Apprenticeship and Industry Training

Ironworker

Apprenticeship Course Outline

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Government of Alberta

Apprenticeship and Industry Training

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Ironworker
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Course Outline

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 journeyperson 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 journeypersons, 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 Ironworker Provincial Apprenticeship Committee.

The graduate of the Ironworker apprenticeship program is a certified journeyperson 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

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

Ironworker PAC Members at the Time of Publication

Mr. A. O'Neill..... Calgary ..... Presiding Officer
Mr. R. Calver..... Calgary ..... Employer
Mr. W. McKee ..... Calgary ..... Employer
Mr. D. Heinrichs ..... Edmonton ..... Employer
Mr. J. Norris ..... Edmonton ..... Employer
Mr. M. Bergeron..... Calgary ..... Employee
Mr. W. Bienz ..... Calgary ..... Employee
Mr. S. Hildebrand..... Edmonton ..... Employee
Mr. D. Laboucan ..... 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 Ironworker apprenticeship technical training:

Northern Alberta Institute of Technology

Procedures for Recommending Revisions to the Course Outline

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

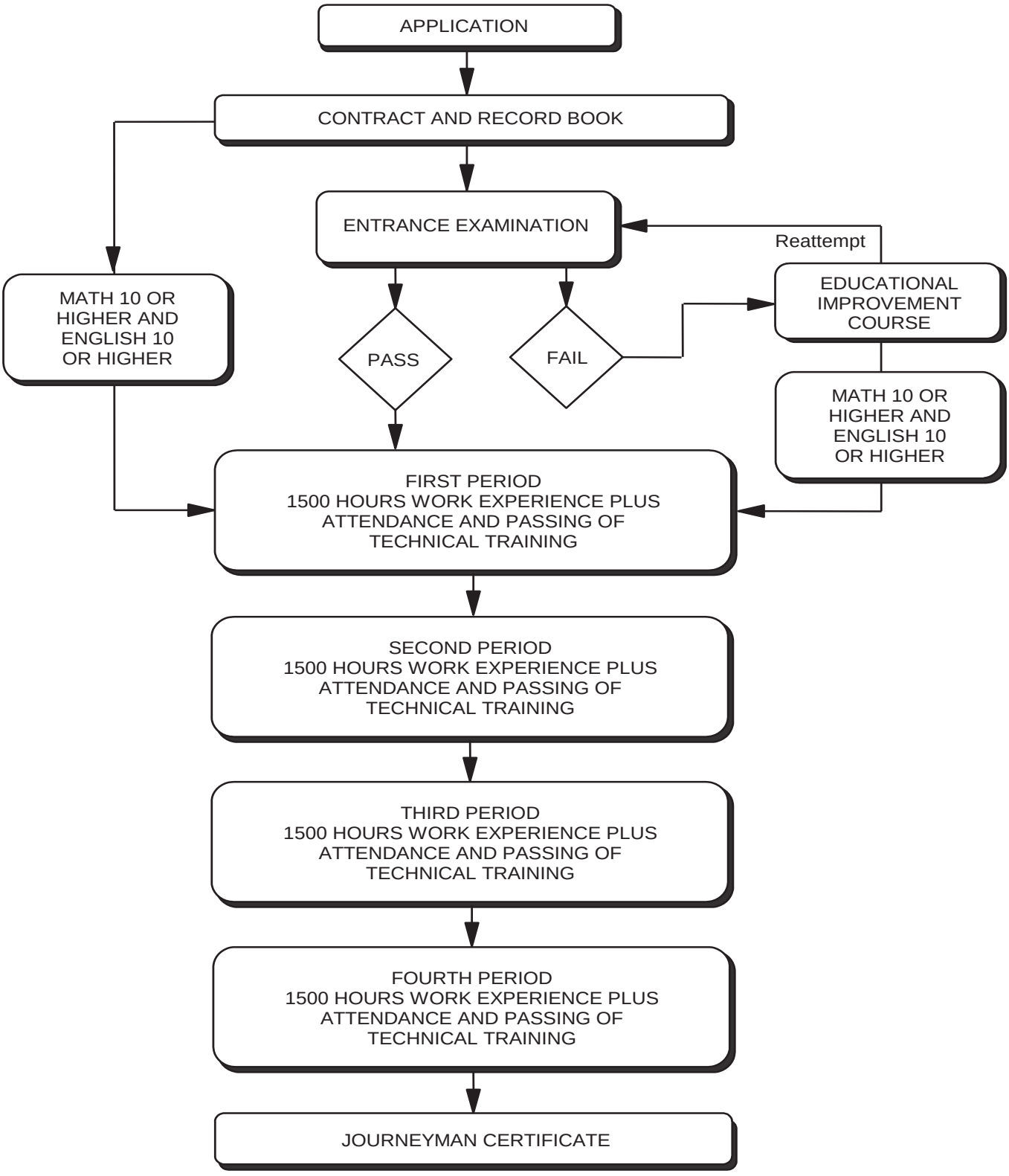
This course outline was approved on March 7, 2006 by the Alberta Apprenticeship and Industry Training Board on a recommendation from the Provincial Apprenticeship Committee. The valuable input provided by representatives of industry and the institutions that provide the technical training is acknowledged.

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

Ironworker 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 Ironworker Provincial Apprenticeship Committee.

Apprenticeship Route toward Certification



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

SECTION ONE

GENERAL SAFETY
52 HOURS

A	B	C
Ironworker Apprenticeship Program Orientation 2 Hours	Hand and Power Tools 16 Hours	Safety 4 Hours

D	E
Lab Practices 24 Hours	Emergency First Aid and CPR Perquisite to Obtaining Journeyperson Status 6 Hours

SECTION TWO

OXY-FUEL EQUIPMENT AND TACK WELDING
30 HOURS

A	B	C
Oxy-Fuel, Equipment, and Cutting 7 Hours	Electric Arc Welding 7 Hours	Basic Welding Lab Practices 16 Hours

SECTION THREE

DRAWING INTERPRETATION AND MATHEMATICS
40 HOURS

A	B
Introduction to Drawings 16 Hours	Trade Mathematics 24 Hours

SECTION FOUR

LEVEL ONE RIGGING
58 HOURS

A	B	C
Ropes and Fittings 12 Hours	Hoisting Devices 6 Hours	Introduction to Load Charts 2 Hours

D	E	F
Signals 2 Hours	Level One Rigging Lab Practices 18 Hours	Scaffolding 3 Hours

G	H	I
Swing Stage and Aerial Work Platforms 3 Hours	Fall Protection 2 Hours	Scaffolding, Swing-Stage and Fall Protection Lab Practices 10 Hours

