Critical line of vision
 - b) identify the type of chip
 - c) apply safety precautions when using resins, drills and UV lights
 - d) determine when to drill
 - e) protect customer vehicle
 - f) clean finished product to industry standards
5. Ship and store auto glass:
 - a) correct handling and safety precautions
 - b) select correct case and carton for product
6. Keep all work areas clean and tidy:
 - a) clean tools and equipment
 - b) practice good house keeping guidelines

SECTION SEVEN: ESTIMATING AND PLANS 52 HOURS**A. Mathematic Functions.....2 Hours****Outcome: Demonstrate the ability to complete basic math operations.**

1. Demonstrate the use of metric/imperial conversion calculators.
2. Solve problems related to rounding off numbers.
3. Solve problems related to basic arithmetic functions (addition, subtraction, multiplication and division).
4. Apply the metric system to measuring lengths.
5. Apply the imperial system to measuring lengths.

6. Use fractions in addition, subtraction, multiplication and division.
7. Convert between fractions and decimals.

B. Perimeters and Areas.....4 Hours

Outcome: *Demonstrate the ability to solve perimeters and areas.*

1. Calculate perimeters.
2. Use formulas to calculate the areas of various shapes.

C. Ratio, Proportion and Percentage 2 Hours

Outcome: *Demonstrate the ability to solve ratio and proportion and percentage problems.*

1. Convert between decimal and percentage numbers.
2. Calculate the percentage value of a number.
3. Calculate the percentage value of one number relative to another.
4. Calculate the numeric value of a percentage.
5. Solve ratio and proportion problems.

D. Quantity Calculations for Glazing Materials6 Hours

Outcome: *Demonstrate the ability to calculate quantity glazing materials.*

1. Calculate quantities related to study of plans and drawings for:
 - a) clearances and bites
 - b) glass cutting from stock sheet
2. Solve trade related problems:
 - a) calculate the weight of a piece of glass
 - b) calculate the cost of a piece of glass
 - c) maximize the yield of a sheet of glass
 - d) maximize the yield of an aluminum extrusion
 - e) calculate the required quantities

E. Basic Drawing..... 14 Hours

Outcome: *Demonstrate the ability to use drawing instruments and produce drawings.*

1. Describe the function of drawing instruments.
2. Complete exercises using metric and imperial scales.
3. Draw basic geometric layouts.
4. Interpret floor plans.
5. Draw orthographic drawings to scale of a sash, window frames and doors.
6. Draw cross sections and details for shop project.
7. Draw shop drawings of a window.
8. Produce cutting lists from blueprints.

F. Residential and Light Commercial Blueprints..... 16 Hours

Outcome: ***Interpret blueprints.***

1. Interpret schedules and specifications.
2. Interpret elevation drawings.
3. Interpret section views.
4. Interpret floor plans.
5. Interpret symbols and notations.
6. Interpret scaling and dimensioning.
7. Interpret plot plans.
8. Interpret and sketch details.
9. Interpret and locate dimensions of windows etc.

G. Estimating Materials From Residential Blueprints 8 Hours

Outcome: ***Interpret plans and specifications for material quantities.***

1. Interpret the various types of plans.
2. Calculate material quantities from blueprints and specifications.

**SECOND PERIOD TECHNICAL TRAINING
GLAZIER TRADE
COURSE OUTLINE**

UPON SUCCESSFUL COMPLETION OF THIS PROGRAM THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

SECTION ONE:.....GLASS AND MIRROR 26 HOURS

A. Drilling, Shaping and Sand Blast Glass 1 Hour

Outcome: ***Describe methods of drilling, shaping and sand blasting glass.***

1. Describe properties, uses, and selection of abrasives, coolants and lubricants used to drill glass and select proper:
 - a) bits, carbide, tube, fluted and diamond
 - b) cutting compound (carborundum)
 - c) coolants, water or turpentine
2. Describe the effects of speed and heat when drilling glass:
 - a) select speed according to thickness
3. Describe methods and procedures to sand blast glass:
 - a) identify types of sand blasting equipment
 - b) identify types of abrasive materials
 - c) identify personal protective equipment required
 - d) describe sand blasting techniques

