Apprenticeship and Industry Training

Ironworker

Curriculum Guide

040 (2022)

Alberta Government

Apprenticeship and Industry Training
Alberta Trades. World Ready.

ALBERTA ADVANCED EDUCATION

Ironworker : apprenticeship education program curriculum guide

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Ironworker
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CURRICULUM GUIDE

Apprenticeship

Apprenticeship is post-secondary education with a difference. Apprenticeship begins with finding a sponsor. Sponsors guide apprentices, and support on-the-job learning through provision of mentorship. Approximately 80 per cent of an apprentice's time is spent on the job under the supervision of a certified journeyperson or qualified tradesperson. The other 20 per cent involves technical training provided at, or through, a post-secondary institution (PSI) – usually a college or technical institute.

To receive their post-secondary credential, apprentices must learn theory and skills, and they must pass examinations. Criteria for the program—including the content and delivery of technical training—are developed and updated by the Registrar.

The graduate of the Ironworker apprenticeship program is an individual who will be able to:

- responsibly do all work tasks expected of a journeyperson
- supervise, train and coach apprentices
- demonstrate the principles of drafting, how drawings originate and how to correctly interpret the information given - the use of each type and the related work orders, materials, lists, etc.
- comply with all applicable Codes and Regulations with reference to materials, its uses and safety
- identify structural shapes, ropes, wire and fibre as it relates to structural and ornamental components
- demonstrate the placement of pre-cast concrete and concrete reinforcement materials to an acceptable level of workmanship
- use hand tools and powered equipment in a proper and safe manner
- perform a satisfactory operation with oxy-fuel or electric arc welding equipment in order to facilitate this work
- co-ordinate iron work with other trades on the job site
- perform assigned tasks in accordance with quality and production standards required by industry

Apprenticeship and Industry Training System

Alberta's apprenticeship education programs are supported by industry stakeholders that ensures a highly skilled, internationally competitive workforce in the province. The Registrar establishes the educational standards and provides direction to the system supported by industry and the PSI's. The Ministry of Advanced Education provides the legislative framework and administrative support for the apprenticeship and industry training system.

Special thanks are offered to the following industry members who contributed to the development of the standard:

Mr. S. Papineau ..... Stony Plain
Mr. P. Bichel ..... Carvel
Mr. M. Emery ..... Sherwood Park
Mr. M. Grenis ..... Edmonton
Mr. B. White ..... Calgary
Mr. C. Carriere ..... Calgary
Mr. O. Cooper ..... Okotoks
Mr. C. Porte ..... Edmonton
Mr. G. Dellezay ..... Red Deer

Alberta Government

Alberta Advanced Education works with industry, sponsor 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 sponsors
- coordinate technical training in collaboration with training providers
- certify apprentices and others who meet industry standards

Apprenticeship Safety

Safe working procedures and conditions, incident/injury prevention, and the preservation of health are of primary importance in apprenticeship education programs in Alberta. These responsibilities are shared and require the joint efforts of government, sponsors, 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.

Occupational Health and Safety

Persons engaged in, or supporting an individual in an experiential learning environment are often exposed to more worksite hazards than in other forms of traditional postsecondary education 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.

Occupational Health and Safety-OHS (a division of Alberta Labour and Immigration) conducts periodic inspections of workplaces to ensure that safety regulations for industry are being observed.

Additional information is available at www.alberta.ca/occupational-health-safety.aspx

Technical Training

Apprenticeship technical training is delivered by the PSI's throughout Alberta. The PSI's are committed to delivering the technical training component of Alberta apprenticeship education programs in a safe, efficient and effective manner. All PSI's place a strong emphasis on safety that complements safe workplace practices towards the development of a culture of safety for all professions.

The PSI's work with industry and Alberta Advanced Education to enhance access and responsiveness to industry needs through the delivery of the technical training component of apprenticeship education programs across the province. They develop curriculum from the curriculum guides established by the Registrar in consultation with the PSI's and industry and provide the technical training to apprentices.