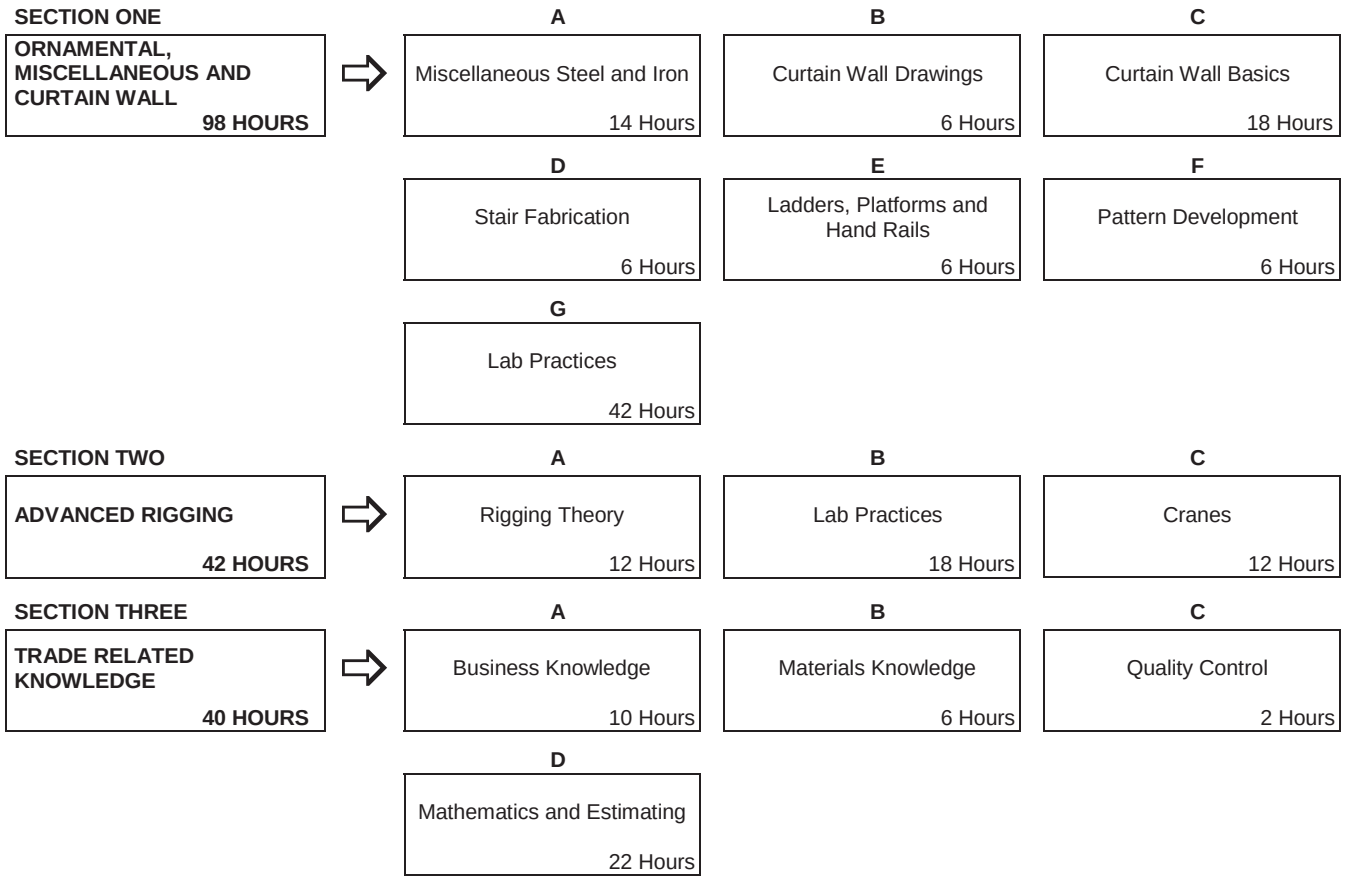
SECOND PERIOD
(6 Weeks 30 Hours per Week – Total of 180 Hours)

SECTION ONE	**A**	**B**	**C**
DRAWING INTERPRETATION AND MATHEMATICS **60 HOURS**	Reinforcing Steel Drawings 24 Hours	Post-Tensioning Drawings 12 Hours	Mathematics & Estimating 24 Hours
SECTION TWO	**A**	**B**	**C**
REINFORCED CONCRETE **102 HOURS**	Concrete 6 Hours	Reinforcing Steel 32 Hours	Reinforcing Steel Lab Practices 36 Hours
	D	**E**	**F**
	Cranes 12 Hours	Post-Tensioning 10 Hours	Post-Tensioning Lab Practices 6 Hours
SECTION THREE	**A**	**B**	**C**
TRADE RELATED KNOWLEDGE **18 HOURS**	Business Knowledge 10 Hours	Materials Knowledge 6 Hours	Quality Control 2 Hours

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

SECTION ONE	**A**	**B**	**C**
DRAWING INTERPRETATION AND MATHEMATICS **48 HOURS**	Drawings 14 Hours	Structural Steel Drawings 4 Hours	Material Designations 10 Hours
	D		
	Mathematics & Estimating 20 Hours		
SECTION TWO	**A**	**B**	
LEVEL TWO RIGGING **50 HOURS**	Rigging Theory 18 Hours	Rigging Practices 32 Hours	
SECTION THREE	**A**	**B**	**C**
STRUCTURAL STEEL AND METAL BUILDING SYSTEMS **82 HOURS**	Walls Systems 16 Hours	Roof Systems 12 Hours	Pre Engineered Building Erection 30 Hours
	D	**E**	
	Windows Doors and Air Barrier 6 Hours	Structural Steel Lab Practices 18 Hours	

FOURTH PERIOD
(6 Weeks 30 hours per Week – Total 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
IRONWORKER TRADE
COURSE OUTLINE

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

SECTION ONE: .....GENERAL SAFETY ..... 52 HOURS

A. Ironworker Apprenticeship Training Program Orientation.....2 Hours

Outcome: Describe the responsibilities and opportunities in the Ironworker Trade.

1. Describe the apprenticeship training system in Alberta.
2. Identify the training profile of Ironworker Apprenticeship in Alberta.
3. Explain the Ironworker program outline learning outcomes and objectives.
4. Describe the responsibilities for the Contract of Apprenticeship by the apprentice, employer and Alberta Apprenticeship and Industry Training.
5. Identify industrial, commercial and construction fields that provide employment opportunities for ironworkers.
6. Discuss the contents of the apprenticeship training record book.
7. Demonstrate the ability to complete an acceptable resume.

B. Hand and Power Tools .....16 Hours

Outcome: Use hand and power tools.

1. Describe and demonstrate the safe use of hand and power tools used in the trade:
   a) measurement, layout and alignment tools
   b) squaring and marking tools
   c) heating, cutting and bending tools
   d) punching, boring and drilling tools
   e) securing and assembly tools
   f) prying and dismantling tools
   g) clamping tools
   h) grinding tools
2. Describe the types and bonds of grinding stones.
3. Demonstrate safety procedures for dressing grind stones.
4. List and describe:
   a) drill sizes
   b) drill speeds and feeds
   c) materials and cutting fluids
   d) uses of countersinking points
5. Describe the types of layout tools and their uses.

6. Describe the uses of:
    a) tape measures
    b) squares, scribes
    c) centre punches
    d) trammels
    e) chalk lines
7. Describe and demonstrate the correct use of levelling instruments.
8. Describe and demonstrate the correct use of a transit level.
9. List the advantages of a transit level.
10. Define and describe a spirit level and laser levels.

C. Safety .....4 Hours

Outcome: Use general safe work practices.

1. Recognize and correct the common causes of accidents in the work environment:
    a) inattention to work
    b) alcohol and drugs
    c) prescription drugs
    d) ineffective guarding
    e) inadequate housekeeping
    f) attitude
    g) improper use of tools
    h) unsuitable clothing
    i) excessive haste
    j) fire
    k) horse play
    l) lack of instruction
2. Identify the safety regulations as they apply to safe work practices in the trade on:
    a) general safety precautions
    b) house keeping, personal protective equipment and clothing
    c) guards
    d) grinding
    e) rigging
3. Describe and apply safety regulations on:
    a) use of safeguards
    b) ladders
    c) protection from fallings materials
    d) fall protection systems
    e) scaffolds, bracket, rolling, and power lifts
    f) floor and roof openings, perimeter guardrails
    g) temporary floors, temporary supporting structures

D. Lab Practices.....24 Hours

Outcome: Demonstrate the ability to do the following:

1. Demonstrate the ability to cope and punch holes using the ironworker machine.
2. Demonstrate the ability to start and finish a project from an approved drawing by:
   a) laying out a fabrication project
   b) cutting steel with oxy-fuel cutting equipment and ironworker to suit layout
   c) tack welding components together without distortion
   d) grinding welds on frame and clean up project

E. Emergency First and CPR .....6 Hours

Outcome: Demonstrate the ability to administer immediate on-the-spot first aid to persons with minor injuries and administer temporary emergency first aid to the more seriously injured, as deemed adequate until qualified medical personnel is available.