B. Mirrors 3 Hours

Outcome: ***Describe manufacturing, repair and installation of mirrors.***

1. Describe the material and methods of application used to silver mirrors:
 - a) silver nitrate, ammonia
 - b) spray application
2. Describe the methods used to colour glass:
 - a) spray application / fired on
 - b) chemicals in batch mix
3. Describe the methods used to polish out a scratch:
 - a) felt wheel
 - b) cerium oxide
4. Describe the proper procedures for measuring and installing mirrors:
 - a) plumb and mark a centre line on wall, full height
 - b) level and mark a line on the wall at centre height, full length of the wall
 - c) using plumb and level lines measure mirrors
 - d) cut and edge mirrors to prescribed dimensions
 - e) install mirrors using specified fastening / adhesives
 - f) clean mirrors and work site

C. Specialty Glass 4 Hours

Outcome: *Describe uses and installation of specialty glass.*

1. Describe uses and installation of specialty glass:
 - a) tempered glass
 - b) heat strengthened glass / spandrel
 - c) insulating glass
 - d) laminated glass
 - e) heat absorbing glass
 - f) coated glass, reflective and Low-E
 - g) fire rated glass
 - h) radiation shielding glass
 - i) back painted glass
 - j) low Iron

D. Glass Cutting 10 Hours

Outcome: *Lay out, cut and edge glass.*

1. Pattern cut glass:
 - a) using correct glass, lay out pattern and cut
 - b) use proper safety precautions
 - c) allow proper clearances
 - d) proper edging procedures
 - e) clean glass to industry standards
2. Cut 6 mm - 10 mm and 12 mm float glass:
 - a) select proper glass cutter
 - b) select the type of lubricant
 - c) select method of breaking the score
3. Cut and finish glass shelves:
 - a) interpret work order
 - b) select appropriate glass type
 - c) cut glass
 - d) edge as per specifications
4. Cut glass accurately free hand:
 - a) practice free hand arcs
 - b) mark pattern on glass
 - c) cut glass
 - d) use pliers or turn glass over to break the score

E. Drilling and Fabrication 6 Hours

Outcome: *Drill and fabricate glass.*

1. Drill holes in glass using power drills:
 - a) lay out locations of hole on glass
 - b) select correct bit and size
 - c) select proper coolant and cutting compound
 - d) turn glass over, once it has been pierced to reduce spalling

2. Use a glass saw:
 - a) lay out notch
 - b) use saw to complete cut out
3. Maintain drilling equipment—clean bits and equipment after use.

F. Mirrors and Decorative Glass Cutting 2 Hours

Outcome: *Cut, prep and repair mirrors and decorative glass.*

1. Cut, from stock sizes, drill and polish mirrors:
 - a) clean and strip edges of mirror
 - b) interpret work order for size, edge work, and hole diameter and location
 - c) proceed with caution as mirror scratches magnify
2. Sand blast glass:
 - a) clean glass
 - b) apply pattern to be blasted
 - c) set sand blaster to specified pressure
 - d) proceed with caution as distance and time are critical
3. Remove scratches using scratch polishing machine:
 - a) apply water and cerium oxide to wheel
 - b) proceed with caution as to much pressure or not enough water will cause glass to heat up and break
4. Lay out, field assemble and attach mirrors and determine which fastening method is prescribed.

SECTION TWO: GLAZING 22 HOURS

A. Commercial Glazing 6 Hours

Outcome: *Identify glazing types and methods of installation.*

1. Describe the theory of energy efficient glazing:
 - a) determine proper clearances and glazing bites
 - b) describe heat absorbing and glass advantages
 - c) describe heat reflective and Low-E advantages
2. Describe the methods used and the necessary precautions to be taken when replacing store front glass:
 - a) hazard assessment
 - b) secure the area (barricades) for workers and public
 - c) remove broken glass from top down
 - d) clean and prepare store front for new glass
 - e) install glass, caulk, and clean up area to industry standards
3. Describe the fastening devices used for glass:
 - a) snap on stop
 - b) screw applied stop
 - c) glazing gasket
 - d) mechanical fasten through hole in glass and special hardware
 - e) structural glaze; two sided, four sided

4. Describe the purpose and correct use of spacer shims and setting blocks:
 - a) setting block location and size for fixed glazing
 - b) setting block location for doors and windows

B. Glazing Installation 2 Hours

Outcome: Prepare, glaze and install glass and frames.

