Curriculum for Welding

(Certificate Level - 6 months)

Contents

Introduction

Name of course: Welding 06 month (800 hrs)

Overall objective of Course:

- Improve the Level of skill of workers in industry and increase the economic potential of the country.
- Provide industry with workers whose scope with job knowledge and skills are identified.
- Assist in human resources development by providing precise and assessed country's skilled manpower quantitatively as well as qualitatively.
- Create an incentive and desire for workers to attain a high level of knowledge and skills competency in their respective trade / profession.
- Establish a co-ordination among employer's, workers and government relating to human resources development programs.
- Provide technical and vocational training basis which reflects the requirements of industry.
- Facilitate the mobility skilled workers.

Competencies gained after completion of course:

Knowledge Competency:

After successful completion of this training, the trainee should be able to:

- Describe Measuring, Marking, Cutting, Sawing, and Filing, Drilling/Counter sinking, Threading tools / instruments, their uses & Safety and Personal safety.
- Explain basic arithmetic & geometric terminologies, calculate, and solve the problems.
- Explain the Gas Welding / Cutting tools and equipment, their use and safety.
- Explain the Soldering & Brazing process and their use on common metals.
- Determine Arc Welding processes, tools and equipment, their use and safety.
- Express the suitable welding joints, welding positions, Electrodes, their use and selection.
- Describe welding defects and their remedies.
- Explain the inspection and testing of welded joints to ensure quality of weld.

Skill Competency:

After successful completion of this training, the trainee should be able to:

- Measure, Mark, Cut, Saw, File, Grind, Drill / Counter sink, Tap / Thread the job observing work and personal safety.
- Weld with Gas Welding process on different Joints and Positions.
- Solder the sheet metals.
- Braze the common metals i.e. Mild steel (MS), Cast iron (CI), Stainless steel (SS) and Copper (Cu).
- Weld with Arc Welding process on different Joints and Positions.
- Inspect and Test the welded joints.
- Weld the simple structural shapes.

Job opportunities available immediately and in the future:

- Steel manufacturing industry.
- Construction industry.
- Industrial projects.
- Shipyards.
- Railway.
- Pakistan Ordinance Factory Wah.
- Heavy Mechanical Complex Taxila.
- Heavy Forge and Foundry Taxila.
- Tractor and Agricultural Equipment Industry.
- Automobile industry.
- Local industry.
- Local metal fabrication shops.
- Self employment.
- And many others.

Trainees Entry level:

Middle Pass

Minimum Qualification of Teacher:

DAE in Mechanical/Welding with two year relevant experience

Or

Two years (G-II) Proficiency Certificate of Welding Trade With six years experience.

Curriculum Structure

Duration of Course	Six Months
Total Hours	800 hrs
Training Hours	765 hrs
Module Test	25 hrs
Final Test	10 hrs
Per Week Hours	30 hrs
Per Day Hours	05 hrs (6 days a week)

Overview about the program – Curriculum for Welding (06 months).

Module Title and Aim	Learning Units	Theory hours	Workplace hours
Module 1: Basic metal work. Aim: • Provide knowledge and skill on common bench work tools and selected jobs. • Introduction to the kinds of welding. • Reading of drawings	**1.1 BENCH WORK** I. Metal working tools, basic. II. Practical Exercises. III. Jobs, Tools and Personal Safety. IV. Arithmetic's/Geometrical terminologies and problems solving. V. Kinds of welding, their principles and use.	22 hrs.	98 hrs.
Module 2: Welding Aim: • Provide knowledge and skill on gas welding process. • Identify gas welding defects and adopt remedies. • Provide knowledge and skill on soldering and brazing. • Use of soldering and brazing • Provide knowledge and skill on arc welding joints and positions. • Identify arc welding defects and adopt remedies.	**2.1 GAS WELDING** I. Gas welding tools, equipment and accessories, their use, care and safety. II. Welding joints and welding positions. III. Gas welding techniques. IV. Gas cutting technique. V. Common gas welding / cutting and arc welding defects and remedies. VI. Gas welding practice. **2.2 SOLDERING AND BRAZING** I. Soldering tools, equipment and accessories. II. Soldering joints and practice. III. Solder & Brazing filler metals and fluxes. IV. Brazing on different metals and joints.	29 hrs 13 hrs	147 hrs 56 hrs