The following PSI's deliver Ironworker apprenticeship technical training:

Northern Alberta Institute of Technology Southern Alberta Institute of Technology

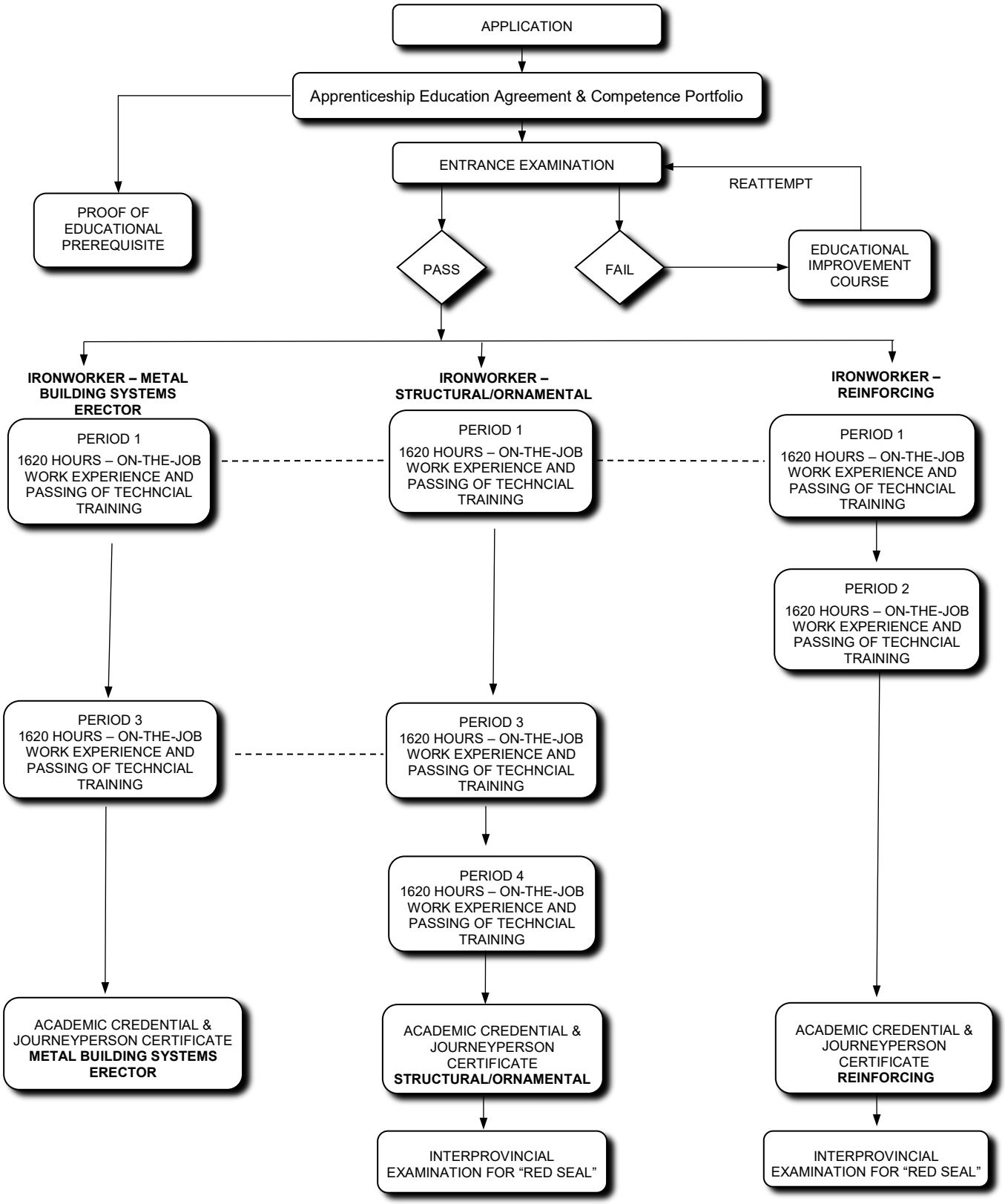
Procedures for Recommending Revisions to the Curriculum Guide

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

Registrar of Apprenticeship Programs
c/o Apprenticeship Delivery and Industry Support Services
Apprenticeship Delivery and Industry Support
Advanced Education
19th 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.