1. Prepare and glaze sash:
 - a) prepare sash to specifications
 - b) place setting blocks in correct location
 - c) install glass leaving appropriate edge clearances
 - d) seal as per specifications (heal bead, cap bead, etc.)
2. Store and ship glazed units:
 - a) determine the weight of glass
 - b) clean area where glass is to be set
 - c) provide adequate cushions, protection for glass
 - d) secure glass
3. Prepare and glaze frames with insulating glass:
 - a) prepare wood sash to specifications
 - b) place setting blocks in correct location
 - c) install glass leaving appropriate edge clearances
 - d) seal as per specifications (heal bead, cap bead, etc.)

C. Store Front Glass Installation 4 Hours

Outcome: Remove and replace store front glazing.

1. Remove and replace store front glass:
 - a) check size of replacement glass
 - b) barricade area for public and worker safety
 - c) remove any sealants
 - d) remove stops
 - e) remove glass from top down
 - f) install new glass
2. Install total vision glazing:
 - a) install Aluminum framing
 - b) measure glass, leaving correct clearances
 - c) cut and edge glass to specifications
 - d) Install glass into openings
 - e) Mask joint and seal
 - f) tool the joint and remove masking tape
 - g) clean project to industry standards

D. Show Case Glass and Hardware..... 10 Hours

Outcome: ***Fabricate show case and install hardware.***

1. Cut, edge and install show case glass including hardware:
 - a) interpret work order for type of glass, hardware, locks, etc.
 - b) cut glass and edge as per specifications
 - c) install specified hardware on glass or cabinet
 - d) install doors
 - e) clean glass and surrounding area

SECTION THREE: GLAZING COMPOUND AND SEALANTS..... 16 HOURS

A. Compounds and Sealants 12 Hours

Outcome: ***Describe the application and installation of glazing compounds and sealants.***

1. Describe the advantages and applications of glazing compounds and sealants such as:
 - a) backer rod
 - b) gaskets, neoprene, PVC and santoprene
 - c) extruded gaskets
 - d) glass cements (dental cement)
 - e) silicones
 - f) butyl tapes and shim tapes
 - g) polysulphide
 - h) urethanes, polyurethanes and foam tapes
2. Describe the correct sealant and application methods:
 - a) workmanship
 - b) sealant failures
 - c) joint design
 - d) primers
 - e) joint preparation
 - f) compatibility

B. Apply Glazing Compounds and Sealants 4 Hours

Outcome: ***Apply glazing compounds and sealants.***

1. Observe the application of glazing compounds to wood and metal sash:
 - a) clean frame
 - b) apply glazing compound to frame (back bed)
 - c) install glass
 - d) apply putty to face
 - e) trim excess putty off back
 - f) clean frame and glass
2. Caulk windows and substrates to industry standards:
 - a) clean frame and substrate
 - b) apply prescribed primers
 - c) install backer rod
 - d) apply caulking
 - e) clean frame and surrounding area

SECTION FOUR:METAL WORK 35 HOURS

A. Frames and Doors5 Hours

Outcome: *Identify and describe the components of fabrication and installation of aluminum frames.*

1. Describe the components of commercial aluminum frames:
 - a) head
 - b) sill
 - c) jambs
 - d) horizontal and vertical mullions and coupling mullions
 - e) flashing
 - f) anchors
 - g) membranes

2. Describe aluminum entrance ways:
 - a) hinging types
 - b) closers
 - c) thresholds
 - d) locking systems
 - e) framing members
 - f) standard door dimensions