1. Explain the responsibilities and duties of the first aid person.
2. Explain the diagnoses for:
   a) respiratory failure
   b) burns
   c) body injury
3. Apply artificial respiration.
4. Explain the process of freeing the victim of breathing restrictions.
5. Explain the process of applying mouth-to-mouth respiration.
6. Apply emergency treatment.
7. Describe the procedure for:
   a) assessing injury
   b) moving the patient
   c) arresting bleeding
8. Explain the methods of:
   a) quenching fire on a victim
   b) treating various burns
9. Demonstrate basic one-rescuer.
10. Explain what cardiovascular disease is and how it kills.
11. Explain the signs and symptoms of cardiovascular emergencies (severe angina, heart attack, cardiac arrest, etc.) and choking by their signs and symptoms.
12. Demonstrate an effective response to cardiovascular and choking emergencies.

SECTION TWO: .....OXY-FUEL EQUIPMENT AND TACK WELDING.....30 HOURS

A. Oxy-Fuel Equipment and Cutting .....7 Hours

Outcome: Demonstrate the knowledge of cutting equipment.

1. Describe oxy-fuel equipment.
2. Describe the construction of the oxygen and acetylene cylinders.
3. Explain the procedure for handling, transporting and storing cylinders.
4. State the procedure for handling faulty cylinders.
5. Explain the construction and purpose of a manifold.
6. Describe the purpose of regulator.
7. Describe the basic construction and pressures involved for a single stage and double stage regulator.
8. Explain the construction of hoses.
9. Identify hoses and fittings.
10. Explain the C.S.A. specifications of hoses.
11. Sate the procedure for the repair and maintenance of hoses.
12. Describe the design and construction of cutting tips.
13. Describe and demonstrate the care, maintenance and selection of tips.
14. Demonstrate and explain the assembly of oxy fuel equipment.
15. Explain and demonstrate the correct placement and securing of cylinders.
16. Explain and demonstrate the clearing and checking of cylinder valves.
17. Attach regulators safely and correctly.
18. Attach hoses and explain reason for cleaning new hoses.
19. Attach the barrel and tip correctly.
20. Explain the correct procedure used when checking for leaks.
21. Check to assure that the regulators were not used for any other purpose than for what they were intended.
22. Demonstrate the correct pressures and flame adjustments.
23. Explain and demonstrate the correct regulator adjustments and balancing pressures.
24. List the reasons for backfires and flashbacks.
25. Define flame propagation.
26. Ignite the torch using the recommended striker.
27. Explain and demonstrate the different types of flames and uses.
28. List and demonstrate the acceptable shutting down procedure.
29. Demonstrate the fire prevention and controls for oxy fuel equipment.
30. Identify the types of fire extinguishers available and where used.
31. Define hazardous areas in construction.
32. Describe how to prevent fires.

B. Electric Arc Welding .....7 Hours

Outcome: Identify SMAW Equipment.

1. Explain basic electricity.
2. Define arc voltage.
3. Define alternating current and direct current.
4. Define resistance.
5. Explain duty cycle.
6. Define reverse and straight polarity.
7. Explain the heat distribution using reverse or straight polarity.
8. Explain voltage loss.
9. Demonstrate knowledge of arc welding machines.
10. Describe the basic components and operation of various types of welding machines.
11. Describe the basic components and operation of an A.C. - D.C. rectifier.
12. List the advantages and disadvantages of the various types of welding machines.
13. Explain the selecting, installing and maintenance of welding machines.
14. Explain the reasons for selecting a welding machine for a specific task.
15. Explain the consideration to be taken when installing a welding machine in a shop environment.
16. Explain the day-to-day maintenance required for welding machines.
17. Describe the accessories for welding machines.
18. Describe cable construction.
19. Explain cable sizing.
20. Describe the various types of electrode holders and explain the maintenance required.
21. Describe cable lugs, quick connectors and ground clamps.
22. Describe the controls on arc welding equipment.
23. Describe the controls on a welding machine.
24. Explain the arc characteristics in relation to the different voltage and amperage settings.
25. Identify mild steel welding electrodes.
26. Explain the numerical definitions of electrodes.
27. Explain the manufacturing specification control.
28. List the functions of the coating.
29. List the functions of the slag.
30. Explain the effects of alloy additions to the coating.
31. Explain static and dynamic loading.
32. Identify the types of welds:
    a) fillet
    b) groove
    c) plug or slot

33. Identify the types of joints:
    a) butt
    b) lap
    c) edge
    d) tee
    e) corner
34. Identify basic weld and welding symbols:
    a) weld symbols
    b) parts of the welding symbol
    c) define arrow side and other side
35. Identify the types of basic weld faults.
36. Describe and define dimensional defects like warp age and wrong measurements.
37. Describe and define notch effect.
38. Describe and define surface and internal defects like slag inclusions, porosity and lack of fusion.
39. Describe and define GMAW, FCAW, GTAW, SAW, PAW, CAC-A and stud welding equipment.
40. Describe welding safety.
41. Describe and wear proper welding apparel.
42. Describe and wear proper welding goggles.
43. Describe the process for fireproofing materials.
44. State the use of protective screens.
45. Describe a welding helmet and illustrate the proper placement of lenses.
46. Describe and illustrate safe housekeeping practices.
47. List the rays involved with welding and the effects associated with these rays.
48. Describe the procedures to protect oneself and the general public from harmful rays.
49. List the reasons for grounding of electrical equipment.

C. Basic Welding Lab Practices.....16 Hours

Outcome: Demonstrate the ability to safely operate a hand held oxy fuel cutting torch and SMAW equipment.

1. Demonstrate the ability to safely operate a hand held oxy fuel cutting torch on available plate and structural shapes.
2. Perform safe set-up procedures.
3. Perform correct regulator adjustments and balancing pressures.
4. Perform straight line and bevel cutting on plate steel.
5. Perform cuts on various structural steel shapes.
6. Perform cutting of bolt holes in structural shapes.
7. Perform coping and fitting of various structural shapes into each other.
8. Demonstrate the ability to tack weld.
9. Demonstrate the ability to weld surface welds (stringer beads) in the flat position on available mild steel using E7018 (E4918) filler material.

10. Demonstrate the ability to weld fillet welds in the 2F position using E7018 (E4918) filler material on available steel.

SECTION THREE: ..... DRAWING INTERPRETATION AND MATHEMATICS ..... 40 HOURS

A. Introduction to Drawings .....16 Hours

Outcome: Identify types of drawings.

1. Identify the types of drawings:
   a) perspective drawings
   b) isometric drawings
   c) oblique drawings
   d) orthographic drawings
2. Demonstrate the ability to sketch objects in the orthographic projection.
3. Identify the parts of a drawing:
   a) lines
   b) dimensions
   c) elevation and plan views
   d) sections
   e) notes
4. Explain the relationship of drawings.
5. Explain the requirements for architectural drawings.
6. Reasons for structural, mechanical, electrical, pre-engineered, fabrication and erection and placing drawings.
7. Identify and demonstrate the use of drawing standards:
   a) tile block
   b) drawing number
   c) contract numbers
   d) scale
   e) revisions
   f) engineer's stamp
8. Identify symbols and abbreviations:
   a) abbreviations used on drawings
   b) symbols used on drawings
   c) structural steel shapes
   d) structural steel connections
   e) basic welding symbols
9. Demonstrate the ability to free hand sketch:
   a) structural shapes
   b) a beam showing dimensions
10. Demonstrate the ability to interpret basic drawings.