	2.3 ARC WELDING I. Basic Electricity and welding machines. II. Welding polarities, classification of electrode, care and storage. III. Arc welding tools, equipment and accessories. IV. Relationship among the size of electrode, current setting and job thickness. V. Arc welding practice on different joints and positions.	50 hrs	200 hrs
Module 3 Fabrication of steel articles Aim: • Provide knowledge and skill on producing steel gates, doors, windows, grills, railing etc.	**3.1 Design and weld the steel articles** I. Building construction II. Domestic use.	30 hrs	120 hrs

Curriculum Contents for Welding
(Teacher and Learner Guide).

Module 1 title: Basic Metal work.
Objective of the Module: 1. Describe common metal working tools and prepare bench work exercises.
2. Explain the kinds of welding.
Duration: 120 hrs **Theory:** 22 hrs **Practical**: 98 hrs

Learning Unit	Learning Outcomes	Learning Elements	Duration	Material required	Learning place
1.1 **Bench work.** 1.2 **Job, tools and personal safety.** 1.3 **Practical exercises.** **1.4 Arithmetic's / Geometrical terminologies and problem solving.** 1.5 **Kinds of Welding their principles and use.**	i. Is able to identify basic metal working tools. ii. Is able to select the select the suitable tool for the job. iii. Observe safety for tools, work and personal. iv. Explain basic Arithmetic's/Geometrical Terminologies. v. Explain kinds of welding	**1.1.1 Identify select and use the Measuring tools:** Steel foot rules, Steel tape, Vernier Caliper, Calipers (internal & external), Micrometer, Gauges, Solid steel squares, Protectors. **1.1.2 Identify select and use the Marking tools:** Steel scribers, Divider, Centre Punch, Surface gauge. **1.1.3 Identify select and use the Cutting tools:** Shears, Saws, Chisels, Punches. **1.1.4 Identify select and use the Files and Scrapers:** Single cut file, Cross cut, Rasp cut, Shapes of files, Flat scraper, Triangle scrapers. **1.1.5 Identify select and use the Grinding:** Wheels, Discs, and pencils. **1.1.6 Identify select and use the Drills / Counter Sinks:** Twist drills, Counter sinks. **1.1.7 Identify select and use the Threading:** Types of Threads, Tapes and Dies. **1.2.1 Explain and use the Safety Rules:** Introduction to the safety rules and regulations for tools, work and personal.	2 hrs 1 hrs 1 hrs 1 hrs 1 hrs 1 hrs 1 hrs	-Original Tools, -White/Chalk board, -OHP, -Information sheets, -Materials, -Exercise sheets -work sheets	Class room Class room Class room Class room Class room Class room

		1.3.1 Prepare the selected jobs according to the drawing.			
		i. Filing Exercise (Channel)	27 hrs		Workplace
		ii. Squaring.	10 hrs		Workplace
		iii. Marking.	4 hrs		Workplace
		iv. Sawing.	8 hrs		Workplace
		v. Drilling.	10 hrs		Workplace
		vi. Counter Sinking.	4 hrs		Workplace
		vii. Threading.	10 hrs		Workplace
		viii. Stretching.	12 hrs		Workplace
		ix. Sheet Metal Box.	13 hrs		Workplace
		1.4.1 Solve the problems 0f Arithmetic's / Geometrical using Terminologies: Addition & Subtraction, Multiplication & Division, Metric system, Diameter / Circumference finding., Percentage, Conversion of Inches to Metric to Inches, Lines, Angles, Drawing of Radius, Corner finding from Isometric views, Views finding and matching of views.	11 hrs		Class room
		1.5.1 Explain the different Kinds of Welding: Kinds of welding, their principles and use.	2 hrs		Class room

Module 2 Title: Welding

Objective of the Module:
2.1 Describe Gas welding process accessories, use them safely and weld the metals.
2.2 Differentiate between Soldering and Brazing processes, and solder / braze the different ferrous and non-ferrous metals.
2.3 Describe Arc welding process, Tools, accessories, use them safely and weld the metals.