3. Describe the installation of heavy tempered glass doors and glass shower enclosures:
 - a) pivot locations
 - b) clearances
 - c) hardware

4. Describe the preparation for fabrication of aluminum frames:
 - a) refer to shop drawings
 - b) determine materials required
 - c) layout and methods of fabrication
 - d) cutting list
 - e) tool selection
 - f) drill bits and fastener selection

B. Installation of Doors and Hardware30 Hours

Outcome: *Fabricate and install doors and hardware.*

1. Fabricate, glaze and install entrance doors including closers and locks:
 - a) measure rough opening
 - b) cut and lay out material as per shop drawing
 - c) deburr and fasten together using specified anchors, screw, and sealants
 - d) interpret drawings for frame location and install frame
 - e) install door into frame allowing proper clearances
 - f) cut lock recess into jamb
 - g) follow manufacturer's specifications and install door closer
 - h) caulk frame using specified sealant and backer rod
 - i) clean area to industry standards

2. Troubleshoot and repair doors and hardware:
 - a) pre determine the necessary replacement hardware
 - b) secure area of work
 - c) refer to manufacturer's specifications and complete repair
 - d) perform final adjustments testing replacement hardware
3. Fabrication and use templates:
 - a) select material required to make jig
 - b) adhere to manufacturer's specifications and commence the layout; note tolerances are critical
 - c) cut, drill and deburr jig
 - d) test jig on scrap piece of metal
 - e) clean and label jig for future use

SECTION FIVE:AUTO GLASS..... 27 HOURS

A. Auto Glass Deficiencies..... 1 Hour

Outcome: Identify causes of auto glass deficiencies.

1. Describe the major causes of deficiencies:
 - a) improper sealant
 - b) improper primers
 - c) windshield not properly aligned
 - d) incorrect windshield
 - e) clean up procedures not to customer satisfaction
 - f) damage to vehicle
 - g) faulty workmanship
2. Describe the faults generally found to cause problems in side glass:
 - a) incorrect replacement part
 - b) vehicle has previous damage
 - c) mechanisms (moving parts) faulty
 - d) faulty workmanship

B. Auto Glass Removal and Replacement..... 3 Hours

Outcome: Identify and describe auto glass removal and replacement.

1. Describe the removal and replacement of outside moldings and clips:
 - a) determine whether you require new molding or clips
 - b) remove moldings or clips as prescribed in the service manual
 - c) exercise caution when removing moldings or clips as to vehicle damage
 - d) replace clips or moldings as per manual
 - e) clean area to customer satisfaction
 - f) consult NAGS catalogue, confirming the correct part number
 - g) refer to manual for proper installation technique
 - h) exercise caution (damage to customer vehicle)
 - i) clean area to industry standards

2. Describe the installation of commercial equipment including fixed lights and sliding windows:
 - a) confirm type of window and location with customer
 - b) protect vehicle inside and out with coverings
 - c) disconnect power source
 - d) use manufacturer's template for lay out
 - e) cut out vehicle metal and head liner
 - f) install window
 - g) connect power source
 - h) test window operation
 - i) clean vehicle to industry standards

C. Auto Glass Manuals 1 Hour

Outcome: *Interpret auto glass manuals.*

1. Cross reference NAGS catalogue to find specific windshield, back glass, side window, or miscellaneous vent window, opera window, etc. for a given vehicle year and model.
2. Interpret Auto Manuals as they apply to glass; referring to the correct Service Manual, remove and install broken vehicle glass.