B. Trade Mathematics .....24 Hours

Outcome: Solve problems involving fractions, decimals, percentage, metric and imperial measurements, and geometric formulas.

1. Identify key terms and concepts used in working with fractions.
2. Change fractions to a common denominator.
3. Solve problems using whole numbers and fractions.
4. Solve problems using whole numbers and fractions in practical applications.
5. Read and write decimal fractions.
6. Round decimal fractions to specified place values.
7. Convert decimal inches to a fraction with a practical denominator.
8. Convert decimal feet to feet and inches with a practical denominator.
9. Convert fractions to decimals.
10. Add and subtract decimal fractions.
11. Multiply and divide decimal fractions.
12. Convert between fractions and percents.
13. Convert between decimals and percents.
14. Calculate ratio problems: two quantities in the form of a ratio and two ratios in the form of a proportion.
15. Solve percent problems.
16. Identify commonly used metric units of measurement.
17. Convert between units of measurement.
18. Convert imperial units: feet to inches, square inches to square feet, and cubic measures to gallons.
19. Identify key terms and concepts used in working with formulas.
20. Identify common formulas for perimeter, area and volume.
21. Solve problems using common formulas for perimeter, area and volume.
22. Calculate the capacity of a container in gallons.
23. Calculate the weight of a solid.

SECTION FOUR: ..... LEVEL ONE RIGGING .....58 HOURS

A. Ropes and Fittings .....12 Hours

Outcome: Apply safe work practices and procedures when rigging.

1. Identify and define wire ropes.
2. List the types of steel for wire rope.
3. List and explain:
   a) basic types of lays
   b) advantages of lays
   c) available type of core
   d) where cores are used
4. Describe the four basic classifications of wire rope.

5. Explain W.L.L. (working load limits) and when a wire rope is unsafe.
6. Identify and define fibre ropes.
7. Define lays of fibre rope.
8. Describe why a certain fibre would be used.
9. List factors and formulas for natural and synthetic fibre ropes.
10. Describe types of synthetic ropes why and when used.
11. Identify and list the use of various knots and hitches.
12. Identify and define synthetic slings.
13. Explain formulas for different types of synthetic slings.
14. Explain proper methods of care and handling of slings.
15. List and describe wire rope fittings.
16. List and describe uses of the following fittings:
    a) clips
    b) sockets
    c) thimbles
    d) rings
    e) shackles
    f) hooks
17. Describe how proof loading works.
18. List and describe formula and their uses for:
    a) slings
    b) guys
    c) chains
    d) clips
19. Identify and describe rigging aids.
20. Identify and describe the uses for:
    a) spreader bar
    b) balance beam
    c) equalizing beam

B. Hoisting Devices .....6 Hours

Outcome: Identify and describe hoisting devices.

1. List and describe manual and power assisted hoisting devices.
2. List and describe cranes:
    a) types of mobile cranes
    b) parts of a mobile crane
    c) parts of a crawler crane
    d) safe operating and working practices

C. Introduction to Load Charts.....2 Hours

Outcome: Demonstrate the ability to identify parts of load charts.

1. List and describe the following parts of a load chart:
   a) type of crane base
   b) type of crane configuration
   c) areas of operation
   d) length of boom
   e) angle of boom
   f) load radius

D. Signals .....2 Hours

Outcome: Identify and demonstrate the use of signals.

1. List and demonstrate signals used for:
   a) moving equipment
   b) hoisting
2. Describe methods and precautions in using hand signals.
3. Describe and demonstrate the use of voice communications:
   a) radio (2 way and walkie talkie)
   b) intercom (station to station)
4. Describe precautions used in voice communication.

E. Level One Rigging Lab Practices.....18 Hours

Outcome: Demonstrate the safe use of hoisting equipment.

1. Demonstrate slings and hitches used for preparing and lifting materials.
2. Demonstrate the ability to tie knots and hitches and awareness of load limits:
   a) bowline
   b) clove hitch
   c) sheet bend
   d) scaffold hitch and self-centering bowline
   e) bowline on a bight
3. Demonstrate the proper use of slings and tag lines.
4. Demonstrate proper use and location of slings for lifting:
   a) smooth heavy loads
   b) long flexible loads
   c) off balance loads
   d) fragile loads
5. Identify Working Load Limits (W.L.L.).
6. Test knots and splices.

F. Scaffolding.....3 Hours

Outcome: Apply safe work practices when using scaffolding.

1. Identify scaffold systems and structures:
   a) scaffold components and materials
   b) scaffold safety and access
   c) tying and bracing scaffolds
   d) base conditions for scaffolds
   e) erection and dismantling procedures
   f) needle beam platform
2. List and describe safety rules for access structures.

G. Swing Stage and Aerial Work Platforms .....3 Hours

Outcome: Apply safe work practices when using swing stage and aerial work platforms.

1. Describe and explain:
   a) conventional swing stage
   b) platform components
   c) thrust outs and support hooks
   d) wall rollers and tie offs
   e) manual winches
   f) power swing stage hoists
   g) fall arrest equipment
   h) wire rope and fittings
   i) swing stage safety rules and regulations
   j) accident awareness
   k) check list, precautions, inspections, and maintenance
2. Describe the safe use of aerial work platforms and forklifts.
3. Describe common types of material and personnel lifts and their components.
4. Describe acceptable safety precautions to be used when operating material and personal lifts.
5. Describe manufactures specifications and recommendations for aerial work platforms and forklifts.

H. Fall Protection .....2 Hours

Outcome: Identify and describe the safe use of fall protection systems.

1. Identify and describe the safe use of fall protection systems.
2. Identify situations where fall protection systems are required.
3. Identify the procedure for correctly fitting a harness.
4. Identify the components for vertical and horizontal lifelines.
5. Describe the procedures for equipment inspections.

I. Scaffolding, Swing Stage and Fall Protection Lab Practical.....10 Hours

Outcome: Demonstrate the ability to safely use scaffolding, swing-stage, aerial work platforms and fall protection systems.

1. Demonstrate the ability to erect the following scaffold systems:
   a) frame (metal)
   b) modular
   c) tube and clamp
2. Demonstrate the ability to use swing stage and aerial work platforms.
3. Demonstrate the ability to use fall protection systems.

SECOND PERIOD TECHNICAL TRAINING
IRONWORKER TRADE
COURSE OUTLINE

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

SECTION ONE:.....DRAWING INTERPRETATION AND MATHEMATICS ..... 60 HOURS

A. Reinforcing Steel Drawings.....24 Hours

Outcome: ***Demonstrate the ability to read and interpret reinforcing steel drawings.***

1. Identify the following types of reinforcing steel drawings:
   a) architectural drawings
   b) structural drawings
   c) reinforcing steel placing drawings
   d) reinforcing steel abbreviations and symbols
2. Sketch an orthographic projection drawing.
3. Identify the following types of concrete construction from structural engineering and reinforcing steel placing drawings:
   a) foundations and footings
   b) walls
   c) columns
   d) slabs
   e) beams, joists, and girders
4. Identify and compile the following types of reinforcing steel drawings:
   a) the reinforcing steel from a structural engineering drawing
   b) the reinforcing steel from a reinforcing steel placing drawing
   c) a cutting or bar list from a reinforcing steel placing drawing
5. Identify and prepare schedules from a structural engineering drawing:
   a) footings
   b) columns
   c) beams and joists
   d) slabs
6. Interpret and analyze the following reinforcing steel drawings:
   a) foundations and footings
   b) wall and columns
   c) one way slabs and two way slabs
   d) beams and slab
   e) beam joists and waffle slabs
   f) waffle slabs
   g) bridge decks, piers and abutments
   h) tanks and silos
   i) pre-cast members
   j) reinforcing steel placing
7. Interpret the placing sequences for two way flat slab and for a beam and a slab.

