National Vocational Certificate
Level 2 in Mechanical Technology (Welding)

Competency Standards

NATIONAL VOCATIONAL & TECHNICAL TRAINING COMMISSION

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1. INTRODUCTION

A welder is a tradesman who specializes in joining materials together. The term welder refers to the operator; the machine is referred to as the welding power supply. The materials to be joined can be metals (such as steel, aluminum, brass, stainless steel etc.). Welders typically have to have good dexterity and attention to detail, as well as some technical knowledge about the materials being joined and best practices in the field.

Welding, without the proper precautions appropriate for the process, can be a dangerous and unhealthy practice. However, with the use of new technology and proper protection, the risks of injury and death associated with welding can be greatly reduced. Because many common welding procedures involve an open electric arc or flame, the risk of burns is significant. To prevent them, welders wear personal protective equipment in the form of heavy leather gloves and protective long sleeve jackets to avoid exposure to extreme heat and flames. Additionally, the brightness of the weld area leads to a condition called arc eye in which ultraviolet radiation causes the inflammation of the cornea and can burn the retinas of the eyes. Full face welding helmets with dark face plates are worn to prevent this exposure, and in recent years, new helmet models have been produced that feature a face plate that self-darkens upon exposure to high amounts of UV radiation. To protect bystanders, opaque welding curtains often surround the welding area. These curtains, made of a polyvinyl chloride plastic film, shield nearby workers from exposure to the UV radiation from the electric arc, but should not be used to replace the filter glass used in helmets.

Welders are also often exposed to dangerous gases and particulate matter. Processes like flux-cored arc welding and shielded metal arc welding produce smoke containing particles of various types of oxides, which in some cases can lead to medical conditions like metal fume fever. The size of the particles in question tends to influence the toxicity of the fumes, with smaller particles presenting greater danger. Additionally, many processes produce fumes and various gases, most commonly carbon

dioxide and ozone, that can prove to be dangerous if ventilation is inadequate. Furthermore, because the use of compressed gases and flames in many welding processes pose an explosion and fire risk, some common precautions include limiting the amount of oxygen in the air and keeping combustible materials away from the workplace. Welders with expertise in welding pressure vessels, including submarine hulls, industrial boilers, and power plant heat exchangers and boilers, are generally referred to as boiler-makers.

Name of course:

Welder (SMAW, GMAW, GTAW, SAW)
6 Months (800 hrs)

Overall objectives of course:

1. The prime objective of this course of Welder is to develop and enhance the skill level of the incumbent in the industry.
2. Semi-skilled and skilled worker produced by this training would help to reduce unemployment and poverty in the society.
3. To impart the training and provide the industry with workforce whose scope with job knowledge and skills are identified.
4. This curriculum is designed to train the Middle / Matric pass persons who are facing a lot of shortage of Welders in the field of industry.
5. This training program will provide opportunity to those who want to equip themselves with such knowledge and skills which will be helpful for their employment after completing this training of 06 months and would enable them to start their own business with professional approach.

6. Further, this Curriculum is developed by considering the requirements of local and international market and need of the trade enabling the pass-outs to meet the job market to reduce the shortage of Semi Skilled and Skilled workers in the area.
7. To establish coordination among employer's, workers and government relating to human resource development programs.
8. Provide technical and vocational training basis which reflects the requirements of the industry.

Competencies gained after completion of course

Knowledge based Competencies:

1. Safety precautions applicable to Welding machines, hand tools, equipment, tools and during welding operations.
2. The common types of materials and their uses.
3. Express the knowledge of welding, marking, identifying of material, cutting tools & instruments, their uses and safety.
4. Define basic principles of welding symbols, read & interpretation of drawings, bevel preparation and tacking.
5. Describe the knowledge of Arc (SMAW) welding equipment, their use and safety.
6. Express knowledge of (GMAW) welding equipment, their use and safety.
7. Express knowledge of (GTAW) welding equipment, their use and safety.
8. Express knowledge of (SAW) welding equipment, their use and safety.
9. Describe the knowledge of welding joints, positions, their use and selection.
10. Express the knowledge of inspecting and testing welded joints to ensure weld quality.
11. Understand application of work Permit, WPS&instruction sheet etc.
12. Understand welding defects, their identification and rectification process.

Skill related Competencies:

1. Observe all safety precautions about tools and equipment.
2. Common working hand tools (measuring, grinding, cutting tools, welding tools), their use and maintenance.
3. Preparation of workplace.
4. Grinding on work piece / job.
5. Use pencil grinders and cutting machine / discs for the preparation of work piece.
6. Measure, cut and place job according to the given size.
7. Making bevel of the job to make it ready for welding.
8. Tacking the two welding pieces for joint.
9. SMAW welding of common welding joints in different positions.
10. GMAW welding of common welding joints in different positions.
11. GTAW welding of common welding joints in different positions.
12. SAW welding of common welding joints.
13. Inspect and test weld joints.
14. Distinguish different metals & electrodes.
15. Understand electricity & control of welding machines.
16. Able to make bevel & cuts by grinders.
17. Able to prepare his job according to instruction sheet / WPS

Sequence of the modules:

Module A:Follow Safety Rules

Aim: This is designed to follow safety rules at workplace by welder in accordance with the organization's approved guidelines and procedures. Trainee will be expected to apply personal safety measures, Apply workplace safety measures, Apply tools & equipment safety measures and Apply job/work piece safety measures at all times.

Module B:Perform Maintenance Operation

Aim: This Module is designed to perform maintenance operations at workplace by welder in accordance with the organization's approved guidelines and procedures. Trainee will be expected to inspect welding equipment, replace damaged tools, clean welding equipment and accessories at the workplace.

Module C: Learn types of materials, weld joints and welding positions:

Aim: This Module identifies the competencies required to learn types of materials, weld joints and welding positions by welder as per requirement of the job. Trainee will be expected to know about different types of materials used in industry and learn about different types of weld joints and welding positions encountered during welding. Trainee's underpinning knowledge regarding types of materials, weld joints and welding positions will be sufficient to provide the trainee the basics of the subject.

Module D:Perform Shielded Metal Arc Welding (SMAW) Operations

Aim: This module is designed to perform Shielded Metal Arc Welding (SMAW) Operations at workplace by welder in accordance with the organization's approved guidelines and procedures. Trainee is expected to organize the workplace for welding, prepare the

base metal for welding, perform operations related to Shielded Metal Arc Welding (SMAW) and perform post welding operations at the workplace.

Module E:Perform Gas Metal Arc Welding (GMAW) Operations

Aim: This module is designed to perform Gas Metal Arc Welding (GMAW) operations at workplace by welder in accordance with the organization's approved guidelines and procedures. Trainee is expected to organize the workplace for welding, prepare the base metal for welding, perform operations related to Gas Metal Arc Welding (GMAW) and perform post welding operations at the workplace.

Module F:Perform Gas Tungsten Arc Welding (GTAW) Operations

Aim: This module is designed to perform Gas Tungsten Arc Welding (GTAW) operations at workplace by welder in accordance with the organization's approved guidelines and procedures. Trainee is expected to organize the workplace for welding, prepare the base metal for welding, perform operations related to Gas Tungsten Arc Welding (GTAW) and perform post welding operations at the workplace.