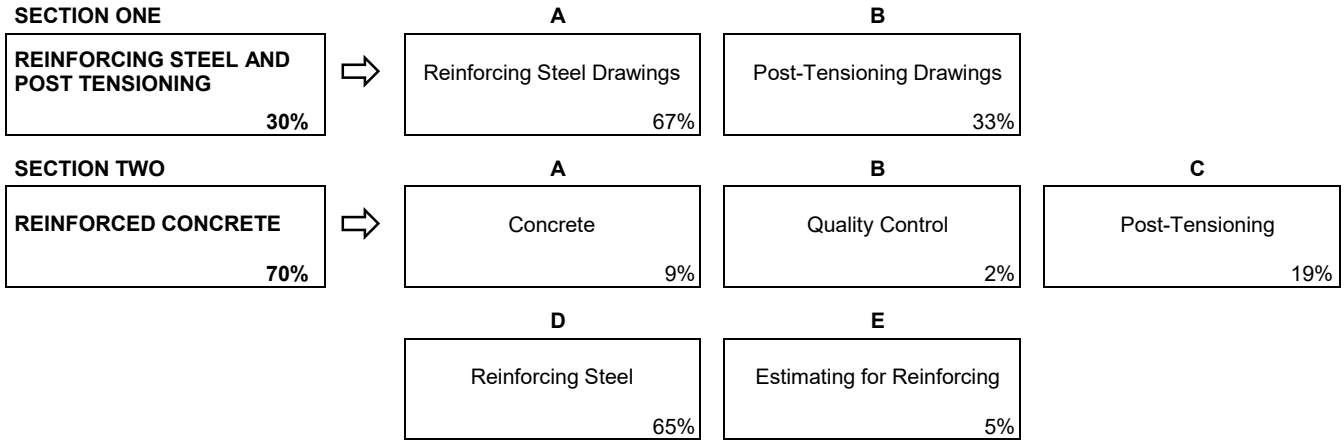
Apprenticeship Route toward Academic Credential



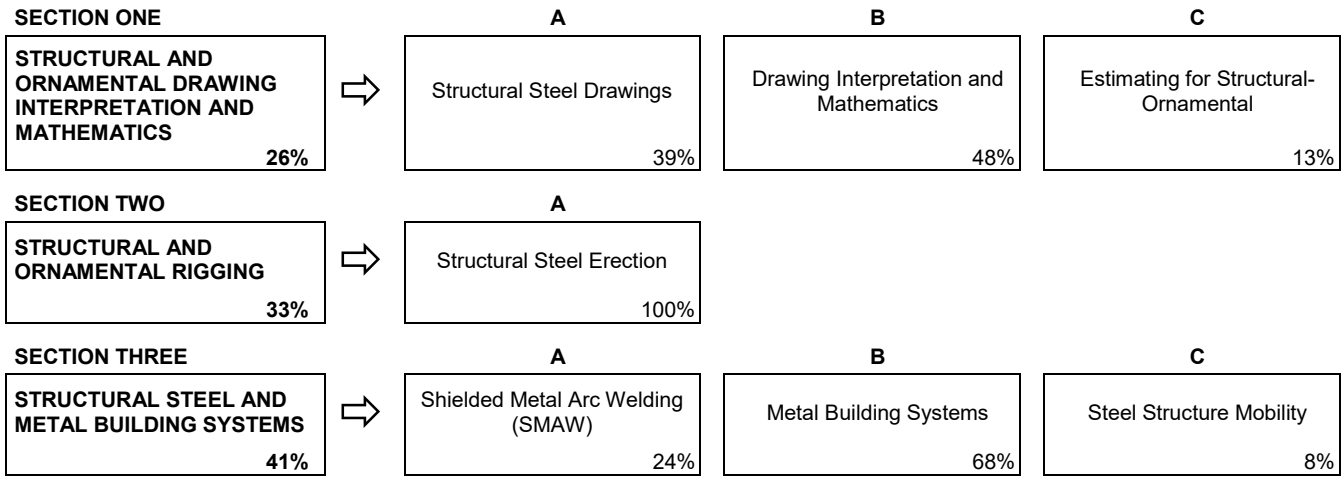
Ironworker Training Profile
FIRST PERIOD
(6 Weeks 30 Hours per Week – Total of 180 Hours)

SECTION ONE		**A**	**B**	**C**
STANDARD WORKPLACE SAFETY **10%**	⇨	Safety Legislation, Regulations & Industry Policy in the Trades 11%	Climbing, Lifting, Rigging and Hoisting 11%	Hazardous Materials & Fire Protection 11%
		D	**E**	
		Apprenticeship Education Training Program 33%	Safety 34%	
SECTION TWO		**A**	**B**	
MATH AND DRAWING INTERPRETATION **23%**	⇨	Mathematics 57%	Drawings 43%	
SECTION THREE		**A**	**B**	**C**
RIGGING **37%**	⇨	Rigging and Hoisting 55%	Hand and Power Tools 27%	Scaffolding, Swing Stage 18%
SECTION FOUR		**A**		
OXY-FUEL EQUIPMENT **30%**	⇨	Oxy-Fuel Cutting Equipment 100%		