8. Interpret:
   a) various types of reinforcing steel drawings
   b) different types of construction
9. Interpret of reinforcing steel placing drawings.

B. Post-Tensioning Drawings ..... 12 Hours

Outcome: Demonstrate the ability to read and interpret post-tensioning drawings.

1. Identify the two types of post-tensioning as shown on drawings:
   a) bonded
   b) unbonded
2. Identify the post-tensioning system being used as shown on drawings:
   a) wire
   b) bar
   c) strand
3. Identify the post-tensioning anchorage needs as shown on drawings:
   a) pocket clearance
   b) anchor recess
   c) anchor zone reinforcing
   d) type of anchorages
   e) types of stressing equipment
4. Identify the post-tensioning symbols and abbreviations used on drawings:
   a) stressing ends anchorages
   b) dead end anchorages
   c) support systems
   d) tendon symbols
   e) drape profile
   f) anchor zone reinforcing
5. Identify the types of post-tensioning concrete construction from structural engineering and post-tensioning drawings:
   a) slabs
   b) beams
   c) slabs and beams
   d) beams and joists
   e) bridge girders
   f) silos, tanks, and slab on grade
6. Identify and compile:
   a) the post-tensioning requirements from a structural engineering drawing
   b) tendon cutting list from a post-tension placing drawing
   c) a stressing data sheet from the tendons from a post-tensioning drawing
   d) calculate elongations and stressing lengths from post-tensioning drawings
7. Prepare material take offs for:
   a) the post-tensioning support system
   b) anchorages and anchor zone reinforcing
8. Interpret post-tensioning drawings.

9. Compile material take-offs from post-tensioning placing drawings.

C. Mathematics and Estimating ..... 24 HOURS

The mathematics delivered under this section shall maintain a level applicable to the tradesperson, and have a definite relationship to functions experienced in the trade of an Ironworker.

Outcome: Demonstrate the ability to solve mathematical problems.

1. Demonstrate ability to solve imperial and metric linear measurement problems using:
   a) fractions
   b) decimals
   c) conversions between decimal and fractions
2. Calculate ratios and proportions.
3. Calculate similar triangles.
4. Calculate slopes.
5. Calculate percentages:
   a) calculate simple interest
   b) calculate discounts
6. Calculate the perimeter and area of:
   a) squares and rectangles
   b) triangles
   c) circular objects
   d) parallelograms
   e) irregular shapes
7. Solve area measurement problems using:
   a) unit of area measure
   b) conversions of area units
   c) plane figures (rectangle, circle, etc.)
8. Solve volume measurement problems using:
   a) units of volume measurement
   b) conversions of volume units
   c) volume figures (cube, cone, etc.)
9. Calculate quantities related to study of plans and drawings:
   a) general - scaffolding, equipment use, etc.
   b) cutting list for specified projects
   c) fasteners required
10. Define triangulation using the appropriate formulas, calculate a position by means of bearings from two fixed points a known distance part.

SECTION TWO: ..... REINFORCED CONCRETE ..... 102 HOURS

A. Concrete ..... 6 Hours

Outcome: Describe the basics of concrete and its usage.

1. Describe the various types of cement.
2. Explain the history of cement.
3. Describe concrete and list its uses.
4. Describe grouts and explain applications.
5. List the basic principles of stresses in concrete:
   a) compression
   b) tension
   c) shear
   d) live and dead loads
   e) physical and mechanical bonds
6. List the basic principles of deflection as reinforcing steel is used to counteract the stresses in concrete.
7. Describe conditions where reinforcing in concrete is needed.

B. Reinforcing Steel ..... 32 Hours

Outcome: Describe the basics of reinforcing steel and its safe usage.

1. Explain how reinforcing steel is manufactured.
2. Describe the reinforcing steel and mill standards.
3. Identify the various grade strengths and diameters of reinforcing steel.
4. Identify reinforcing steel according to colour coding.
5. Describe appropriate fabrication methods including:
   a) cutting
   b) bending
   c) calculating and measuring
   d) cutting and bending schedules
6. Explain and demonstrate safe use of bending and cutting equipment.
7. Explain the placing and placing codes of reinforcing steel.
8. Describe the basic reinforcing steel ties required for placing reinforcing steel.
9. Explain the uses of the reinforcing steel ties in placing reinforcing steel.
10. Identify all reinforcing steel splicing.
11. Calculate the splicing lengths of reinforcing steel.
12. Identify the placing tools required to place reinforcing steel.
13. Identify and describe the uses of reinforcing steel supports used in placing.
14. Identify and describe safety in fabrication and placing of reinforcing steel.
15. List and demonstrate the safety precautions of unloading reinforcing steel.
16. Describe the safety precautions used in tying reinforcing steel.
17. Identify all aspects of unsafe use of reinforcing steel placing tools.

18. Demonstrate an ability to calculate the weights of reinforcing steel.

C. Reinforcing Steel Lab Practices.....36 Hours

Outcome: Demonstrate the ability to sort, cut, place and tie reinforcing steel.

1. Sort reinforcing steel according to size.
2. Cut reinforcing steel according to a cutting list using the shearing machine in a safe, efficient manner.
3. Apply colour code to the reinforcing steel to identify cutting lengths.
4. Demonstrate safe operation of the bending machine.
5. Bend reinforcing steel into 90° and 180° hook bars as per bending sheet using the bending machine and correct pin diameter.
6. Tie the cut and bent reinforcing steel into bundles.
7. Demonstrate the ability to place reinforcing steel.
8. Tie wire ties in the horizontal and vertical positions.
9. Tie a double curtain wall according to specifications on a drawing.
10. Tie columns as per column schedule.
11. Tie a reinforcing steel mat as per information sheet.
12. Perform the following:
    a) shear reinforcing steel from cutting list
    b) bend reinforcing steel from bending schedule
    c) colour code all sheared and bent reinforcing steel
13. Place a two-way flat slab from a drawing using the correct:
    a) placing sequence
    b) support systems
    c) ties for securing reinforcing steel
14. Demonstrate safe working practices while operating equipment:
    a) inspection of reinforcing steel for a flat slab from the drawing
    b) check that all reinforcing steel
        i) is in the correct position
        ii) is correctly tied
        iii) is lapped correctly
        iv) has the correct sequence
15. Dismantle reinforcing steel:
    a) untie all the wires from the reinforcing steel
    b) remove all the chairing and replace in correct location
    c) sort all reinforcing steel in correct location
    d) clean up the deck and the equipment
    e) dispose of all loose wire

D. Cranes.....12 Hours

Outcome: Describe safe procedures for lifting, hoisting or moving loads.

1. Demonstrate or describe:
   a) general use of tables and charts
   b) signals
   c) boom assembly and disassembly
   d) components
   e) breakdown for transportation
   f) safety precautions
   g) deductions from gross capacity to determine net capacity
2. Describe the reason for and load reduction when jib is fitted on the boom.
3. List and describe safe working practices for tower cranes:
4. Identify and describe the following cranes:
   a) hydraulic
   b) conventional
   c) rough terrain
   d) high capacity

E. Post-Tensioning.....10 Hours

Outcome: Describe post-tensioning its usage and safety issues.

1. Define post-tensioning.
2. List and explain the safety aspects of stressing.
3. Identify the two types of post-tensioning:
   a) bonded
   b) unbonded
4. Identify the post-tensioning systems:
   a) bar
   b) strand
5. Identify the post-tensioning anchorages:
   a) type of anchorages
   b) single strand anchor
   c) multi-strand anchor
   d) bell anchor
   e) shim anchor
   f) lock nut anchor
   g) anchor zone reinforcing
   h) anchor recess and pocket clearances
6. Define prestressing.
7. List and explain the applications of prestressing.
8. State the safe stressing procedures.
9. Explain the procedures in tendon placement.
10. Identify and describe the use of the tendon support system.