Module G:Perform Submerged Arc Welding (SAW) Operations

Aim: This module is designed to perform Submerged Arc Welding (SAW) operations at workplace by welder in accordance with the organization's approved guidelines and procedures. Trainee is expected to organize the workplace for welding, prepare the base metal for welding, perform operations related to Submerged Arc Welding (SAW) and perform post welding operations at the workplace.

Module H: Repair welding defects

Aim: This module is designed to perform repairing of welding defects at workplace by welder in accordance with the organization's approved guidelines and procedures. Trainee is expected to identify and repair defected areas of job/work pieces at the workplace.

Module I: Develop Professionalism

Aim: This module is designed to develop Professionalism by welder in accordance with the organization's approved guidelines and procedures. Trainee is expected to perform communication with others, upgrade professional skills and work in a team.

Job opportunities available immediately and in the future

- Steel manufacturing industry.
- Construction industry.
- Fertilizer industry
- Chemical industry
- Sugar industry
- Industrial projects.
- Shipyards.
- Railways.
- 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 etc.

Entry Qualifications:

The trainee selected should be minimum Matric in qualification, whereas Middle pass may also be considered, who have earned practical experience of welding prior to the admission.

Minimum qualification of Trainer:

1. D.A.E / B. Tech: / B.E. / B.Ed.Tech:with 2 year experience in the field of welding

2. CSWIP / TTC Certificate coursewith 5-year experience as welding trainer
   (Familiar with Computer Application).

Medium of instruction:

Medium of instruction would be Urdu, but the English would also be there, as the jargons, terminologies, standards, tools and equipment name are in English and they must be learnt in the same language.

Suggested Personality Traits

- Person should be mentally and physically fit.
- Can work in any working environment.

2. OVERVIEW OF THE CURRICULUM FOR WELDER TRADE

Module Title and Aim	Learning Units	Theory hours	Workplace hours	Timeframe of modules
Module 1:Follow Safety Rules **Aim:** This is designed to follow safety rules at workplace by welder in accordance with the organization's approved guidelines and procedures. Trainee will be expected to apply personal safety measures, Apply workplace safety measures, Apply tools & equipment safety measures and Apply job/work piece safety measures at all times.	**LU1**.Apply personal safety measures **LU2**.Apply workplace safety measures **LU3**.Apply tools & equipment safety measures **LU4**.Apply job/work piece safety measures	10	40	50
Module 2:Perform Maintenance Operation **Aim:** This Module is designed to perform maintenance operations at workplace by welder in accordance with the organization's approved guidelines and procedures. Trainee will be expected to inspect welding equipment, replace damaged tools, clean welding equipment and accessories at the workplace.	**LU1**. Inspect the welding equipment **LU2**. Replace damaged tools **LU3**. Clean welding equipment and accessories	10	40	50

Module Title and Aim	Learning Units	Theory hours	Workplace hours	Timeframe of modules
Module 3:Learn types of materials, weld joints and welding positions: **Aim:**This Module identifies the competencies required to learn types of materials, weld joints and welding positions by welder as per requirement of the job. Trainee will be expected to know about different types of materials used in industry and learn about different types of weld joints and welding positions encountered during welding. Trainee's underpinning knowledge regarding types of materials, weld joints and welding positions will be sufficient to provide the trainee the basics of the subject.	**LU1. Identify types of Material** **LU2. Prepare weld joint** **LU3: Employ Welding Positions**	6	6	12
Module4:Perform Shielded Metal Arc Welding (SMAW) Operations **Aim:** This module is designed to perform Shielded Metal Arc Welding (SMAW) Operations at workplace by welder in accordance	**LU1**. Organize the workplace for welding **LU2**. Prepare the base metal for welding	24	114	138

Module Title and Aim	Learning Units	Theory hours	Workplace hours	Timeframe of modules
with the organization's approved guidelines and procedures. Trainee is expected to organize the workplace for welding, prepare the base metal for welding, perform operations related to Shielded Metal Arc Welding (SMAW) and perform post welding operations at the workplace.	**LU3**. Perform operations related to Shielded Metal Arc Welding (SMAW) **LU4**. Perform post welding operations			
Module 5:Perform Gas Metal Arc Welding (GMAW) Operations **Aim:** This module is designed to perform Gas Metal Arc Welding (GMAW) operations at workplace by welder in accordance with the organization's approved guidelines and procedures. Trainee is expected to organize the workplace for welding, prepare the base metal for welding, perform operations related to Gas Metal Arc Welding (GMAW) and perform post welding operations at the workplace.	**LU1**. Organize the workplace **LU2**. Prepare the base metal for welding **LU3**. Perform operations related to Gas Metal Arc Welding (GMAW) **LU4**. Perform post welding operations	30	120	150
Module 6:Perform Gas Tungsten Arc Welding (GTAW) Operations		40	160	200

Module Title and Aim	Learning Units	Theory hours	Workplace hours	Timeframe of modules
Aim: This module is designed to perform Gas Tungsten Arc Welding (GTAW) operations at workplace by welder in accordance with the organization's approved guidelines and procedures. Trainee is expected to organize the workplace for welding, prepare the base metal for welding, perform operations related to Gas Tungsten Arc Welding (GTAW) and perform post welding operations at the workplace.	**LU1**. Organize the workplace **LU2**. Prepare the base metal for welding **LU3**. Perform operations related to Gas Tungsten Arc Welding (GTAW) **LU4**. Perform post welding operations			
Module 7:Perform Submerged Arc Welding (SAW) Operations **Aim:** This module is designed to perform Submerged Arc Welding (SAW) operations at workplace by welder in accordance with the organization's approved guidelines and procedures. Trainee is expected to organize the workplace for welding, prepare the base metal for welding, perform operations related to Submerged Arc Welding (SAW) and perform post welding	**LU1**. Organize the workplace **LU2**. Prepare the base metal for welding **LU3**. Perform operations related to Submerged Arc Welding (SAW) Operations **LU4**. Perform post welding operations	20	80	100

Module Title and Aim	Learning Units	Theory hours	Workplace hours	Timeframe of modules
operations at the workplace.				
Module 8: Repair welding defects **Aim:** This module is designed to perform repairing of welding defects at workplace by welder in accordance with the organization's approved guidelines and procedures. Trainee is expected to identify and repair defected areas of job/work pieces at the workplace.	**LU1**. Identify the defected areas of job/work piece **LU2**. Repair defected areas of job/work piece	10	40	50
Module 9: Codes, Standards, Specifications, and Welding Qualifications **Aim:** This Module identifies the competencies required to learn different international welding codes and agencies that set codes and standards. This module also defines the scope of three popular international welding codes, namely API 1104, ASME Sec-IX (BPVC) and AWS D1.1 and explains their areas of applications. Trainee will be expected to get basic knowledge of WPS, PQR and WPQ and different types of tests required for welding procedure and	**LU1.** Identify applicable standards, codes, and specifications **LU2:** Comply with requirements of welding codes **LU3:** Comply with Welding Procedure Specifications (WPS)	10	0	10

Module Title and Aim	Learning Units	Theory hours	Workplace hours	Timeframe of modules
welder/operator qualifications. Trainee's underpinning knowledge will be sufficient to provide the trainee the basics of the subject.				
Module 10: Develop Professionalism **Aim:** This module is designed to develop Professionalism by welder in accordance with the organization's approved guidelines and procedures. Trainee is expected to perform communication with others, upgrade professional skills and work in a team.	**LU1**. Perform Communication with others **LU2**. Upgrade professional skills **LU3**. Work in a team	10	40	50

3. TEACHING AND LEARNING GUIDE FOR WELDER TRADE

3.1. Module A: Follow Safety rules

Overview: This Module identifies the competencies required to follow safety rules at workplace by welder in accordance with the approved guidelines and procedures of organization. Trainee is expected to apply personal safety measures, workplace safety measures, tools and equipment safety measures and job/work place safety measures at all times.