D. Auto Glass Installation..... 22 Hours

Outcome: *Demonstrate handling, cutting and installation of door lites, side lites and powered glass components.*

1. Remove and install fixed side lites:
 - a) refer to NAGS catalogue and confirm correct part number
 - b) follow service manual for proper installation technique
 - c) exercise caution (damage to customer vehicle)
 - d) clean vehicle work area
2. Install and adjust operable lites:
 - a) refer to NAGS catalogue and confirm correct part number
 - b) follow service manual for removal, installation or adjustment
 - c) disable power source
 - d) remove and replace glass components
 - e) clean vehicle work area
3. Install custom lites:
 - a) use existing glass as template
 - b) prepare new pattern, allowing proper clearances
 - c) use pattern as guide when cutting glass
 - d) cut glass with appropriate clearances, allowing for edge work
 - e) clean vehicle work area

SECTION SIX:..... ESTIMATING AND PLANS 54 HOURS

A. Mathematical Functions..... 18 Hours

Outcome: *Demonstrate the ability to complete math operations.*

1. Calculate perimeters, areas, volumes and circumferences of geometric figures.
2. Calculate center to center measurements.
3. Calculate material requirements including waste and pricing.
4. Calculate conversions from imperial to metric measure when required.
5. Demonstrate the ability to problem solve relating to Glass Industry.

B. Blueprints and Shop Drawings 36 Hours

Outcome: *Interpret plans and specifications and produce drawing.*

1. Calculate sizes of lites from shop drawings and blueprints.
2. Locate holes and in cuts from drawings and specifications.
3. Produce shop drawings and free hand sketches for shop use:
 - a) cutting list
 - b) material list
 - c) tool list
4. Read and interpret a set of commercial blueprints showing:
 - a) site plan
 - b) foundation plan
 - c) floor plan
 - d) elevations
 - e) wall sections
 - f) building sections and details
 - g) interpret specifications
 - h) hand of doors
 - i) opening direction of windows
 - j) window, door and hardware schedules

**THIRD PERIOD TECHNICAL TRAINING
GLAZIER TRADE
COURSE OUTLINE**

UPON SUCCESSFUL COMPLETION OF THIS PROGRAM THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

SECTION ONE:.....METAL WORK 72 HOURS

A. Aluminum 1 Hour

Outcome: Identify & describe history, hining, refining and reduction of aluminum.

1. Give a brief overview of the general history of aluminum and the basic refining process:
 - a) Sir Humphrey Davey
 - b) Hall / Herault reduction process
 - c) Bayer refining process

B. Extruding Process 1 Hour

Outcome: Describe the extruding process.

1. Describe the general process of extruding:
 - a) describe ingots, billets and alloys
 - b) describe hydraulic press
 - c) describe snapping the extrusion
 - d) describe heat treatment

C. Aluminum Finishes 4 Hours

Outcome: Identify and describe aluminum finishes.

1. Describe the methods and materials used to finish aluminum:
 - a) anodize (electro-chemical) / conventional and hard coat
 - b) paint finish / spray electro static / thermal setting / powder coating
 - c) porcelain aluminum panels
2. Describe the types of corrosion:
 - a) galvanic
 - b) dissimilar metals
 - c) chemical environment
 - d) concrete
 - e) UV
 - f) salt water
 - g) acid rain
3. Identify and describe types of corrosion and prevention:
 - a) primer application
 - b) bituminous paint
 - c) release agents
 - d) isolation materials

D. Operate Power Tools.....2 Hours

Outcome: Operate power tools in a safe and efficient manner.

1. Describe job procedures and safe work practices of power tools:
 - a) cut off saws
 - b) table saws
 - c) drill press
 - d) bench grinders
 - e) hand held power tools
 - f) laser equipment

E. Fabricate Frames.....64 Hours

Outcome: Layout, fabricate, and install aluminum frames.

1. Layout, cut and assemble store fronts:
 - a) measure rough opening
 - b) deduct appropriate clearances
 - c) follow safe job procedures and cut extrusion to correct size
 - d) lay out material as per shop drawing confirming dimensions
 - e) deburr material and fasten together using appropriate spigots, screws, and sealants
 - f) clean material to industry standards
2. Fabricate door frames including transoms and side lights, using flush line material:
 - a) determine frame size from shop drawing
 - b) cut extrusions and lay out confirming dimensions with shop drawing
 - c) lay out for door pivots, hinges and lock strikes
 - d) proceed to cut out for hinges or pivots
 - e) deburr extrusions and fasten together using appropriate anchors, screws, and sealants
 - f) hang door and check clearances
 - g) clean material to industry standards
3. Install flashing:
 - a) measure rough opening to ensure fit
 - b) cut and install flashing as per drawings
4. Install frames and caulk:
 - a) measure rough opening to ensure proper clearances
 - b) follow shop drawing and anchor frame into rough opening
 - c) prepare opening for caulking; primers, backer rod, cleaning
 - d) apply caulking to opening as per specifications