11. Explain the procedures in placing anchor zone reinforcing.

F. Post-Tensioning Lab Practices ..... 6 Hours

Outcome: Demonstrate the ability to operate stressing equipment, a grouting pump and fabricate a beam.

1. Demonstrate the operation of stressing equipment.
2. Identify the parts of the stressing pump.
3. Operate the stressing pump.
4. List safety precautions of the pumping operation.
5. Identify the parts of various stressing jacks.
6. Operate two types of stressing jacks together.
7. Identify a safe method to check stressing gauges.
8. Demonstrate setting the by-pass safety valve on stressing jack.
9. Demonstrate the operation of post tension grouting pump.
10. Identify the parts of the grouting pump.
11. Operate the grouting pump.
12. List safety precautions while operating grout pump.
13. Demonstrate mixing of grout.
14. Demonstrate cleaning of the grout pump after grouting operation.
15. Demonstrate the ability to fabricate a beam:
    a) drape
    b) supports
    c) anchors
16. Describe tension instillation:
    a) bar strand
    b) multi strand
17. Tie the cut and bent reinforcing steel into bundles.
18. Tie wire ties in the horizontal and vertical positions.
19. Tie a double curtain wall according to specifications on a drawing.
20. Tie columns as per column schedule.
21. Tie a reinforcing steel mat as per information sheet.
22. Tie a reinforcing steel beam as per placing drawing.

SECTION THREE: .....TRADE RELATED KNOWLEDGE..... 18 HOURS

A. Business Knowledge .....10 Hours

Outcome: List and describe basic business knowledge.

1. Demonstrate the correct procedure for developing reports and filling in time cards.
2. Interpret written orders.
3. Interpret requests and conditions.
4. Explain the responsibilities that an ironworker has to:
   a) oneself, fellow workers and general public
   b) the foreman and employer
   c) Apprenticeship and Trade Certification
   d) provincial labour standards
   e) company policies and procedures
5. Describe the following workplace coaching skills, used for training apprentices:
   a) identify the point of the lesson
   b) link the lesson
   c) demonstrate a skill
   d) provide opportunity to practice a skill
   e) give feedback to the learner
   f) assess the learner's progress
6. Explain the public relations an Ironworker has in:
   a) co-operation with allied trades
   b) co-ordination with other trade functions
   c) recognition of work related problems
   d) consideration of public needs
7. Listen to guest speakers of the training establishment's choice who may include trade experts or product representatives:
   a) W.C.B.
   b) O.H.&S.
   c) company representatives (Q.A., production superintendent, safety coordinator, owners, job coordinator, estimator)
   d) C.W.B. representatives
   e) personal protection equipment supplier
8. Demonstrate the ability to perform basic computer skills.

B. Materials Knowledge ..... 6 Hours

Outcome: Describe basic materials.

1. Define and describe the following types of physical and mechanical properties of metals:
   a) density
   b) brittleness
   c) ductility
   d) elasticity
   e) hardness
   f) thermal and electrical conductivity
   g) malleability
   h) tensile strength
   i) toughness
   j) coefficient of expansion
   k) melting and boiling points
2. Explain the chemical composition of steel.
3. Describe:
   a) effects of elements in steel
   b) carbon, manganese and silicon
   c) sulphur and phosphorus
4. Describe the following types of classifications of steels:
   a) carbon and alloy steels
   b) steel code classifying systems such as S.A.E. and A.I.S.I.
   c) A.S.T.M. and C.S.A. designations of structural steels
5. Describe the types of coatings.

C. Quality Control ..... 2 Hours

Outcome: Describe the basics of quality control.

1. Describe methods of inspection.
2. Explain scope and quality control /assurance (ISO-9000).
3. Discuss elements of a quality control (Q.C.) system and why it is used.
4. Identify method of Q.C. used by the Steel Fabrication Industry today to insure quality.
5. Discuss relationship between Q.C. personnel and tradespersons.
6. Describe the difference between a standard and code.
7. Discuss functions of standards, codes, specifications and procedures.
8. Define scope of Q.C. inspection.
9. Describe and observe each method of non-destructive and destructive testing.
10. Describe methods of inspecting welds.

THIRD PERIOD TECHNICAL TRAINING
IRONWORKER TRADE
COURSE OUTLINE

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

SECTION ONE:.....DRAWING INTERPRETATION AND MATHEMATICS ..... 48 HOURS

A. Drawings.....14 Hours

Outcome: Identify structural steel components.

1. Identify and list structural steel components:
   a) girts
   b) purlins
   c) bracing
   d) bays and bents
   e) columns
   f) trusses
   g) girders
   h) beams
2. Identify anchor bolt setting:
   a) orientation
   b) grid lines
   c) anchor bolt patterns
   d) anchor bolt projection
   e) shims and grouting
   f) base plate elevations
   g) anchor bolt plan
3. Identify single frame structures:
   a) single frame buildings
   b) beams and columns
   c) multi frame buildings
   d) bracing
4. Identify fabrication drawings:
   a) fabrication drawings
   b) gauge, pitch and edge distances
   c) running dimensions
   d) fabrication practices
5. Identify erection drawings:
   a) erection drawings
   b) marking system
   c) erection pre-planning
   d) erection tolerances
   e) leveling and plumbing

6. Identify trusses and portal frames:
    a) components
    b) spacing
    c) bracing and bridging
    d) decking

B. Structural Steel Drawings ..... 4 Hours

Outcome: Demonstrate the ability to read and understand structural steel drawings.

1. Identify:
    a) structural steel placing drawings
    b) anchor bolt layouts
    c) structural steel components from a drawing
    d) components from open web steel joists
    e) various types of bracing and its use
    f) structural steel fabrication details
2. Calculate the weights and prepare material take-offs of structural steel drawings.

C. Material Designations ..... 10 Hours

Outcome: Identify and describe various structural steel shapes, types and fasteners.

1. Identify structural steel shapes:
    a) dimensioning of shapes
    b) types of connections
    c) mill tolerances
    d) material specifications
2. Identify structural plates.
3. Identify various plate dimensions.
4. Calculate weight of plates.
5. Identify:
    a) gauge plate
    b) expanded metal
    c) bar grating
    d) checker plate (4 way safety)
6. Identify structural pipe and tubing:
    a) pipe and tubing
    b) sizing and dimensioning
    c) scheduling of pipe
    d) illustrations of tubing
7. Identify fasteners:
    a) types of bolts
    b) bolt diameters
    c) bolt grip and length
    d) methods of installation
    e) precautions for use

f) fasteners to other types of materials

D. Mathematics and Estimating ..... 20 Hours

Due to the nature of application in the trade of Ironworker, the mathematics given under this section shall be flexible and applied to the work where feasible.

Outcome: Demonstrate the ability to solve mathematical problems.

1. Solve problems using:
   a) fractions
   b) decimals
   c) dimensions (metric and imperial)
2. Describe and layout slopes.
3. Solve problems between distance and angles using:
   a) sin functions
   b) cos functions
   c) tan functions
4. Demonstrate ability to use suitable formulas to solve given problems related to:
   a) perimeters
   b) areas
   c) volumes
   d) triangulation

SECTION TWO: ..... LEVEL TWO RIGGING ..... 50 HOURS

A. Rigging Theory ..... 18 Hours

Outcome: Describe types of rigging procedures.

1. List and describe formulas.
2. Perform calculations with rigging formulas:
   a) deadman
   b) drum capacities
   c) sheaves
   d) stress formulas
3. List and describe the following for pre-cast erection:
   a) sling configurations
   b) methods of transferring loads
   c) safety rules for handling pre-cast objects
4. Apply the S.W.F. into various load and sling configurations.
5. Use slings and general rope hardware tables and charts.
6. Determine the safe working load that can be lifted with a given rigging arrangement.
7. Describe mechanical advantage of reeving.
8. Define friction.
9. List and describe:
   a) types of reeving
   b) methods of reeving

c) advantages and disadvantages of reeving

10. Calculate the mechanical advantage of block and tackle systems.
11. Determine the lead line pull when the number of parts and load weight including rope size are known.
12. Identify the factors that determine the amount of wire rope needed for a reeving system.
13. Identify types of sheaves, friction bearings and the coefficient of friction expressed in percent.