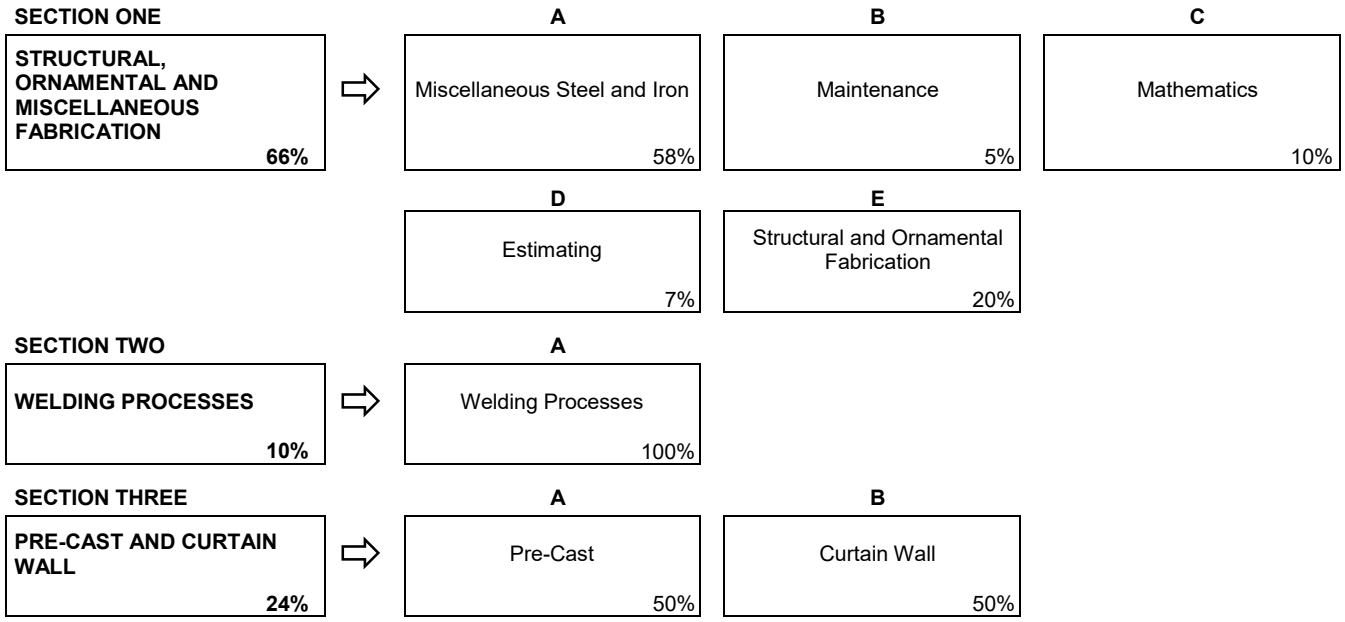
SECOND PERIOD
(6 Weeks 30 Hours per Week – Total of 180 Hours)



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



FOURTH PERIOD
(6 Weeks 30 hours per Week – Total 180 Hours)



FIRST PERIOD TECHNICAL TRAINING
IRONWORKER TRADE
CURRICULUM GUIDE

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

SECTION ONE:..... STANDARD WORKPLACE SAFETY 10%

A. Safety Legislation, Regulations & Industry Policy in the Trades 11%

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 sponsor 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 sponsors 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 sponsors 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 11%

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 11%

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.

D. Apprenticeship Education Training Program 33%

Outcome: Manage an apprenticeship to earn journeyman certification.

1. Describe the contractual responsibilities of the apprentice, sponsors and Alberta Apprenticeship and Industry Training.
2. Describe the purpose of the apprentice competency portfolio.
3. Describe the procedure for changing sponsors during an active apprenticeship.
4. Describe the purpose of the curriculum guide.
5. Describe the procedure for progressing through an apprenticeship.
6. Describe advancement opportunities in this trade.

E. Safety 34%

Outcome: Apply general safe work practices.

1. Identify causes of accidents in the work environment.
2. Explain the safety regulations for safe work practices in the trade.

SECTION TWO: ..... MATH AND DRAWING INTERPRETATION 23%

A. Mathematics 57%

Outcome: Solve problems using trade math.