Duration: 495 hrs **Theory:** 92 hrs **Practical**: 403 hrs

Learning Unit	Learning Outcomes	Learning Elements	Duration	Material required	Learning place
2.1 GAS WELDING. Gas welding equipment and accessories, Welding joints and positions, Welding and cutting techniques, Welding defects and practical skill.	i. Identify gas welding tools, equipment, care and use them observing safety rules and regulations. ii. Explain welding joints and positions. iii. Determine the gas welding and cutting techniques. iv. Identify gas and arc welding defects and adopt remedies. v. Weld the metals with Oxy-Acetylene process on different joints and positions.	**2.1.1 Identify and select the Gas welding equipment and accessories:** Gas cylinders and Acetylene generator, Regulators, Hoses with fittings, Goggles, Spark lighter, Gas welding and Cutting Torches with nozzles / tips, Flashback arrestors, Filler rods, Burner pliers, their care and safety rules. **2.1.2 Identify and Explain the types of welding joints:** Butt joint, Corner joint, Tee joint, Lap Joint, Edge Joint. **2.1.3 Identify and Explain the types of welding positions:** Flat position, Horizontal position, Vertical position, Overhead position. **2.1.4 Explain and select the Welding techniques:** Forehand welding, Backhand welding. **2.1.5 Select and use the Oxy-Acetylene Cutting techniques:** Flame cutting process, freehand cutting, Guide bar cutting, Curve and Circular cutting. **2.1.6 Identify Welding defects (Arc & Gas), causes and select remedies:** Lack of Fusion, Under cut, Blowholes, Porosity, Slag inclusion, Cracks, Their causes and remedies.	20 hrs 2 hrs 2 hrs 1 hrs 2 hrs 2 hrs	-Original Tools, -White/Chalk board, -OHP, -Information sheets, -Materials, -Exercise sheets -work sheets	Class room Class room Class room Class room Class room Class room

		2.1.7 Weld the job with Gas welding on practical exercises:			
		I. Lightening of flame.	6 hrs		Workplace
		II. Adjusting of flames (Carburizing, Neutral and Oxidizing).	6 hrs		Workplace
		III. Blind weld flat (Puddling procedure).	10 hrs		Workplace
		IV. Double flange edge weld.	10 hrs		Workplace
		V. Butt joint flat.	10 hrs		Workplace
		VI. Corner joint (out side) flat.	10 hrs		Workplace
		VII. V - Butt joint flat.	15 hrs		Workplace
		VIII. Corner joint outside horizontal.	10 hrs		Workplace
		IX. Butt joint horizontal.	10 hrs		Workplace
		X. T-joint horizontal.	10 hrs		Workplace
		XI. Square butt joint vertical.	10 hrs		Workplace
		XII. Square butt joint on pipe flat.	10 hrs.		Workplace
		XIII. Square butt joint on pipe horizontal.	15 hrs.		Workplace
		XIV. Square butt joint on pipe fix.	15 hrs.		Workplace

2.2 Soldering and Brazing. Soldering and brazing tools, equipment, Filler metals, Fluxes and Practical exercises.	i. Select the proper tools equipment and accessories for the soldering and brazing job. ii. Select the solder or brazing filler metals and fluxes. iii. Solder and braze the different metals.	**2.2.1 Explain, Identify and select the Soldering accessories.**		-Original Tools, -White/Chalk board, -OHP, -Information sheets, -Materials, -Exercise sheets -work sheets	
		I. Soldering Process,	2 hrs		Class room
		II. Types of soldering iron,	1 hr		Class room
		III. Kinds of solders,	1 hrs		Class room
		IV. Soldering fluxes.	1 hrs		Class room
		2.2.2 Solder the Joints on various metals.			
		• Lap joint soldering on MS, GI, Cu and brass sheets.	8 hrs		Workplace
		• Butt joint soldering on MS, GI, Cu and brass sheets.	8 hrs		Workplace
		2.2.3 Explain identify and select the Brazing accessories.			
		I. Brazing process,	2 hrs		Class room
		II. Types of brazing filler metals,	2 hrs		Class room
		III. Brazing fluxes,	2 hrs		Class room
		IV. Melting Temperature of different metals,	1 hrs		Class room
		V. Melting temperature of brazing filler metals.	1 hr		Class room