Total Hours: 50 Theory Hours: 10 Practical Hours: 40

Module Title and Aim	Learning Outcome	Learning Elements	Time Duration (Th/Pr)	Tools and Equipment	Learning Place
LU1.Apply personal safety measures	**Trainee will be able to:** • Select personal protective equipment in terms of type as per needs • Pick the appropriate quantity according to work permit. • Wear and adjust properly the suitable PPEas required. • Maintain personal protective equipment to ensure correct fit and optimum protection in compliance with company procedures. • Ensure personal protective equipment is cleaned and stored at proper place.	• Explain Importance of using Personal Protective Equipment (PPE) • Define Types of PPE., eyes, hands and feet protection. • Familiarize with Protective clothing and equipment (PPE) to be worn. • Locate from where it can be obtained. • Explain safe maintenance of PPEs. Cleaning and placement of the tools in proper place after completion of work .	**2/10 hours**	Leather apron, safety gloves, safety goggles, welding helmet, safety shoes, ear plug, safety belt, fume mask, dungaree	Class Room / Workshop

LU2.Apply workplace safety measures	**Trainee will be able to:** • Describe Workplace safety guidelines. • Explain Specific company procedures regarding workplace safety. • Explain procedure for cleaning and storing of tools and equipment at workplace. • Develop the importance of clean workplace and exhaust arrangement.	• Explain Importance of safety at workplace including: - Ensure Ventilation - No Inflammable material nearby - Secure gas cylinders - Availability of Fire extinguishers - Secure Electrical connections - Ensure Earthing - No light reflection - Ensure availability of welding booths - Emergency exit - Exhibit housekeeping at workplace according to organizational guidelines - Ensure the availability of first aid box at the workplace - Display a list of emergency contact numbers at workplace • Place tools and equipment in proper place after completion of task. • Arrange Proper light at workplace.	**2/10 hours**	Fire extinguisher, Tool box/bins, Safety covers, First aid box, welding table, fume extractor, lighting system, PPE	Class Room / Workshop
LU3.Apply tools and equipment safety measures	**Trainee will be able to:** • Apply safety measures for selected tools and equipment at workplace: • Demonstrate use fire blankets	• Establish importance of tools and equipment safety and its implications. • Display the use of cleaning tools and equipment	**3/10 hours**	Safety manuals, safety instruction sheets, cleaning	Class Room / Workshop

	• Demonstrate use first aid box • Demonstrate use of Fire Extinguisher. • Perform cleaning of tools and equipment before and after the job • Ensure safe placement of measuring and cutting tools • Follow tools and equipment safety instruction manuals	• Electric Welding machine and equipment • Gas welding/cutting equipment • Mechanical cutting and beveling machines • Describe the importance of safe handling and placement of measuring and cutting tools • Apply the safety manual instructions • Explain Specific company procedures regarding tools and equipment safety. • Illustrate procedure for cleaning and storing of tools and equipment at workplace. • Place welding machine at least one and half feet away from wall. Welding and earth cable should be 15 feet long, Earth clamp must be lightly gripped with welding table. Two and half feet high table should be used for cutting procedure and fire brick should be used on cutting table. Gas connection should be fully tightened.		tools and equipment	
LU4.Apply job/work place safety measures	**Trainee will be able to:** • Follow the work permit for the work piece safety • Apply the following safety measures	• Read and implement work permit according to the nature of job	**3/10 hours**	Safety instructions, cleaning tools and	Class

	for the work piece safety • Workplace/job is free from dust, oil, grease, paint and moisture • Safely cover the job/work piece after the duty • Safely place the job/work piece after the duty . Apply safe handling of job/work piece during . Welding . Loading/unloading . Transportation • Follow specific job/work piece safety instructions	• Describe the importance of job/work place, safety welded work / job should be cooled before placing. • Demonstrate safe handling and transportation of job/ work piece • Explain specific job/ work piece safety instructions, Donot cool the job in water slag should be removed after cooling of the job, chipping hammer and wire brush should be used for cleaning of job.		equipment, cranes, lifters, hand trolleys	Room / Workshop

3.2. MODULE B: Perform Maintenance Operation

Overview: This Module identifies the competencies required to perform maintenance operations at workplace by welder in accordance with the approved guidelines and procedures of organization. You will be expected to inspect welding equipment, replace damaged tools and clean welding equipment and accessories at the workplace. Your underpinning knowledge regarding maintenance operations will be sufficient to provide you the basis for your work.

Total : 50 hrs Theory: 10hrs Practical: 40 hrs

Module Title and Aim	Learning Outcome	Learning Elements	Time Duration (Th/Pr)	Tools and Equipment	Learning Place
LU1. Inspect the welding equipment	**Trainee will be able to:** • Carry out following visual inspection of welding equipment before starting the work I. Check electrical/gas connections II. Check the working of torch coolant system III. Check the working of handy tools (grinding, cutting and cleaning tools) • Follow the organizational instructions during regular inspection of welding equipment • Apply specific safety precautions associated with welding equipment usage	• Guide the trainees how to carry out periodical inspection of the cooling system for their proper working condition. • Demonstrate organizational instructions regarding regular equipment inspection. • Describe specific safety precautions associated with welding equipment usage	4/14	Instruction sheets, safety manuals, Personal Protection Equipment (PPE)	Class Room / Workshop

Module Title and Aim	Learning Outcome	Learning Elements	Time Duration (Th/Pr)	Tools and Equipment	Learning Place
	• Report faults to the supervisor.				
LU2. Replace damaged tools	**Trainee will be able to:** • Arrange tools and equipment required for the replacement of damaged tools. • Identify the damaged tools. • Replace the damaged tools. • Apply specific safety precautions associated with equipment usage • Ensure proper working of replace part / tool.	• Demonstrate the use of tools and equipment required for the job • Identify the hazards related to the usage of damaged tools • Demonstrate the procedure of repair and replacement of damaged tools. • Demonstrate specific safety precautions associated with equipment usage	3/14	Star set, screw driver set, adjustable wrench, pliers, socket set, Allen key set, Open-end ring spanner, multi-meter, pedestal grinders, PPE, etc.	Class Room / Workshop
LU3. Clean welding equipment and accessories	**Trainee will be able to:** • Arrange cleaning tools and material required for welding equipment • Apply cleaning procedures to clean welding equipment and accessories • Apply specific safety precautions associated with welding equipment and accessories.	• Demonstrate usage of tools required for welding equipment • Explain hazards associated with usage of unclean equipment • Illustrate specific safety precautions associated with usage of welding equipment.	3/12	Blower, dusters, wire brush, acetone, liquid cleaner, luster, tip cleaner, anti spatter spray, PPE	Class Room / Workshop

3.3. MODULE C: Learn types of materials, weld joints and welding positions:

Overview: This Module identifies the competencies required to learn types of materials, weld joints and welding positions by welder as per requirement of the job. Trainee will be expected to know about different types of materials used in industry and learn about different types of weld joints and welding positions encountered during welding. Trainee's underpinning knowledge regarding types of materials, weld joints and welding positions will be sufficient to provide the trainee the basics of the subject.