SECTION TWO:..... FRAMES AND DOORS 32 HOURS

A. Aluminum Products 4 Hours

Outcome: *Describe different types of extrusions for store fronts.*

1. Describe the function of extrusions used for store fronts including:
 - a) fin
 - b) flush line
 - c) thermally broken
 - d) curtain wall
 - e) flush line
 - f) ribbon, strip windows

2. Identify and describe wrought products:
 - a) sheet
 - b) thickness
 - c) alloy's
 - d) pre finished
 - e) post finished
 - f) size and limitations of brake shape applications

B. Commercial Aluminum Door System and Hardware20 Hours

Outcome: *Identify & describe entrance door systems & hardware.*

1. Describe entrance door systems including:
 - a) sliding
 - b) revolving
 - c) balanced
 - d) tempered
 - e) swinging
 - f) closer
 - g) hinges
 - h) panics
 - i) security hardware

2. Describe cast products:
 - a) flush bolts
 - b) pivots
 - c) drilling and tapping
 - d) protection and handling

C. Install Door Hardware8 Hours

Outcome: *Layout, fabricate, and install door hardware.*

1. Install, replace and repair door hardware:
 - a) determine if the hardware is the correct type and size required
 - b) refer to hardware manufacturer's specifications and proceed to lay out holes, slots, etc.
 - c) drill, tap, cut, etc. correct sizes to ensure a successful product
 - d) test and clean to industry standards

SECTION THREE: STRUCTURAL GLAZING..... 22 HOURS

A. Structural Glazing..... 6 Hours

Outcome: ***Describe structural glazing installation methods.***

1. Describe structural glazing, its purpose and installation methods:
 - a) 2 sided / stop on two sides
 - b) 4 sided / no stops
 - c) installation as per shop drawing
 - d) T.V.S installation

B. Install Glass and Glazing 16 Hours

Outcome: ***Measure, prepare and install total vision systems.***

1. Install total vision system:
 - a) measure opening to ensure proper fit
 - b) prepare opening to specifications. glazing tape, spline, etc.
 - c) install glass to specifications ensuring that proper clearances, gaps are maintained
 - d) prepare glass by masking the joint and priming the glass
 - e) installation of temporary alignment blocks
 - f) apply silicone to the joint as per specifications
 - g) tooling techniques
 - h) clean glass and area to industry standards

SECTION FOUR: ESTIMATING AND PLANS 54 HOURS

A. Calculations 18 Hours

Outcome: ***Demonstrate the ability to calculate glazing materials.***

1. Calculate material requirements, including waste and pricing.
 - a) sealants
 - b) glass
 - c) metal
 - d) foam rod
 - e) fasteners
 - f) glazing accessories
2. Calculate bearing stress and deflection of extrusions.
3. Calculate glass from opening size.
4. Calculate the coefficient of expansion and contraction of material.
5. Calculate cutting lists of metal from drawings.

B. Blueprint Reading and Estimating.....6 Hours

Outcome: *Produce drawings and cutting lists for shop projects.*

1. Draw sectional views of extrusions.
2. Make shop drawings, cutting lists and sketches for shop projects.
3. Take off materials that apply to the trade from blueprints.
4. Make drawing and sectional views of various shapes for formed metal trim.
5. Follow plans, specifications and codes for the installation of total vision systems.
6. Read and discuss provided shop drawings for skylights.