		2.2.4 Braze the jobs on different metals. • Lap joint brazing on MS sheet. • Butt joint brazing on MS sheet. • Double lap joint brazing on MS sheet. • Brazing Non ferrous metals Cu, Brass, Stainless Steel. • Pipe on sheet / plate brazing	 8 hrs 8 hrs 8 hrs 8 hrs 8 hrs		 Workplace Workplace Workplace Workplace Workplace
2.3 Arc welding. .Provide knowledge and skill on welding process, tools, equipment, accessories, electricity, welding machines, welding different joints.	i. Explain Basic electricity, welding current. ii. Explain welding machines, equipment, and terminology. iii. Select the electrode, care and storage. iv. Strike an Arc and maintain the desired arc length.	**2.3.1 Explain the Basic Electricity terminologies and Units:** Conductor, Electrical Circuit, Current / Ampere, Voltage, Resistance and Watt. **2.3.2 Explain the Arc welding Electrical terminologies.** I. Alternating current (AC), Direct Current (DC). II. Open Circuit Voltage, Close Circuit (Arc) Voltage. III. Polarity (Straight and Reverse). **2.3.3 Distinguish the Welding Machines, their construction and use:** I. Transformer, II. Generator, III. Rectifier, **2.3.4 Identify and use the proper Tools and Equipment:** Cables, Electrode holder, Earth clamp, Welding screen / helmet, Chipping hammer, Steel wire brush, Leather apron, Leather gloves. **2.3.5 Identify, select, store the Arc welding Electrode:** I. Types of Core wire. II. Types of coating. III. Function of coating. IV. Identifying electrode. V. Selecting the correct electrode. VI. Caring and storing electrode.	 3 hrs 2 hrs 2 hrs 2 hrs 3 hrs 3 hrs 3 hrs 2 hrs 2 hrs 3 hrs 2 hrs 3 hrs 2 hrs 2 hrs	-Original Tools, -White/Chalk board, -OHP, -Information sheets, -Materials, -Exercise sheets -work sheets	 Class room Class room Class room Class room Class room Class room Class room Class room Class room Class room Class room Class room Class room Class room

		2.3.6 Explain the Welding Arc:			
		I. Method of striking an arc (Tapping / Scratching),	2 hr		Class room
		II. Maintaining the arc (Long, Standard, Short),	2 hr		Class room
		III. Running short beads.	2 hr		Class room
		2.3.7 Explain the factors for Running continuous Bead:	5 hrs		Class room
		I. Correct electrode.			
		II. Arc length.			
		III. Current and amperage.			
		IV. Speed of travel.			
		V. Electrode angle.			
		VI. Crater formation.			
		VII. Maintaining crater.			
		VIII. Breaking the arc.			
		IX. Restarting the arc.			
		X. Running continuous bead.			
		2.3.8 Select the proper Bead forming Motions: Straight, Crescent, Figure 8, Rotary, Triangle.	2 hrs		Class room
		2.3.9 Weld the jobs with Arc welding on Practical exercises:			
		I. Striking the arc MS 200x100x6mm (1piece).	6 hrs		Workplace
		II. Running short beads.	6 hrs		Workplace
		III. Breaking and restarting the arc.	6 hrs		Workplace
		IV. Straight bead weld.	10 hrs		Workplace
		V. Depositing metal by weaving motion between straight beads.	8 hrs		Workplace
		VI. Square butt joint flat.	10 hrs		Workplace
		VII. Lap joint single pass.	8 hrs		Workplace
		VIII. T-fillet joint single pass.	8 hrs		Workplace
		IX. T-fillet joints multiple pass.	8 hrs		Workplace
		X. Out side corner joint.	8 hrs		Workplace
		XI. V-butt joint flat.	12 hrs		Workplace
		XII. Straight bead in horizontal position.	10 hrs		Workplace
		XIII. Lap joint horizontal position single pass.	10 hrs		Workplace
		XIV. V-butt joint in horizontal position.	15 hrs		Workplace
		XV. Straight bead in vertical down position.	8 hrs		Workplace
		XVI. Straight bead in vertical up position.	10 hrs		Workplace
		XVII. Lap joint vertical up.	12 hrs		Workplace
		XVIII. Butt joint vertical up.	12 hrs		Workplace