Total: 12 Hrs Theory: 6 Hrs Practical: 6Hrs

Module Title and Aim	Learning Outcome	Learning Elements	Time Duration (Th/Pr)	Tools and Equipment	Learning Place
LU1. Identify types of Material	**Trainee will be able to:** • inspect metals for identification - Identify metals by visual inspection - Perform flame, chip, spark and file tests	• Describe types of metals by their physical characteristics: - visualappearance - colour - relative weight - typical shape - texture • Describe mechanical and thermal tests foridentifying metals - Chip - Spark - Hardness - Files - Center punch	2/2	Materials - Steel - Cast steel - Cast irons - Copper - Brass and bronze - Aluminum - Stainless steel - Lead - Magnesium - Zinc Grinders Hardness Tester Files Chiesel	Class Room / Workshop

Module Title and Aim	Learning Outcome	Learning Elements	Time Duration (Th/Pr)	Tools and Equipment	Learning Place
		- Chisel - Flame - Magnetic - Non-magnetic - Slightly magnetic - Melting point		Magnet	
LU2. Prepare weld joint	**Trainee will be able to:** • Recognize different types of weld joints. • Know different methods of joint preparations	• Elaborate different types of weld joints. - Butt joint - Lap joint - Corner joint - T- joint - Edge joint • Demonstrate joint preparation methods: - Gas cutting - Plasma cutting - Mechanical cutting - Grinding	2/2	Grinder, Beveling machine, Gas Cutting machine,	Classroom / Workshop
LU3: Employ Welding Positions	**Trainee will be able to:** • Become familiar with different welding positions. • Utilize different welding positions during welding	• Demonstrate different welding positions during welding. - Flat - Horizontal - Vertical - Over Head	2/2	Literature, Books	Classroom / Workshop

3.4. MODULE D. Perform Shielded Metal Arc Welding (SMAW) Operations

Overview: This Module identifies the competencies required to perform Shielded Metal Arc Welding (SMAW) Operations at workplace by welder in accordance with the approved guidelines and procedures of organization. You will be expected to organize the workplace for welding, prepare the base metal for welding, perform operations related to Shielded Metal Arc Welding (SMAW) and perform post welding operations at the workplace. Your underpinning knowledge regarding Shielded Metal Arc Welding (SMAW) operations will be sufficient to provide you the basis for your work.

Total: 138 Hrs Theory: 24 Hrs practical: 114 Hrs

Module Title and Aim	Learning Outcome	Learning Elements	Time Duration (Th/Pr)	Tools and Equipment	Learning Place
LU1. Organize the workplace for SMAW welding	**Trainee will be able to:** • Arrange the workplace according to the requirement of the job: • Apply safety measures as per job requirement: • Prepare the required SMAW welding machine as per job requirement:	• Explain the equipment and principles of SMAW process. • Illustrate requirement of a workplace for SMAW welding of specific job: - SMAW Welding booth/fire blanket - SMAW Welding machine and accessories - Electric supply - Jigs and fixtures - Lighting • Explain organizational safety rules and guidelines: - Ventilation	6/28	SMAW Welding machine, grinder, chipping hammer, wire brush, electrode oven, desiccators, jigs and fixtures, lights, exhaust fans, fire blankets, fire extinguishers, first aid box, PPE	Class Room / Workshop

Module Title and Aim	Learning Outcome	Learning Elements	Time Duration (Th/Pr)	Tools and Equipment	Learning Place
		- Fire extinguishers - First Aid box - Emergency alarm/light - Ambulance Personal protective equipment • Demonstrate preparation of welding machine including: - Type of current (AC/DC) • Current polarity			
LU2. Prepare the base metal for SMAW welding	**Trainee will be able to:** • Arrange tools and cleaning chemicals required for the job • Prepare joint as per instruction sheet. • Follow instructions for SMAW welding according to the requirement. • Apply specific safety precautions associated with SMAW welding process	• Illustrate usage of required tools and chemicals (acetone, ethynol etc.) • Explain importance of joint preparation, cleaning and tacking - preparation - cleaning - Tacking • Elaborate instruction sheet • Explain specific safety precautions associated with SMAW welding process	6/28	Grinders, cutters, beveling machine, files, measuring tools, acetone, SMAW welding equipment, desiccators, electrodes, WPS/ instruction sheet, PPE	Class Room / Workshop
LU3. Perform operations	**Trainee will be able to:** • Arrange electrode and pre-heating	• Elaborate specification/	5/28	SMAW Welding	Class Room / Workshop

Module Title and Aim	Learning Outcome	Learning Elements	Time Duration (Th/Pr)	Tools and Equipment	Learning Place
related to Shielded Metal Arc Welding (SMAW)	equipment as per instruction sheet • Adjust electrical parameters as per instruction sheet. • Perform SMAW welding as per instruction sheet • Apply specific safety precautions associated with SMAW welding process	classification of electrode required for job • Explain instruction sheet. • Establish importance of pre heating • Show how to adjust SMAW welding parameters and their effects on SMAW welding - Pre heat the job, if required - Perform SMAW welding operation - Inter-pass cleaning - Inter-pass inspection • Demonstrate SMAW welding operation as per instruction sheet • Explain specific safety precautions associated with SMAW welding process		machine, electrodes, pre-heating equipment, grinders, wire brush, chipping hammer, temple sticks, desiccators, PPE, instruction sheet	
LU4. Perform post SMAW welding operations	**Trainee will be able to:** • Apply post SMAW weld cleaning process: • Perform post-heating of the job as	• State the importance of post weld cleaning. • Removal of slag • Removal of jigs and fixtures	7/30	SMAW Welding machine, electrodes, post-heating equipment,	Class Room / Workshop

Module Title and Aim	Learning Outcome	Learning Elements	Time Duration (Th/Pr)	Tools and Equipment	Learning Place
	per instruction sheet, if required • Execute specific safety precautions associated with SMAW welding process	• Removal of spatters • Identify and explain visual defects. - Undercut - Porosity - Excessive Reinforcement - Lack of penetration etc. • Elaborate purpose of post-heating. • Elaborate specific safety precautions associated with SMAW welding process.		grinders, wire brush, chipping hammer, desiccators, PPE, instruction sheet	

3.5. Module E. Perform Gas Metal Arc Welding (GMAW) Operations

Overview: This Module identifies the competencies required to perform Gas Metal Arc Welding (GMAW) operations at workplace by welder in accordance with the approved guidelines and procedures of organization. Trainee is expected to organize the workplace for welding, prepare the base metal for welding, perform operations related to Gas Metal Arc Welding (GMAW) and perform post welding operations at the workplace.