1. Identify terms and equations used with fractions.
2. Use practical fractions with a tape measure.
3. Solve problems using whole numbers and fractions in practical applications.
4. Identify terms and equations used with decimal fractions.
5. Convert fractions to decimals.
6. Convert between fractions, decimals and percentages.
7. Calculate ratio and proportions.
8. Convert units of measurement.
9. Calculate perimeter, area, volume and weight.

B. Drawings 43%

Outcome: Interpret drawings.

1. Identify the types and components of drawings.
2. Sketch objects.
3. Explain the relationship of drawings, specifications and standards.

SECTION THREE: ..... RIGGING 37%

A. Rigging and Hoisting 55%

Outcome: Demonstrate rigging and hoisting techniques.

1. Describe engineered lifts.
2. Describe manual and power assisted hoisting devices.

3. Describe crane types.
4. Describe material handling equipment.
5. Describe fibre ropes, wire ropes and fittings.
6. Demonstrate the use of knots and hitches.
7. Describe slings and accessories.
8. Explain the formulas and calculations for rigging.
9. Demonstrate the inspection and handling of rigging.
10. Demonstrate the application of slings, hitches, knots and tag lines used for rigging.
11. Communicate using signals.
12. Interpret load charts.

B. Hand and Power Tools 27%

Outcome: Use hand and power tools.

1. Use of tools and accessories.
2. Use layout and measurement tools.
3. Use levelling instruments.

C. Scaffolding, Swing Stage 18%

Outcome: Apply safe work practices with scaffolding systems and elevated work platforms.

1. Describe scaffold systems and structures.
2. Describe elevated work platforms, personnel lifts.

SECTION FOUR: ..... OXY-FUEL EQUIPMENT 30%

A. Oxy-Fuel Cutting Equipment 100%

Outcome: Use oxy-fuel cutting equipment.

1. Define hazards associated with oxy-fuel cutting equipment.
2. Explain the procedure for handling, transporting and storing cylinders.
3. Describe oxy-fuel equipment and accessories.
4. Maintain oxy-fuel equipment and accessories.
5. Demonstrate start-up, operating and shut-down procedures of oxy-fuel equipment.

SECOND PERIOD TECHNICAL TRAINING
IRONWORKER TRADE
CURRICULUM GUIDE

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

SECTION ONE:.....REINFORCING STEEL AND POST-TENSIONING..... 30%

A. Reinforcing Steel Drawings..... 67%

Outcome: Interpret reinforcing steel drawings.

1. Identify types of reinforcing steel drawings.
2. Identify the concrete components from structural engineering and reinforcing steel placing drawings.
3. Interpret schedules from a structural engineering drawing.

B. Post-Tensioning Drawings 33%

Outcome: Interpret post-tensioning drawings.

1. Identify types, details and systems on post-tensioning drawings.
2. Document stressing data and elongations from post-tensioning drawings.

SECTION TWO:.....REINFORCED CONCRETE..... 70%

A. Concrete 9%

Outcome: Interpret the characteristics of reinforced concrete.

1. Describe the types of concrete and its uses.
2. Describe grouts and their applications.
3. Identify stresses in reinforced concrete.

B. Quality Control..... 2%

Outcome: Apply quality control practices and procedures.

1. Explain quality assurance.
2. Interpret standards, codes, specifications and procedures.
3. Complete Quality Control Inspection.

C. Post-Tensioning..... 19%

Outcome: Install post-tensioning.

1. Define post-tensioning systems.
2. Review safety aspects of stressing.
3. Explain the applications of pre-stressing.
4. Explain the procedures in tendon placement.
5. Explain the procedures in placing anchor zone reinforcing.

D. Reinforcing Steel 65%

Outcome: Install reinforcing materials.

1. Describe reinforcing steel and mil standards.
2. Describe fabrication methods.
3. Use bending and cutting equipment.
4. Explain the placing codes and standards of reinforcing steel.
5. Demonstrate the reinforcing steel ties required for placing reinforcing steel.
6. Identify reinforcing steel splicing.
7. Identify placing tools.
8. Describe reinforcing steel supports and accessories.
9. Demonstrate the safety precautions of unloading and placing reinforcing steel.
10. Calculate the weights of reinforcing steel.
11. Install specialty reinforcing materials.
12. Pre-fabricate reinforcing components.
13. Create a lift plan for a reinforced project.
14. Rig pre-fabricated reinforcing steel components.

E. Estimating for Reinforcing 5%

Outcome: Estimate labour and material requirements for reinforcing projects.