		XIX. Pipe on plate	8 hrs		Workplace
		XX. Pipe weld fix.	15 hrs		Workplace
		XXI. Pipe weld horizontal	10 hrs		Workplace

Module 3 Title: Fabrication of Steel articles.
Objective of the Module: Describe and Design Fabrication of different steel structure and weld skillfully for Domestic and Building constructional use.
Duration: 150 hrs **Theory:** 30 hrs **Practical:** 120 hrs

Learning Unit	Learning Outcomes	Learning Elements	Duration	Material required	Learning place
3. Design and Weld the steel articles.	i. Imitate and draw the different designs seen surroundings i.e. gate, windows, grills, railings and fences etc. ii. Make templates, dies and fixtures for equal size and uniform shape / design. iii. Assemble and weld the fabricated parts in correct shape, design and size.	**3.1.1 Explain the Actual size and Fabrication size** Actual size of place, Tolerance / Margins of fitting, Actual making size, Type of design, Size of design.	6 hrs	-Original Tools, -White/Chalk board, -OHP, -Information sheets, -Materials, -Exercise sheets -work sheets	Class room
		3.1.2 Determine the steps of work process in making the articles considering the design.			
		I. Cutting of metals in size.	2 hrs		Class room
		II. Shaping or bending the pieces	3 hrs		Class room
		III. Placing the pieces in the fixture.	3 hrs		Class room
		IV. Tacking of pieces.	2 hrs		Class room
		V. Welding of pieces.	2 hrs		Class room
		VI. Hinge making	3 hrs		Class room
		VII. Hinge welding.	2 hrs		Class room
		VIII. Making door bolt.	3 hrs		Class room
		IX. Welding door bolt.	2 hrs		Class room
		X. Grinding and Finishing.	2 hrs		Class room
		3.1.3 Practical exercises: (Should be prepared as project in a group of 4-5 trainees).			
		i. Window with safety grill. (Hinges doors / Sliding doors).	20 hrs		Workplace
		ii. Door with solid sheet fitted with Threshold.	20 hrs		Workplace
		iii. Door with safety grill and lattice fitted.	20 hrs		Workplace
		iv. Railing in different design.	20 hrs		Workplace

Assessment

Module 1: Basic Metal work.

Learning unit	Theory hours	Workplace hours	Recommended formative assessment	Recommended Methodology	Scheduled Dates
1.1 Bench work. **1.2** Job, tools and personal safety. **1.3** Practical exercises. **1.4** Arithmetic's / Geometrical terminologies and problem solving. **1.5** Kinds of Welding their principles and use.	25 hrs	100	Identify select and use the Measuring tools. Identify select and use the Marking tools. Identify select and use the Cutting tools. Identify select and use the Files and Scrapers. Identify select and use the Grinding. Identify select and use the Drills / Counter Sinks. Identify select and use the Threading Explain and use the Safety Rules. Prepare the selected jobs according to the drawing. Solve the problems 0f Arithmetic's / Geometrical using Terminologies. Explain the different Kinds of Welding.	Objective/short ans./oral Objective/short ans./oral Objective/short ans./oral Objective/short ans./oral Objective/short ans./oral Objective/short ans./oral Objective/short ans./oral Objective/short ans./oral Practical Test Problem solving written test Objective/short ans./oral	

Module 2: Welding.