Total: 150 hrs Theory: 30 hrs Practical: 120 hrs

Module Title and Aim	Learning Outcome	Learning Elements	Time Duration (Th/Pr)	Tools and Equipment	Learning Place
LU1. Organize the workplace for GMAW welding	**Trainee will be able to:** • Arrange the workplace according to the requirement of the job: • Apply safety measures as per instruction sheet. • Prepare the required GMAW welding machine as per job requirement: - Type of current (AC/DC) - Current polarity	• Explain the equipment and principles of GMAW process. • Illustrate requirement of a workplace for GMAW welding specific job - GMAW Welding booth/fire blanket - GMAW Welding machine and accessories - Electric supply - Jigs and fixtures - Lighting • Explain organizational safety rules and guidelines - Ventilation - Fire extinguishers - First Aid box - Emergency alarm/light - Ambulance	8/30 hrs	GMAW Welding machine and gas cylinders (CO_2, Argon) with accessories, grinder, chipping hammer, wire brush, wire cutter, anti spatter spray, wire spool, jigs and fixtures, lights, exhaust fans, mig plier, fire blankets, fire extinguishers, first aid box, PPE	Class Room / Workshop

Module Title and Aim	Learning Outcome	Learning Elements	Time Duration (Th/Pr)	Tools and Equipment	Learning Place
		- Personal protective equipment • Demonstrate preparation of GMAW welding machine including: • Type of current (AC/DC) • Current polarity (straight / reverse) • Gas flow rate • Torch angle			
LU2. Prepare the base metal for GMAW welding	**Trainee will be able to:** • Arrange tools and cleaning chemicals required for the job • Prepare joint as per instruction sheet: • Follow instruction sheet for welding • Apply specific safety precautions associated with GMAW welding process	• Illustrate usage of required tools and chemicals (acetone, anti-spatter spray etc,) • Explain importance of joint preparation, cleaning and tacking - preparation - cleaning - Tacking • Elaborate instruction sheet • Explain specific safety precautions associated with GMAW welding process	8/30 hrs	Grinders, cutters, beveling machine, files, measuring tools, acetone, instruction sheet, PPE	Class Room / Workshop

Module Title and Aim	Learning Outcome	Learning Elements	Time Duration (Th/Pr)	Tools and Equipment	Learning Place
LU3. Perform operations related to Gas Metal Arc Welding (GMAW)	**Trainee will be able to:** • Arrange wire spool, gas cylinder (CO2, argon, helium) with accessories and pre-heating equipment as per instruction sheet • Adjust GMAW welding parameters as per instruction sheet • Perform GMAW welding as per instruction sheet • Apply specific safety precautions associated with GMAW welding job/process	• Elaborate specification/ classification of electrode required for job • Explain instruction sheet. • Establish importance of pre heating • Show how to adjust GMAW welding parameters and their effects on welding • Demonstrate GMAW welding operation as per instruction sheet - Pre heat the job, if required - Perform GMAW welding operation - Inter-pass cleaning - Inter-pass inspection • Explain specific safety precautions associated with GMAW welding process	7/30 hrs	GMAW Welding machine and gas cylinders (CO2, Argon) with accessories, grinder, chipping hammer, wire brush, wire cutter, anti spatter spray, wire spool, jigs and fixtures, lights, exhaust fans, fire blankets, fire extinguishers, first aid box, PPE, instruction sheet	Class Room / Workshop
LU4. Perform post GMAW welding operations	**Trainee will be able to:** • Apply post weld cleaning process:	• State the importance of post GMAW weld cleaning. • Removal of slag	7/30 hrs	GMAW Welding machine and gas cylinders (CO_2, Argon)	Class Room / Workshop

Module Title and Aim	Learning Outcome	Learning Elements	Time Duration (Th/Pr)	Tools and Equipment	Learning Place
	• Identify visual defects. • Perform post-heating of the job as per instruction sheet, if required • Execute specific safety precautions associated with GMAW welding process	• Removal of jigs and fixtures • Removal of spatters • Identify and explain visual defects. - Undercut - Porosity - Excessive Reinforcement - Lack of penetration etc. • Elaborate purpose of post-heating. • Elaborate specific safety precautions associated with GMAW welding process.		with accessories, anti spatter spray, wire spool, post-heating equipment, grinders, wire brush, chipping hammer, PPE, instruction sheet	

3.6. Module F. Perform Gas Tungsten Arc Welding (GTAW) / Tungsten Inert Gas Welding (TIG) Operations

Overview: This Module identifies the competencies required to perform Gas Tungsten Arc Welding (GTAW) operations at workplace by welder in accordance with the approved guidelines and procedures of organization. Trainee is expected to organize the workplace for welding, prepare the base metal for welding, perform operations related to Gas Tungsten Arc Welding (GTAW) and perform post welding operations at the workplace.

Total: 200 Hrs Theory: 40 Hrs practical: 160 Hrs

Module Title and Aim	Learning Outcome	Learning Elements	Time Duration (Th/Pr)	Tools and Equipment	Learning Place
LU1. Organize the workplace for GTAW / TIG welding	**Trainee will be able to:** • Arrange the workplace according to the requirement of the job: • Apply safety measures as per work permit: • Prepare the required GTAW / TIG welding machine as per job requirement:	• Explain the equipment and principles of GTAW/TIG process. • Illustrate requirement of a workplace for welding specific job - Welding booth/fire blanket - GTAW / TIG Welding machine and accessories - Electric supply - Jigs and fixtures - Lighting • Explain organizational safety rules and guidelines - Ventilation - Fire extinguishers - First Aid box - Emergency alarm/light - Ambulance - Personal protective equipment	10/40 hrs	GTAW / TIG Welding machine and gas cylinders (Argon) with accessories, tungsten electrode, filler rod/ wire, grinder, wire brush, jigs and fixtures, lights, exhaust fans, fire blankets, fire extinguishers, first aid box, PPE	Class Room / Workshop

		• Demonstrate preparation of welding machine including: - Type of current (AC/DC) • Current polarity (straight / reverse) • Gas flow rate • Types of Tungsten Electrode • Torch angle			
LU2. Prepare the base metal for welding	**Trainee will be able to:** • Arrange tools and cleaning chemicals required for the job • Prepare joint as per instruction sheet: • Follow instruction sheet for GTAW/TIGwelding • Apply specific safety precautions associated with GTAW/TIGwelding process	• Illustrate usage of required tools and chemicals (acetone etc) • Explain importance of joint preparation, cleaning and tacking - preparation - cleaning - Tacking • Elaborate instruction sheet • Explain specific safety precautions associated with GTAW/TIGwelding process	10/40 hrs	Grinders, cutters, beveling machine, file, measuring tools, acetone, hammers, anvil, tungsten electrode, filler rod/wire, instruction sheet, PPE	Class Room / Workshop
LU3. Perform operations related to Gas Tungsten Arc Welding (GTAW) / Tungsten Inert Gas Welding (TIG)	**Trainee will be able to:** • Arrange filler wire, gas cylinder (argon, helium) with accessories as per instruction sheet • Adjust GTAW/TIG welding parameters as per instruction sheet	• Elaborate specification/ classification of filler wire required for job • Explain instruction sheet. • Establish importance of pre heating	10/40 hrs	GTAW/TIG Welding machine and gas cylinders (Argon) with accessories, tungsten electrode, grinder, wire brush, filler wire/rod, jigs and fixtures, lights, exhaust fans, fire	Class Room / Workshop

	• Perform GTAW/TIG welding as per instruction sheet • Apply specific safety precautions associated with GTAW/TIG welding process.	• Show how to adjust GTAW/TIG welding parameters and their effects on GTAW/TIGwelding • Demonstrate welding operation as per instruction sheet - Perform GTAW/TIG welding operation - Inter-pass cleaning - Inter-pass inspection • Explain specific safety precautions associated with GTAW/TIG welding process		blankets, fire extinguishers, first aid box, PPE, instruction sheet	
LU4. Perform post GTAW / TIG welding operations	**Trainee will be able to:** • Apply post GTAW / TIG weldingprocess. • Remove jigs and fixtures (if any) • Identify visual defects. • Execute specific safety precautions associated with GTAW / TIG welding process	• State the importance of post GTAW/TIG weld cleaning. • Identify and explain visual defects. - Undercut - Porosity - Excessive Reinforcement - Lack of penetration etc. • Elaborate specific safety precautions associated with GTAW / TIG welding process.	10/40 hrs	GTAW/TIG Welding machine and gas cylinders (Argon) with accessories, filler wire/rod , post-heating equipment, grinders, wire brush, PPE, instruction sheet	Class Room / Workshop

3.7. Module G. Perform Submerged Arc Welding (SAW) Operations

Overview: This Module identifies the competencies required to perform Submerged Arc Welding (SAW) operations at workplace by welder in accordance with the approved guidelines and procedures of organization. Trainee is expected to organize the workplace for welding, prepare the base metal for welding, perform operations related to Submerged Arc Welding (SAW) and perform post welding operations at the workplace.