**FOURTH PERIOD TECHNICAL TRAINING
GLAZIER TRADE
COURSE OUTLINE**

UPON SUCCESSFUL COMPLETION OF THIS PROGRAM THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

SECTION ONE:..... FRAMES AND DOORS 24 HOURS

A. Automatic Entrances.....2 Hours

Outcome: ***Describe types and application for automatic doors.***

1. Identify and describe the types of automatic doors:
 - a) swing
 - b) sliders
 - c) revolvers
 - d) bi-fold
2. Identify and describe automatic door controls:
 - a) electrical sources
 - b) electronic sources

B. Fabricate and Install Frames and Doors 18 Hours

Outcome: ***Fabricate and install door frames with transom, sidelight, doors and closers.***

1. Fabricate and install store front.
2. Follow job procedures and safe work practices:
 - a) refer to shop drawing for frame size and cutting list
 - b) cut extrusion to specified size
 - c) lay out extrusions, confirming dimensions with shop drawing
 - d) deburr extrusions and fasten together using specified anchors, screws and sealants
 - e) refer to shop drawing for location of frame in relation to rough opening
 - f) fasten frame into rough opening maintaining clearances as specified on shop drawing
 - g) install doors and closer
 - h) install glass and door lights using specified glazing materials
 - i) adjust doors for proper operation
 - j) cut in door lock slot or flush bolts
 - k) install backer rod and caulk frame as per specifications
 - l) clean area to industry standards

C. Automatic Doors.....4 Hours

Outcome: ***Analyze automatic door malfunctions.***

1. Troubleshoot automatic doors:
 - a) check the electrical source
 - b) diagnose the situation

SECTION TWO:..... CURTAIN WALLS..... 69 HOURS**A. Curtain Walls.....21 Hours****Outcome: Identify and describe types of curtain wall layout and installation.**

1. Describe the types of curtain walls, anchors, reinforcing, structural requirements, expansion and sealing:
 - a) describe loads; dead, live
 - b) describe types; aluminum, stainless steel, concrete
 - c) fastened to top, bottom or face of concrete slab; other fastening methods available
 - d) reinforce with steel to increase strength
 - e) designed to accommodate wind and applied loads
 - f) describe typical expansion and deflection joints
 - g) follow manufacturer's installation manual for sealing criteria
2. Describe flush wall panel systems and its application:
 - a) curtain wall is used as the basic framing system for flush wall panel systems
 - b) installed in non vision areas to hide floor slab
 - c) follow manufacturer's specifications closely, clearances, ventilation, drainage and sealant applications
 - d) panels damage easily, pay special attention to handling
3. Describe curtain wall layout survey and alignment:
 - a) describe setting the sill using builders level
 - b) describe bench mark and transferring of bench mark to extrusion
 - c) describe centre line and location of curtain wall extrusion to centre line
 - d) as all installations differ, refer to architectural drawing

B. Building Envelope 18 Hours**Outcome: Identify and describe building envelope application.**

1. Identify and describe building envelope membranes:
 - a) identify types of membranes
 - i) peel and stick
 - ii) neoprene
 - iii) torch applied
 - iv) galvanized
2. Identify and describe building envelope application:
 - a) ensure compatibility with other building membranes
 - b) substrate preparation
 - c) storage and handling of products
 - d) installation methods
 - i) stepped
 - ii) bellowed
 - iii) mechanical and non-mechanical fastening systems

C. Fabricate Curtain Walls.....30 Hours

Outcome: *Interpret blue print, fabricate and install curtain wall system.*

1. Layout, fabricate and install curtain walls:
 - a) determine frame dimensions from architectural or shop drawings
 - b) cut extrusions to specified dimensions (deburr extrusions)
 - c) fasten extrusions, refer to manufacturer’s specifications; screw, spline or spigots, sealant required around spigots
 - d) as all curtain wall installations differ, refer to architectural drawings, shop drawings, or manufactures specifications

2. Demonstrate the considerations for venting, draining, expansion and sealing curtain walls (install membrane):
 - a) refer to manufacturer’s installation instructions
 - b) special consideration must be adhered to concerning venting, draining, sealing, air seals, and membranes
 - c) special consideration for deflection joints

3. Install pair of doors with adapter:
 - a) check opening dimension
 - b) hang doors
 - c) install related hardware
 - d) test door operation
 - e) clean work area to industry standards