Learning unit	Theory hours	Workplace hours	Recommended formative assessment	Recommended Methodology	Scheduled Dates
2.1 Gas Welding	40 hrs	160 hrs	Identify and select the Gas welding equipment and accessories.	Objective/short ans./oral	
			Identify and Explain the types of welding joints.	Objective/short ans./oral	
			Identify and Explain the types of welding positions.	Objective/short ans./oral	
			Explain and select the Welding techniques.	Objective/short ans./oral	
			Select and use the Oxy-Acetylene Cutting techniques.	Objective/short ans./oral	
			Identify Welding defects (Arc & Gas), causes and select remedies.	Objective/short ans./oral	
			Weld the job with Gas welding on practical exercises	Practical Test	
2.2 Soldering and Brazing	15 hrs	60 hrs	Explain, Identify and select the Soldering accessories.	Objective/short ans./oral	
			Solder the Joints on various metals.	Practical Test	
			Explain identify and select the Brazing accessories.	Objective/short ans./oral	
			Braze the jobs on different metals.	Practical Test	
2.3 Arc Welding	50 hrs	200 hrs	Explain the Basic Electricity terminologies and Units.	Objective/short ans./oral	
			Explain the Arc welding Electrical terminologies.	Objective/short ans./oral	
			Distinguish the Welding Machines, their construction and use.	Objective/short ans./oral	
			Identify and use the proper Tools and Equipment.	Objective/short ans./oral	
			Identify, select and store the Arc welding Electrode.	Objective/short ans./oral	
			Explain the Welding Arc.	Objective/short ans./oral	

			Explain the factors for Running continuous Bead. Select the proper Bead forming Motions. Weld the jobs with Arc welding on Designed Practical exercises.	Objective/short ans./oral Objective/short ans./oral Practical Test	

Module 3: Fabrication of Steel articles.

Learning unit	Theory hours	Workplace hours	Recommended formative assessment	Recommended Methodology	Scheduled Dates
3.1 Design and Weld the steel articles.	30 hrs	120	Explain the Actual size and Fabrication size. Determine the steps of work process in making the articles considering the design. Practical exercises.	Objective/short ans./oral Objective/short ans./oral Practical Test	

Mechanical Welding (06 Months)

List of Tools, Equipment and Machines (For 20-25 Trainees)

List of Tools and Machines

Sr. No.	Name of Item	Quantity	Sr. No.	Name of Item	Quantity
1.	Steel rule 30 cm	25 Nos.	26.	Allen key set 3mm to 12mm	01 No.
2.	Steel Tape 3 meter	25 Nos.	27.	Hand shear straight 12”	06 Nos.
3.	Steel Tape 5 meter	06 Nos.	28.	Blow lamp kerosene oil	02 Nos.
4.	Sprit level 12 inch/30 Cm	06 Nos.	29.	Soldering Iron 300 Watt.	06 Nos.
5.	Work benches	13 Nos.	30.	Chisel flat & crosscut	25 nos. each
6.	Bench vice 5”	25 Nos.	31.	Centre punch	25 Nos.
7.	Hammer ball peen 500gm	25 Nos.	32.	Twist Drill set 25 pieces (3-13 mm)	02 Nos.
8.	Hammer cross peen 500 gm	25 Nos.	33.	Counter sink set 25 pieces (3-13 mm)	02 Nos.
9.	Hammer 1000 gm	06 Nos.	34.	Hand vice	06 Nos.
10.	Sledge hammer 8000 gm	06 Nos.	35.	Tape and die set (6-12 mm)	02 Nos.
11.	Hand Hacksaw frame (blade size 12”/30 cm)	25 Nos.	36.	Line scriber	25 Nos.
12.	Outside Caliper 6”/15 Cm	25 Nos.	37.	Vernier Caliper 6”	06 Nos.
13.	Inside Caliper 6”/15 Cm	25 Nos.	38.	Vernier height gauge	01 No.
14.	File flat 300 x 1	25 Nos.	39.	Angle plate	01 No.
15.	File half round 250 x 1	25 Nos.	40.	Safety goggle	12 Nos.
16.	File round 250 x 1	25 Nos.	41.	Pedestal drill machine	01 No.
17.	File triangular 200 x 1	25 Nos.	42.	Pedestal grinder heavy duty wheel size 300 x 50mm	01 No.
18.	Try square 8”	25 Nos.	43.	Electric Hand drill machine	01 No.
19.	Combination Pliers 8”	06 Nos.	44.	Power saw	01 No.
20.	Open end spanner set in Inch. (double end ¼ to 1”)	01 No.	45.	Bench shear	01 No.
21.	Open end spanner set in mm (double end 6mm to 32mm)	01 No.	46.	Hand disc grinder 7”	03 Nos.
22.	Screw driver straight 8” & 12”	04 Nos. each	47.	Hand disc grinder 4”	03 Nos.
23.	Screw driver Philips 8” & 12”	04 Nos. each	48.	Lever Shear Blade size 12” with profile cutting	01 no
24.	Spanner adjustable 8”, 10” & 12”	03 Nos. each	49.	Cutoff machine dia. 14” with angle adjustment	01 no
25.	Anvil 100 Kg with stand	01 No.	50		