Total: 100 Hrs Theory: 20 Hrs Practical: 80 Hrs

Module Title and Aim	Learning Outcome	Learning Elements	Time Duration (Th/Pr)	Tools and Equipment	Learning Place
LU1. Organize the workplace for SAW Welding	**Trainee will be able to:** • Arrange the workplace according to requirement of job • Apply safety measures: • Prepare required SAW welding machine as per job requirement.	• State requirement of a workplace for SAW welding specific job - SAW Welding machine & accessories - Electric supply - Jigs and fixtures - Lighting • Explain organizational safety rules and guidelines - Ventilation - Fire extinguishers - First Aid box - Emergency alarm/light - Ambulance - Personal protective equipment • Demonstrate preparation of SAW welding machine including: - Type of current (AC/DC) - Current polarity - Travel speed	5/20 hrs	SAW Welding machine with accessories, flux drying oven, grinder, chipping hammer, wire brush, jigs and fixtures, lights, exhaust fans, fire extinguishers, first aid box, PPE	Classroom/ Workshop

Module Title and Aim	Learning Outcome	Learning Elements	Time Duration (Th/Pr)	Tools and Equipment	Learning Place
LU2. Prepare the base metal for SAW welding	**Trainee will be able to:** • Arrange tools and cleaning chemicals required for the job • Prepare joint as per instruction sheet • Follow the procedure specification instruction sheet for SAW welding • Apply specific safety precautions associated with SAW welding job	• Display usage of tools required for job • Establish importance of joint preparation, cleaning and tacking - Joint preparation - Joint cleaning • Elaborate instruction sheet • Explain specific safety precautions associated with SAW welding process	5/20 hrs	Grinders, cutters, beveling machine, file, measuring tools, instruction sheet, PPE	Class Room/ Workshop
LU3. Perform operations related to Submerged Arc Welding (SAW) Operations	**Trainee will be able to:** • Arrange the wire spool and flux as per instruction sheet • Arrange pre-heating equipment as per instruction sheet • Adjust SAW welding parameters as per instruction sheet • Perform SAW welding as per instruction sheet. • Apply specific safety precautions	• Explain specification/ classification of wire-flux combination required for job • Elaborate instruction sheet • Establish importance of pre heating • Describe how to adjust SAW welding parameters and their effects on weld - Voltage - Amperes - Travel speed - Type of Polarity	5/20 hrs	SAW Welding equipment with accessories, wire spool, flux, pre-heating equipment, grinders, wire brush, wire cutter, chipping hammer, temple sticks, flux drying	Class Room/ Workshop

Module Title and Aim	Learning Outcome	Learning Elements	Time Duration (Th/Pr)	Tools and Equipment	Learning Place
	associated with SAW welding process	- Stick-out • Demonstrate welding operation as per instruction sheet - Pre heat the job, if required - Perform welding operation - Inter-pass cleaning - Inter-pass inspection - Maintain inter-pass temperature • Explain specific safety precautions associated with SAW welding process		oven, PPE, instruction sheet	
LU4. Perform post welding operations	**Trainee will be able to:** • Apply post SAW weld cleaning of the job following the process • Perform visual inspection of SAW weld area • Perform post-heating of the job as per instruction sheet, if required • Apply safety precautions associated with SAW welding process	• State the importance of post weld cleaning of the job - Removal of unused flux - Removal of slag - Removal of jigs and fixtures • Identify and explain visual defects. - Undercut - Porosity - Excessive Reinforcement - Lack of penetration etc. • State purpose of post-heating • Explain safety precautions associated with SAW welding process	5/20 Hrs	post-heating equipment, grinders, wire brush, chipping hammer, PPE, instruction sheet	Classroom/ Workshop

3.8. Module H. Repair welding defects

Overview: This Module identifies the competencies required to perform repairing of welding defects at workplace by welder in accordance with the approved guidelines and procedures of organization. Trainee is expected to identify and repair defected areas of job/work pieces at the workplace.

Total: 50 hrs Theory: 10 Hrs Practical: 40 Hrs

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Identify the defected areas of job/work piece	**Trainee will be able to:** • Arrange tools and equipment required for the identification of defects • Follow supervisor's / inspector's instructions • Apply safety precautions associated with welding equipment	• Illustrate types of welding defects and their causes and remedies • Show usage of tools and equipment required for job • Give instructions for identification and rectification of defects. • Elaborate non-destructive tests (NDT) and destructive tests for welding inspection: - Visual testing (VT) - Magnetic particle test (MT) - Radiographic test (RT) - Ultrasonic test (UT) - Dye penetration test (PT) - Guided bend test - Impact test - Tensile test - Hardness Test, etc • State safety precautions associated with	5/20 hrs	instruction sheet, measuring tools, magnifying glass, PPE	Class Room / Workshop

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
		welding equipment usage			
LU2. Repair defected areas of job/work piece	**Trainee will be able to:** • Arrange tools and equipment required for repairing defected area(s) • Apply the suitable repair procedure /s: • Apply repair welding to defected area(s) • Re-Inspect the repaired area. • Employ safety precautions associated with welding equipment	• Elaborate usage of tools and equipment required for job • Identify and explain welding defects. • Explain defect removal methods and guide how to select the suitable one. - Grinding - Cutting - Gouging etc. • State importance of repair welding • Describe safety precautions associated with welding equipment usage.	5/20 hrs	Grinder, cutter, gouging equipment, welding equipment with accessories, electrodes/filler wires, gas cylinder, desiccators, electrode drying oven, instruction sheet, PPE	Class Room / Workshop

3.9. MODULE I: Codes, Standards, Specifications, and Welding Qualifications

Overview: This Module identifies the competencies required to learn different international welding codes and agencies that set codes and standards. This module also defines the scope of three popular international welding codes, namely API 1104, ASME Sec-IX (BPVC) and AWS D1.1 and explains their areas of applications. Trainee will be expected to get basic knowledge of WPS, PQR and WPQ and different types of tests required for welding procedure and welder/operator qualifications. Trainee's underpinning knowledge will be sufficient to provide the trainee the basics of the subject.