4. Install back pan and spandrel panel:
 - a) clean and prime frame area that is to receive panel
 - b) refer to manufacturer’s installation manual; Install back pan into opening; Special consideration for sealant application
 - c) prepare area for spandrel
 - d) refer to manufacturer’s installation manual; Install spandrel into opening; Special consideration for sealant application, venting, and drainage
 - e) clean work area to industry standards

SECTION THREE: GLASS AND GLAZING 19 HOURS

A. Specialty Glass and Glazing.....3 Hours

Outcome: *Identify and describe specialty glazing.*

1. Specialty glazing:
 - a) balustrades
 - b) smoke baffles
 - c) floors and ceilings
 - d) security glazing
 - e) spider connectors

B. Specialty Hardware 16 Hours

Outcome: *Installation and service of specialty hardware.*

1. Install intermediate pivot hinges, butt hinges, continuous hinge, latch locks, electric strike and service panic exit device:
 - a) follow manufacturer’s specifications
 - b) lay out materials and mark out on extrusions
 - c) protect extrusion with masking tape, then proceed to cut, drill, tap, etc.
 - d) fit hardware to cut out
 - e) install specified hardware and test operation
 - f) service specified hardware and test operation
 - g) clean area to industry standards

SECTION FOUR:SKYLITES AND SLOPE GLAZING 32 HOURS

A. Skylites and Slope Glazing 10 Hours

Outcome: *Identify and describe skylites and slope glazing systems.*

1. Identify special considerations concerning skylites and slope glazing:
 - a) drainage
 - b) sealing
 - c) flashing
 - d) condensation
 - e) glass types
 - f) layout and levelling
 - g) membranes
 - h) design criteria, building environment
 - i) loads and pressure
 - j) safety factors and load requirements dictate that building codes and manufacturer’s specifications as well as installation manuals, must be adhered to
 - k) follow manufacturer’s specifications as well as manufacturer’s installation manual.
 - l) describe live load and dead load
 - m) pay special attention to sealing and flashing
2. Follow project specifications as well as manufacturer’s installation manual.
3. Describe the anchoring requirements for sloped glazing and skylights:
 - a) describe live load and dead load
 - b) follow manufacturer’s installation manual
 - c) pay special attention to sealing and flashing

B. Fabricate Skylites and Slope Glazing 22 Hours

Outcome: *Layout, fabricate and install a sloped glaze system.*

1. Layout, fabricate and install glass and flashing effectively to perform the function of their design:
 - a) refer to manufacturer’s installation guide
 - b) pay special attention to drainage, sealants, clearances, membranes and flashings which will be indicated in installation manuals

2. Seal and provide drainage:
 - a) refer to drawings and specifications for specific design criteria
 - b) using product specified, apply caulking, air barriers and flashings
 - c) clean all excess sealants and frames
3. Troubleshoot and repair sloped glazing:
 - a) investigate the immediate and surrounding area to determine where problems are occurring
 - b) water test
 - c) determine repair method
 - d) repair as determined

SECTION FIVE: ESTIMATING AND PLANS 54 HOURS

A. Estimating Materials..... 18 Hours

Outcome: *Interpret load charts and calculate material quantities.*

1. Take off materials.
2. Read live and dead load charts for sloped glazing.
3. Calculate material requirements and make cutting lists for curtain walls.
4. Read wind load charts for curtain walls.
5. Calculate labour costs for fabrication, transporting, installation and storage of glass and related materials.

B. Blueprint Reading and Estimating.....36 Hours

Outcome: *Produce drawings and cutting lists for shop projects.*

1. Sloped glazing:
 - a) make shop drawings from blueprints and on-site measurements
 - b) follow specifications and codes
2. Curtain walls:
 - a) make shop drawings from blueprints and on-site measurements
 - b) draw details and sections applicable to curtain walls
 - c) draw partial floor plan showing locations of grids in relation to exterior curtain wall
 - d) frames and doors
 - e) draw working drawings from manufacturer's specification



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