Gas Welding Equipment and Accessories

Sr. No.	Name of Item	Quantity
26.	Gas welding working stations	6 Nos.
27.	Cylinder trolley or Manifold system (one)	5 Nos.
28.	Cylinder for Oxygen gas with key	10 N0s.
29.	Cylinder for Acetylene gas with key	10 Nos.
30.	Regulator (oxygen) double stage	5 Nos.
31.	Regulator (acetylene) double stage	5 Nos.
32.	Flashback arrester acetylene	5Nos.
33.	Flashback arrester oxygen	5 Nos.
34.	Hose pipe (oxygen) 4 meter each	40 meter.
35.	Hose pipe (acetylene) 4 meter each	40 meter.
36.	Oxy-acetylene welding and cutting set (injector type) complete with tip Cleaner needles.	5 Nos.
37.	Steel table with fire bricks top	6 Nos.
38.	Spark lighter	10 Nos.
39.	Welding goggles	25 Nos.
40.	Burner pliers or Tong	10 Nos.
41.	Stool	10 Nos.
42.	Table for gas cutting	01 N0.

Arc Welding Equipment and Accessories

Sr. No.	Name of Item	Quantity
43.	Welding Transformer 50-250 amp complete with leads, earth clamp and electrode holder	06 Nos.
44.	Welding Rectifier (AC / DC) 50-300 amp complete with leads, earth clamp and electrode holder	03 Nos.
45.	Welding Generator 50-350 amp complete with leads, earth clamp and electrode holder	01 Nos.
46.	Welding face shield complete	10 Nos.
47.	Welding helmet complete	10 Nos.
48.	Chipping hammer	10 Nos.
49.	Steel wire brush	20 Nos.
50.	Leather gloves (pair)	20 Nos.
51.	Leather apron	10 Nos.
52.	Welding Table	10 Nos.
53.	Stool	10 Nos.
54.	Electrode drier (electric)	01 No.
55.	Welding Booth	10 Nos.

Consumables (Minimum Required for Six Months)