Total: 12 Hrs Theory: 12 Hrs Practical: 0 Hrs

Module Title and Aim	Learning Outcome	Learning Elements	Time Duration (Th/Pr)	Tools and Equipment	Learning Place
LU1. Identify applicable standards, codes, and specifications	Trainee will be able to: • Identify welding codes, standards and specifications and agencies that set codes and standards	• Describe the scope of welding codes, standards and specifications • Codes: - Welding of steel structures - Welding of boilers and pressure vessels • Specifications • Standards: - Standardization - Relationship of terms • Agencies that set codes and standards: - International Organization for Standardization - (ISO) - American Petroleum Institute (API) - American Society of Mechanical Engineers (ASME)	2/0 hrs	Codes, Standards, Specifications	Classroom

		- American Welding Society (AWS)			
LU2. Comply with requirements of welding codes	Trainee will be able to: • Comply with different welding codes - API 1104 - ASME Sec-IX (BPVC) - AWS D1.1	• Define the scope of the - API 1104 - ASME Sec-IX - AWS D1.1 • Explain the applications of the - API 1104 - ASME Sec-IX (BPVC) - AWS D1.1	2/0	Codes, Standards, Specifications	Classroom
LU3. Comply with welding procedure specifications (WPS)	Trainee will be able to: • Comply with welding procedure specifications (WPS) and data sheets. • Describe and perform testing and inspections.	• Describe requirements for Welding Procedure Specifications (WPS), Procedure Qualification Record (PQR) and Welder/Operator Performance Qualification (WPQ) as per requirements of - API 1104 - ASME Sec-IX (BPVC) - AWS D1.1 • Describe requirements for destructive and non-destructive testing requirements as outlined in the welding codes	6/0	Codes, Standards, Specifications	Classroom

3.10. Module J. Develop Professionalism

Overview: This Module identifies the competencies required to Develop Professionalism by welder in accordance with the approved guidelines and procedures of organization. Trainee is expected to communicate with others, upgrade professional skills and work in a team.

Total: 50 Hrs Theory: 10 Hrs Practical: 40 Hrs

Module Title and Aim	Learning Outcome	Learning Elements	Time Duration (Th/Pr)	Tools and Equipment	Learning Place
LU1. Communicate with others	**Trainee will be able to:** • Communicate with supervisor following appropriate communication procedure • Communicate with colleagues following communication procedure • Use media to communicate effectively (e.g.: email, telephone, laptop etc.)	• Identify the channels required to communicate effectively and precisely within organisation. • Train how to appropriately use electronic and relevant media as per need	4/20 hrs	Computer/ laptop, internet, telephone	Class Room / Workshop
LU2. Upgrade professional skills	**Trainee will be able to:** • Participate in Skill test for professional development • Attend seminars/ training workshops for professional development • Adopt upcoming market trends in welding field	• Describe the importance of trends and market research. • Identify the need of skill sets by getting involved in seminars, workshops and competitions.	3/10hrs	Computer, internet facility, magazines, books, codes and standards	Classroom /Workshop

Module Title and Aim	Learning Outcome	Learning Elements	Time Duration (Th/Pr)	Tools and Equipment	Learning Place
LU3. Work in a team	**Trainee will be able to:** • Demonstrate good team work: - Cooperation/coordination - Work ethics - Etiquettes/manners • Carry an appropriate appearance. • Extend tolerance and ease.	• Establish importance of being a good team player: - Cooperation / coordination - Work ethics - Etiquettes/manners	3/10	Computer, internet facility, multi-media, printer, Over Head Projector	Class Room / Workshop

4. ASSESSMENT GUIDE FOR WELDER TRADE

Assessment is the process of collecting evidence and making judgments on whether competence has been achieved. This confirms that an individual can perform to the standard expected in the workplace as expressed in the nationally endorsed competency standards (where they exist), Good assessment practices should be adopted for developmental and final assessments. Such practices by vocational training providers during developmental and final assessments will form the basis of qualifying the trainees.

Differences between developmental and final assessments

Developmental assessment shall be on an all-time basis. Its purpose is to provide feedback on what students are learning:

- To the student: It will identify achievement and areas for further teaching and its level.
- To the teacher: It will evaluate the effectiveness of teaching, and guide to determine the future plan.

Assessors need to advise developmental assessments for each competency standard. Guidance is provided in the assessment strategy.

Final assessment is the assessment, usually carried out on completion of a course. This determines whether or not the student has "passed". It is - or should be - undertaken with reference to all the objectives or outcomes of the course, and is formal.

Considerations of security - ensuring that the student who gets the credit is the person who did the work - assume considerable importance in final assessment.

Methods of assessment

For lessons with a high quantity of theory, written or oral tests related to learning outcomes and/ or learning content can be conducted. For work place lessons, assessment will focus on the quality of planning and executing the related process along with the quality of the product and/or evaluation of the process.

Direct assessment:

Direct assessment is the most desirable form of assessment. For this, evidence shall be obtained by directly observing the student's performance.

Examples for direct assessment of a Welder will include:

- Work performances, such as the application of correct and appropriate welding techniques to a workpiece
- Demonstrations, for example correctly demonstrating the appropriate method of welding using a welding machine.
- Direct questioning, where the assessor will ask the student the reasons they selected a tool for step TIG/MIG welding
- Paper-based tests, such as multiple choice or short answer questions on entrepreneurship, hygiene and safety issues, communicating and working with others, and types of welding machines, etc.

Indirect assessment

Indirect assessment shall be used where the performance could not be observed and evidence is gained indirectly.

Examples for indirect assessment of a Welding will include:

- Portfolio of evidence, such as compilation of all work produced during the course
- Working safely every day
- Reports from third parties, such as internship workplace employer or supervisor
- Indirect assessment should only be a second choice. (In some cases, it may not even be guaranteed that the work produced by the person being assessed).

Principles of assessment

All assessments should be valid, reliable, fair and flexible:

Fairness means that there should be no advantages or disadvantages for any assessed person. For example, it should not happen that one student gets prior information about the type of work performance that will be assessed, while another candidate does not get any prior information. Provide all learners with an equal opportunity for and access to assessment

Validity means that a valid assessment assesses what it claims to assess. For example, for the competency of cutting a specific gear, the assessment should involve performance criteria that are directly related to gear cutting techniques. An interview about setting of milling machines would not meet this principle.

Reliability means that the assessment is consistent and reproducible. For example, if the preparation procedure of workplace/services area has been assessed, another assessor (e.g. the future employer) should be able to see the same work performance and witness the same level of achievement.

Flexibility means that the assessor has to be flexible concerning the assessment approach. For example, if there is a power failure during the assessment, the assessor should re-schedule to ensure the loss of power does not disadvantage the students.

Suggestions for developmental assessment

- The developmental assessment shall only be used to determine the learning progress of students.
- The development assessment can be undertaken at regular intervals through the delivery of a competency standard to inform teachers of any learning gaps that need to be addressed promptly
- No marks are given in any developmental assessment.
- The developmental assessment, undertaken at the end of the delivery of a competency standard, should be recorded for quality assurance purposes

Suggestions of final assessment

Final assessment shall be in two parts:

Knowledge assessment

The final knowledge assessment shall consist of multiple choice and short answer questions, covering all modules. It is a national assessment document supplied by NAVTTC.

Practical assessment.

The final practical assessment shall consist of a series of tasks designed to provide evidence of competence across all competency standards of the qualification. It is a national assessment document supplied by NAVTTC.