1. Interpret manpower, material and accessories requirements from reinforcing drawings and specifications.

THIRD PERIOD TECHNICAL TRAINING
IRONWORKER TRADE
CURRICULUM GUIDE

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

SECTION ONE:..... STRUCTRUAL AND ORNAMENTAL 26%
DRAWING INTERPRETATION AND MATHEMTICS

A. Structural Steel Drawings..... 39%

Outcome: ***Interpret structural steel drawings.***

1. Identify types of structural steel drawings.
2. Identify the components from structural drawings.
3. Interpret schedules from structural drawings.
4. Coordinate project drawings.

B. Drawing Interpretation and Mathematics..... 48%

Outcome: ***Apply mathematics to drawings.***

1. Describe and layout slopes.
2. Solve problems between distance and angles.
3. Demonstrate ability to use formulas to solve given problems.

C. Estimating for Structural/Ornamental 13%

Outcome: ***Estimate labour and material requirements for metal building systems and miscellaneous projects.***

1. Interpret manpower, material and accessories requirements from structural drawings and specifications.
2. Estimate manpower, material, accessories requirements.

SECTION TWO:.....STRUCTURAL AND ORNAMENTAL RIGGING 33%

A. Structural Steel Erection..... 100%

Outcome: ***Install structural steel components.***

1. Perform calculations with rigging formulas.
2. Determine rigging for pre-cast and structural erection.
3. Demonstrate rigging and reeving procedures.
4. Analyze project drawings and erection procedures.
5. Verify site survey.
6. Describe structural components.
7. Construct structural components.
8. Create a lift plan for a structural project.
9. Review erection and maintenance procedures for specialty structures.

SECTION THREE: ..... STRUCTURAL STEEL AND METAL BUILDING SYTEMS..... 41%

A. Shielded Metal Arc Welding (SMAW)..... 24%

Outcome: ***Use SMAW welding equipment.***

1. Describe electricity as it relates to welding.
2. Identify mild steel welding electrodes.
3. Explain static and dynamic loading.
4. Identify types of welds, weld faults, joints and symbols.

B. Metal Building Systems 68%

Outcome: ***Erect metal building systems.***

1. Describe metal building systems and building envelope.
2. Analyze project drawings and erection procedures.
3. Verify site survey.
4. Estimate manpower, material, accessories requirements.

C. Steel Structure Mobility 8%

Outcome: ***Use techniques for walking steel beams and column climbing.***

1. Demonstrate the ability to manoeuver at heights.
2. Demonstrate the techniques to climb a vertical member.

FOURTH PERIOD TECHNICAL TRAINING
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SECTION ONE:.....STRUCTURAL, ORNAMENTAL AND MISCELLANEOUS FABRICATION..... 66%

A. Miscellaneous Steel and Iron 58%

Outcome: ***Install miscellaneous steel and iron.***

1. Describe ornamental iron and finishes.
2. Describe the sub framing and steel supports.
3. Describe the procedures for installing miscellaneous steel and iron.
4. Fabricate miscellaneous steel and iron.

B. Maintenance 5%

Outcome: ***Perform maintenance, upgrading and repairs.***

1. Dismantle structural, mechanical and miscellaneous components.
2. Repair components.

C. Mathematics 10%

Outcome: ***Apply trigonometry to fabricate and install miscellaneous components.***

1. Solve trigonometry problems using trade math.

D. Estimating 7%

Outcome: ***Estimate labour and material requirements for structural and miscellaneous projects.***

1. Interpret manpower, material and accessories requirements from structural drawings and specifications.
2. Estimate manpower, material, accessories requirements.

E. Structural and Ornamental Fabrication..... 20%

Outcome: ***Construct a project.***

1. Apply pattern development and layout techniques.
2. Use of cutting and welding equipment.
3. Complete a project from a drawing.

SECTION TWO:..... WELDING PROCESSES 10%

A. Welding Processes..... 100%

Outcome: ***Use welding equipment.***

1. Identify mild steel welding processes.
2. Apply welding procedures to shop projects.

SECTION THREE: ..... PRE-CAST AND CURTAIN WALL..... 24%

A. Pre-Cast 50%

Outcome: ***Install pre-cast systems.***

1. Demonstrate the safety precautions of loading and unloading.
2. Layout pre-cast components.
3. Describe sequence of erection.
4. Identify securing procedures.
5. Demonstrate erection procedures.

B. Curtain Wall 50%

Outcome: ***Install curtain wall systems.***

1. Interpret curtain wall drawings.
2. Layout curtain walls.
3. Assemble curtain walls.

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