B. Rigging Practices ..... 32 Hours

Outcome: Demonstrate the ability to do basic rigging.

1. Demonstrate or describe safe work practices of block and tackle involving reeving techniques:
   a) square
   b) skip
   c) tandem
   d) equalizer sheaves
   e) lacing
   f) reeving of simple and multi-blocks up to 24 parts
2. Calculate the mechanical advantage of block and tackle systems.
3. Define the lead pull and explain the method of calculating for the lead line.
4. Using slings, determine the center of gravity for different types of loads such as:
   a) structural members of different designations
   b) regular plates
   c) pre-cast
   d) components
   e) machinery
5. Demonstrate the use of sling stress formulas.
6. Perform rigging, hoisting and jacking operations in a safe and responsible manner in accordance with the Health and Safety Act and any other applicable regulations.
7. Rig loads safely and correctly for:
   a) straight lifts
   b) drifting
   c) turning

SECTION THREE: ..... STRUCTURAL STEEL AND METAL BUILDING SYSTEMS ..... 82 HOURS

A. Wall Systems..... 16 Hours

Outcome: Describe metal building walls.

1. Describe the terminology of wall systems.
2. Explain panel profile, gage number and panel coatings.
3. Describe and differentiate between exposed fastener panels and concealed fastener panels.
4. Discuss the field storage and handling of wall panels.
5. Describe types of factory-assembled wall panels.
6. Describe layout and installation of walls.
7. Describe sheeting safety considerations.

8. Install a base angle using masonry fasteners.
9. List and describe tools required for installing wall coverings.
10. Describe the shakeout, rigging, and handling of wall coverings.
11. Describe the process used to align grits with blocking.
12. Lay out modularity prior to installing wall coverings.
13. Describe how the direction of sheeting is determined.
14. Describe the procedure used to pre-drill a stack of wall panels.
15. Discuss the procedures used to install exposed wall fastener wall panels.
16. Describe and demonstrate correct scaffolding practices common to wall installation practices.
17. Describe and demonstrate how to cut an opening in an exposed fastener wall panel including:
    a) framing
    b) flashing
18. Discuss considerations when sheeting end walls.
19. Describe the cutting and installation of factory-assembled wall panels.
20. Describe sandwich panel systems.

B. Roof Systems.....12 Hours

Outcome: Describe metal building roof systems.

1. Describe panel types and systems design.
2. Describe the various loads to which a metal roof is subjected.
3. List and describe the components of lap seam metal roofs.
4. State common characteristics shared by standing seam metal roof systems.
5. Discuss and describe the:
    a) advantages and limitations of standing and lap seam metal roofs
    b) types of coatings used on standing and lap seam metal roof panels
    c) sealant requirements for standing and lap seam systems
6. Describe the safety involved in working on roofs.
7. Discuss safety considerations when working off the ground.
8. Describe the potential panel dangers during metal roofing:
    a) collapse
    b) slippery
    c) loose panels
    d) wind
9. Discuss material handling dangers.
10. Describe installation of metal roofs with lap seams, standing seams and sandwich systems.
11. State the factors considered in pre-erection planning.
12. Describe the general sequence of erection for standing seam roof systems.
13. Discuss eave conditions, ridge conditions and rake conditions.
14. Discuss skylights, curbs and walkway systems.
15. Describe the procedures used to block purlins according to manufacture's specifications.

16. Describe insulation placement in conformance with the requirements of the specified roof system.
17. Describe procedure used to lay out panel modularity.
18. Describe the installation of roof and ridge panels in conformance with f the roof system.
19. Describe proper splicing of gutter sections.

C. Pre-Engineered Building Erection ..... 30 Hours

Outcome: Apply safe work practices when erecting a pre-engineered metal building.

1. Demonstrate the ability to do the pre-planning for a pre-engineered building.
2. Determine size and weight of building materials.
3. Determine the sequence for erecting the structural steel.
4. Determine the size of the mobile crane needed and the location of crane on site.
5. Check levels of the base and anchor bolt patterns. Ensure that all materials are on site.
7. Apply safe work practices and procedures for use of mobile cranes:
    a) locate and level mobile crane on site
    b) rig up the mobile crane using the correct slings
    c) use correct hand signals for hoisting material
    d) follow safe hoisting procedures
8. Demonstrate the ability to erect a pre-engineered metal building:
    a) hoist and locate the columns in the correct location
    b) level and square columns on the bases
    c) install temporary guys
    d) plumb and square the structural frame using guy lines, bracing, leveling shims and transit
    e) hoist, erect and bolt all secondary structural and bracing in the correct position
    f) torque bolts to proper specifications
        i) impact
        ii) turn of nut method
    g) install wall and roof systems
    h) use recognized safety procedures
9. Demonstrate the ability to dismantle a metal building:
    a) loosen all bolts in correct sequence
    b) dismantle and lower all structural steel and metal building components in the correct sequence
    c) place in storage all structural steel and metal building components using correct and safe methods
    d) de-rig the mobile crane using appropriate safety procedures
    e) clean up site

D. Windows Doors and Air Barrier ..... 6 Hours

Outcome: Describe proper installation of windows, doors and air barrier.

1. Describe and discuss insulation backings used as vapour barriers.
2. Describe other types of air barriers:
    a) polyurethane

b) liner panels (caulked and sealed)

3. Describe cutting rough openings for windows and doors:
   a) while sheeting
   b) after building is sheeted
4. Explain finishing of openings:
   a) sealants required
   b) flashings
   c) insulation

E. Structural Steel Lab Practices.....18 Hours

Outcome: Apply safe work practices when erecting structural steel.

1. Demonstrate the ability to do the pre-planning for a building.
2. Determine size and weight of building materials.
3. Determine the sequence for erecting the structural steel.
4. Determine the size of the mobile crane needed and the location of crane on site.
5. Check levels of the base and anchor bolt patterns.
6. Ensure that all materials are on site.
7. Apply safe work practices and procedures for use of mobile cranes.
8. Locate and level mobile crane on site.
9. Rig up the mobile using the correct slings.
10. Use correct hand signals for hoisting material.
11. Follow safe hoisting procedures.
12. Demonstrate the ability to erect a building.
13. Hoist and locate the columns in the correct location.
14. Level and square columns on the bases.
15. Install temporary guys.
16. Plumb and square the structural frame using guy lines, bracing, levelling shims and transit.
17. Hoist, erect and bolt all secondary structural and bracing in the correct position.
18. Torque bolts to proper specifications:
    a) impact
    b) turn of nut method

FOURTH PERIOD TECHNICAL TRAINING
IRONWORKER TRADE
COURSE OUTLINE

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

SECTION ONE:..... ORNAMENTAL, MISCELLANEOUS AND CURTAIN WALL ..... 98 HOURS

A. Miscellaneous Steel and Iron ..... 14 Hours

Outcome: Describe miscellaneous steel and iron.

1. Describe the meaning of ornamental iron.
2. List uses for ornamental iron.
3. Explain what safety measures must be taken when fabricating and erecting ornamental iron and miscellaneous iron.
4. Describe the finish on special materials.
5. List items that are in the miscellaneous category.
6. List and explain in order of merit, the safe rules to follow.
7. Describe and explain the sub framing and steel supports.
8. Describe and explain the procedures and rules for erection of a chain link fence.
9. Describe proper installation of mail chutes and explain the materials used.