Sr. No.	Name of Item	Quantity
1.	MS Channel 100x75x38x6mm	25pcs.
2.	MS Flat 100x62.5x15mm	25pcs.
3.	MS Flat 173x25 2.5mm	25pcs.
4.	Ms Sheet 132x162x1mm	25pcs.
5.	MS Sheet 150x100x1.5mm	350pcs.
6.	MS Sheet 150x50x1mm	50pcs.
7.	MS Sheet 150x50x3.2mm	50pcs.
8.	MS Pipe dia.50x3.2x50mm	200pcs.
9.	MS Sheet 50x25x1mm	100pcs.
10.	GI Sheet 50x25x22 SWG	100pcs.
11.	Copper Sheet 50x25x1mm	100pcs.
12.	Brass Sheet 50x25x1mm	100pcs.
13.	MS Sheet 100x50x1.6mm	150pcs
14.	Copper Sheet 100x50x1mm	50pcs.
15.	Brass Sheet 100x50x1mm	50pcs.
16.	Stainless Steel Sheet 100x50x1mm	50pcs.
17.	MS Sheet 100x100x3.2mm	25pcs.
18.	MS Sheet flat 200x100x6mm	250pcs.
19.	MS flat 200x50x6mm	450pcs.
20.	MS filler rod 1mm gas welding	10 kg.
21.	MS filler rod 2mm gas welding	10 kg.
22.	MS filler rod 3.2 mm gas welding	10 kg.
23.	Brazing filler rod 1.5 mm	5 kg
24.	Silver solder 50 / 50	1 kg
25.	Solder Tin + Lead, 60 / 40	3 kg
26.	Brazing flux for MS, Cu, Brass, Stainless steel	01 tin each
27.	Soldering fluxes MS, GI, Cu, Brass	01 tin each
28.	MS Electrode E-6013, Dia. 2.4 mm	250 kg
29.	MS Electrode E-6013, Dia. 3.2 mm	300 kg
30.	MS Electrode E-6013, Dia. 4mm	100 kg
31.	MS Electrode E-7018, Dia. 2.4mm	50 kg
32.	MS Electrode E-7018, Dia.3.2mm	50 kg
33.	Filter glass green shade # 10 (for face shield / helmet)	100 Nos.
34.	Clear glass (for face shield / helmet)	200 Nos.

35.	Filter glass green shade # 5 (for gas welding goggle)	100 Nos.
36.	Clear glass (for gas welding goggle)	100 Nos.
37.	MS flat 100x100x6mm	20 pcs.
38.	MS pipe dia. 100x50x6mm	100 pcs

Reference Books for Trainer

1. Modern Welding
   By Althhouse - Turnquist - Bowditch.

2. Welding Skills and Practices
   By Giachino - Weeks.

3. Welding Skills
   By Giachino - Weeks.

4. Welding Principles & Practices
   By Sacks.

5. Practical Welding Technology
   By Rudy Mohler.

6. Principles of Welding Technology
   By L. M. Gourd.

7. Oxy-Acetylene Welding basic fundamentals
   By Ronald J. Baird.

8. Brazing and soldering of Metals
   N. Lashko - S. Lashko

9. Technology of the Metal Trade (GTZ)
   Appold - Feiler - Reinhard - Schmith.

10. Oxy-Acetylene handbook,
    By LINDE

Supportive notes on Assessment

- Monthly Theory test (Objective / short answer type) should be conducted.
- Each practical exercise should be marked on the provided marking criteria.
- Final theory test should be Objective / Short answer type, not more than 30minutes.
- Final practical test should be from the skill, the trainees have performed during training.

Passing Marks in Theory each Test		40 %
Passing Marks in Practical each exercise		60 %

RESULT:

Sessional marks obtained in Theory	(A)	20%
Final Marks obtained in Theory	(B)	80%

Total (A + B) = "C"

Sessional Marks obtained in Practical	(D)	30%
Final Marks obtained in Practical	(E)	70%

Total (D + E) = "F"

Certification Marks will be in percentage = 20 % of "C" + 80% of "F"

General Recommendations

Lesson plans

The teacher should prepare lesson plans for the classroom for each topic. This will provide guideline to the teacher regarding;

a. Topic.
b. Objectives.
c. Teaching aids required.
d. Motivation.
e. Sequence of knowledge transfer.
f. Chalkboard / Whiteboard layout to be developed during lesson delivery.
g. Revision of important points.
h. Test the Achievement of trainees.

Workshop

In order to facilitate the Trainees to develop the desired skills and competencies, it is recommended that:

a. Practical activities by the trainees should be carried out individually.
b. Workshop should be fully equipped as stipulated in the curriculum.
c. Budget provision should be made to replace/purchase the latest tools and equipments to up date the equipment.
d. Recommended consumables should be provided for practical in reasonable quantity.
e. The teacher should himself be able to make / demonstrate the practical exercises to the desired skill level.