Learning Units	Assessment Criteria	Theory hours	Workplace hours	Planned day/Date
Module 1:Follow Safety Rules **LU1**.Apply personal safety measures **LU2**.Apply workplace safety measures **LU3**.Apply tools & equipment safety measures **LU4**.Apply job/work piece safety measures				
Module 2:Perform Maintenance Operation **LU1**. Inspect the welding equipment **LU2**. Replace damaged tools **LU3**. Clean welding equipment and accessories				
Module3:Perform Shielded Metal Arc Welding (SMAW) Operations				

Learning Units	Assessment Criteria	Theory hours	Workplace hours	Planned day/Date
LU1. Organize the workplace for welding **LU2**. Prepare the base metal for welding **LU3**. Perform operations related to Shielded Metal Arc Welding (SMAW) **LU4**. Perform post welding operations				
Module 4:Perform Gas Metal Arc Welding (GMAW) Operations **LU1**. Organize the workplace **LU2**. Prepare the base metal for welding **LU3**. Perform operations related to Gas Metal Arc Welding (GMAW) **LU4**. Perform post welding operations		18	80	98
Module 5:Perform Gas Tungsten Arc Welding (GTAW) Operations **LU1**. Organize the workplace **LU2**. Prepare the base metal for welding **LU3**. Perform operations related to Gas Tungsten				

Learning Units	Assessment Criteria	Theory hours	Workplace hours	Planned day/Date
Arc Welding (GTAW) **LU4**. Perform post welding operations				
Module 6:Perform Submerged Arc Welding (SAW) Operations **LU1**. Organize the workplace **LU2**. Prepare the base metal for welding **LU3**. Perform operations related to Submerged Arc Welding (SAW) Operations **LU4**. Perform post welding operations				
Module 7: Repair welding defects **LU1**. Identify the defected areas of job/work piece **LU2**. Repair defected areas of job/work piece				
Module 8: Develop Professionalism **LU1**. Perform Communication with others **LU2**. Upgrade professional skills **LU3**. Work in a team				

5. LIST OF TOOLS, MACHINERY & EQUIPMENT

(For a class of 25 students)

Sr. No.	Name of Tools / Equipment	Quantity
1.	Star set 7 pieces changeable screw driver	05
2.	Mig Plier 8 inch	10
3.	Anvil 60kg	3
4.	Hammers 1kg to 5kg set	10
5.	Screw driver set 7pcs 4",6",8",10"	5
6.	Adjustable wrench 8',10",12" Max Power	10
7.	Combination Pliers 8" Auto	10
8.	Socket set 52pieces	5
9.	Allen key set 9 pieces 0.5mm to 12mm cromvendiam	10
10.	Open and Ring spanner 12pes , 8mm to 24mm cromvendiam	5set
11.	Digital Multi-meter Taiwan 500volt Ac Dc 1000 ,20 mega oham	5
12.	Blower Gif-2 335watt 13000RPM 1.6Amp	5
13.	Dusters Stander size Pakistan	24
14.	Liquid cleaner	10
15.	Luster Drummond Metal Luster weight 18-0 Itom DL 6220K12 Brand Drummond	10
16.	Tip cleaner Different wire size China	10
17.	Anti spatter spray 400ml Banzan German	10
18.	GTAW Welding machine, TIG welding machine +argon cylinder 6.80cu/meter gas filled+argon regulator gauge+TIG torch heavy pressure, 300 - 400 amp+rubber hose pipe 8.5 mm with length 25ft+ invertor type+single phase /three phase complete installation, air cool system	3
19.	Grinder 4,7 INCH	10
20.	Chipping hammer 10”*4”	10
21.	Wire brush 6 inch	10
22.	Electrode drying oven 10 kg rad	4
23.	Desiccators weight capacity 70kg	3
24.	Work station Jigs and fixtures Model 60S* Fully loaded Sturdy 1/8-in-thick steel frame construction consists of 11/2 in square tubing weight capacity 454kg	3

25.	Lighting system Energy saver 45 watt	10
26.	Exhaust fans 16 inch	6
27.	Fire blankets Fiber glass 4ft * 6ft Thickness 0.030 in weight 3.23 Ib color Brown	5
28.	Cutters 6 inch Auto tera	5
29.	Manual beveling machine Pipe Diamrter 100-600mm cutting thick 5-50mm Edge shape I or V Bevel Angle Up to 45 Weight 9kg weight 9kgs	2
30.	Different File set 8,10,12 inch with plastic handle	10
31.	Measuring tools 12ft Lever Lock Stenley	48
32.	Acetone Acetone 4N 1090 Ley court farm 5 Liters	5
33.	Dc welding machine with all accessories 500 Amp Boc	4
34.	Electrodes E 7018 Kiswel 12No,10No,08No	200pk
35.	WPS/ instruction sheet Stander size	100
36.	Manual post, Pre-heating stress relieving machine In put power 460-575 3-phase 50/60Hz storage Temperature 40c-60c Dimensions H 699mm*W552mm*D933mm weight 103kg	2
37.	Temple sticks Tempindic 200C	10
38.	Gas cylinders (CO_2, Argon) with accessories Jumbo size,2000pound pak with Tig, Mig Regulator,8.5mmpipe gas	10
39.	Wire spool 1.2mm wire size 15Kg weight	6
40.	Tungsten electrode 2.4mm 2% thoriated wt20 Liam	100
41.	Filler rod/ wire Er 70s-3	50kg
42.	MIG WELDING MACHINE +CO2 cylinder gas filled 20kg+mig regulator gauge + mig torch heavy pressure, 300 - 400 amp + rubber hose pipe 8.5 mm with length 25ft+ single, three phase complete installation, air cool system.	3
43.	Welding Flux drying oven 100 Liter	2
44.	Gouging equipment with all accessories Series 602 Amp15-395A volt 72VDC H762MM*Lift eye W 585mm D775mm including strain relief weight 160kg Miller USA	2
45.	Pencil Grinder 10 Inch	5
46.	Multi-media Hp	1
47.	Over Head Projector	1
48.	Printer HP	2
49.	Laptop 3cor2do HP	1
50.	Tungsten Electrode Grinder	3
51.	Leather apron Material leather large size	30
52.	Safety gloves Stander size pak	48

53.	Safety goggles Stander size pak	48
54.	Welding helmet Glass 4.5”*2” Blue Eagle	48
55.	Safety shoes 8,9,10 NO pak	30
56.	Ear plug standard size Japan	40
57.	Safety belt Model no R-502-N Body belt Nylon 50mm weight 1.39kg color orange brown	40
58.	Maxifil clean Fume Extractor self cleaning filter Dimensions w790*885*1.180mm Diametterextractionarm 150mm weight arm 135kg motor power 1.5 kw Maximum vacuum 2.800pa	04
59.	Dungaree Large size	40
60.	Fire extinguisher Dry powder 6Kg	10
61.	Tool box/bins 18inch * 8inch*6inch 16Gauge sheet three step	30
62.	Generator 100kva	01
63.	Sub merged arc welding machine with all accessories miller Hdc 1500A input 115vac 60v 1500Amp Dimensions 178*286*292mm weight 8.2kg	03

6. LIST OF CONSUMABLE SUPPLIES

1. Notebooks
2. CDs Rewriteable
3. Photocopy Papers
4. Ball pens
5. Pencils
6. Erasers
7. Sharpeners
8. Board Markers
9. Plastic files
10. Flip chart papers
11. Pin-board pins
12. Whiteboard
13. Whiteboard Eraser
14. Paper knifes
15. Glue sticks
16. Paper clips
17. Scissors
18. Punching machines
19. Patter Sheets
20. Tracing Papers

21. Generator Fuel
22. UPS With two batter
23. Solar panel system with all accessories 300 watts

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