B. Curtain Wall Drawings ..... 6 Hours

Outcome: Interpret curtain wall drawings.

1. Determine the important measurements for the layout of a curtain wall.
2. Determine the type of anchorage system used to position the curtain wall.

C. Curtain Wall Basics ..... 18 Hours

Outcome: Describe the basics of curtain walls.

1. List and describe:
   a) types of curtain walls
   b) materials used on each
   c) uses of each type
   d) methods of anchoring
   e) proper installation methods for each type
   f) recommended methods for safe handling
   g) sequence and storage methods employed on the job site
   h) special finishes

D. Stair Fabrication ..... 6 Hours

Outcome: Describe basics of stair fabrication.

1. Define common stair terminology.
2. Describe standard safety requirements.
3. State how Alberta Building Code Regulations and customer design criteria affect stair design.
4. Identify common steel stair material.
5. State common stair design rules.
6. State three stair calculation rules.
7. Describe field measurement procedure.

E. Ladders Platforms and Hand Rails ..... 6 Hours

Outcome: Describe basics of ladders, platforms and hand rails.

1. Describe principle types and sizing.
2. Describe basic components and appropriate material selection.
3. Describe methods of layout and assembly, anchorage points.
4. Describe proper procedure for fabrication and shipping.
5. Describe proper finishing, surface protection and anchoring procedures following standard safety requirements.

F. Pattern Development ..... 6 Hours

Outcome: Demonstrate the principles of pattern development.

1. Apply principles of parallel line development to layout the stretch out templates for 90's and lateral connections.

G. Lab Practices ..... 42 Hours

Outcome: Demonstrate the ability to fabricate projects.

1. Layout a project from an approved drawing.
2. Demonstrate appropriate cutting and fitting methods.
3. Demonstrate correct welding procedures and complete the project.
4. Demonstrate ability to apply the appropriate finishing materials.
5. Demonstrate ability to fabricate a curtain wall.
6. Calculate rise, run, step length and stringer length given total rise and total run.
7. Layout a pair of stringers from a shop drawing.

SECTION TWO: ..... ADVANCED RIGGING ..... 42 HOURS

A. Rigging Theory ..... 12 Hours

Outcome: Describe advanced rigging practices.

1. Describe advanced procedures for rigging:
   a) horizontal high lines
   b) multiple member lifts (Christmas Trees)
   c) rigging accessories
   d) new technology hardware and slings
2. Explain ground rules and procedures for heavy lifts.
3. Determine the lead line pull when the number of parts and load weight including rope size are known.
4. Describe and explain:
   a) an equalizer sheave and its uses
   b) advantages of an equalizer sheave
   c) disadvantages of an equalizer sheave
5. Describe and explain a tandem block and its uses.
6. Describe the correct way of assessing the equipment required for lifting.
7. Explain the dangers involved when you ignore the safe procedures for lifting.
8. Explain the use of lift calculation forms for critical lifts and man baskets.
9. Describe and explain engineered lift drawings.

B. Lab Practices ..... 18 Hours

Outcome: Demonstrate the ability to apply safe rigging practices.

1. Demonstrate ability to:
   a) tie various knots
   b) reeving skip square and lacing with equalizer
   c) apply U bolt clips correctly making parallel splice
2. Demonstrate how to:
   a) set up wire rope in splicing clamp and splice eye in wire rope
   b) form farmers eye using ½" wire rope
   c) lower your self when using a bosun's chair in the correct method (optional)
3. Demonstrate proper use and location of slings for lifting:
   a) smooth heavy loads
   b) long flexible loads
   c) off balance loads
   d) fragile loads

C. Cranes.....12 Hours

Outcome: Describe safe procedures for lifting, hoisting or moving loads.

1. Demonstrate or describe the following when using cranes:
   a) general use of tables and charts
   b) signals
   c) boom assembly and disassembly
   d) components
   e) breakdown for transportation
   f) safety precautions
   g) deductions from gross capacity to determine net capacity
2. Describe the reason for and load reduction when jib is fitted on the boom.
3. List and describe tower cranes:
   a) parts of a tower crane
   b) the steps of assembly
   c) safe working practices
4. Identify and describe the following cranes:
   a) hydraulic
   b) conventional
   c) rough terrain
   d) high capacity
5. List and describe derricks:
   a) types of derricks and their uses
   b) ground rules and safety practices
6. Describe and explain uses for guy wires.
7. Define and explain the word "dead man".
8. Describe and explain winches:
   a) winches and their uses
   b) a drum and its capacity
   c) safety rules
9. Sketch sheave and define sheave size.
10. Demonstrate the knowledge of signals.
11. List the basic conditions for counterweight installation and removal.

SECTION THREE: .....TRADE RELATED KNOWLEDGE..... 40 HOURS

A. Business Knowledge .....10 Hours

Outcome: List and describe basic business knowledge.

1. Demonstrate the correct procedure for developing reports and filling in time cards.
2. Interpret written orders.
3. Interpret requests and conditions.
4. Explain the responsibilities that an ironworker has to:
   a) oneself, fellow workers and general public
   b) the foreman and employer
   c) Apprenticeship and Trade Certification
   d) provincial labour standards
   e) company policies and procedures
5. Describe the following workplace coaching skills, used for training apprentices:
   a) identify the point of the lesson
   b) link the lesson
   c) demonstrate a skill
   d) provide opportunity to practice a skill
   e) give feedback to the learner
   f) assess the learner's progress
6. Explain the public relations an Ironworker has in:
   a) co-operation with allied trades
   b) co-ordination with other trade functions
   c) recognition of work related problems
   d) consideration of public needs
7. Listen to guest speakers of the training establishment's choice who may include trade experts or product representatives:
   a) W.C.B.
   b) O.H.&S.
   c) company representatives (Q.A., production superintendent, safety coordinator, owners, job coordinator, estimator)
   d) C.W.B. representatives
   e) personal protection equipment supplier
8. Perform basic use computers.

B. Materials Knowledge ..... 6 Hours

Outcome: Describe basic materials.

1. Define and describe the following types of physical and mechanical properties of metals:
   a) density
   b) brittleness
   c) ductility
   d) elasticity
   e) hardness
   f) thermal and electrical conductivity
   g) malleability
   h) tensile strength
   i) toughness
   j) coefficient of expansion
   k) melting and boiling points
2. Explain the chemical composition of steel.
3. Describe:
   a) effects of elements in steel
   b) carbon, manganese and silicon
   c) sulphur and phosphorus
4. Describe the following types of classifications of steels:
   a) carbon and alloy steels
   b) steel code classifying systems such as S.A.E. and A.I.S.I.
   c) A.S.T.M. and C.S.A. designations of structural steels
5. Describe the types of coatings.

C. Quality Control ..... 2 Hours

Outcome: Describe the basics of quality control.

1. Describe methods of inspection.
2. Explain scope and quality control /assurance (ISO-9000).
3. Discuss elements of a quality control (Q.C.) system and why it is used.
4. Identify method of Q.C. used by the Steel Fabrication Industry today to insure quality.
5. Discuss relationship between Q.C. personnel and tradespersons.
6. Describe the difference between a standard and code.
7. Discuss functions of standards, codes, specifications and procedures.
8. Define scope of Q.C. inspection.
9. Describe and observe each method of non-destructive and destructive testing.
10. Describe methods of inspecting welds.

D. Mathematics and Estimating ..... 22 Hours

Outcome: ***Calculate the costs of labour and materials for projects.***

1. Calculate material quantities related to a study of a specific plan or drawing of:
   a) general material handling, equipment use, etc.
   b) material list
   c) fasteners
2. Calculate labour cost from given man-hours for fabricated units or components.
3. Compute total production costs including given percentages of overhead costs.
4. Calculate basic mathematical problems using trigonometry.

Excellence through training and experience

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