Syllabus for WELDER

Course Name	WELDER
Sector	Capital Goods
Course Code	CGM/2023/WLDR-RPL/270
Level	RPL LEVEL 3
Occupation	WELDER
Job Description	The job role is responsible for Safely operating welding processes and tools. Utilize oxy-acetylene and metal arc welding for cutting and joining metals, ensuring precision based on positions and symbols. Identify and address welding defects through visual inspection and simulated tests.
Course Duration	Total Duration 80 Hrs (T-27, P-53)
Trainees' Entry Qualification	Grade 10 OR Grade 8 with two year of (NTC/ NAC) after 8th OR Grade 8 pass and pursuing continuous schooling in regular school with vocational subject OR 8th grade pass with 2 yrs relevant experience OR Previous relevant Qualification of NSQF Level 2 with one yr experience OR Previous relevant Qualification of NSQF Level 2.5 with 6 months experience
Trainers Qualification	BE/B TECH IN MECHANICAL ENGINEERING OR DIPLOMA IN MECHANICAL ENGINEERING OR ITI IN WELDER TRADE 2 YEARS FOR B.E/B. TECH OR 3 YEARS FOR DIPLOMA ENGINEERING OR 5 YEARS FOR ITI

Structure of Course:

Module No.	Module name	Outcome	Theory (Hrs)	Practical (Hrs)	Total (Hrs) [Multiple of 30]
1	Workplace safety	Apply Safe Working Practices	1	1	2
2	Basic Engineering Drawing	Practice & interpret technical drawings	4	8	12
3	Basic welding terminology and application of tools in welding process.	Enumerate the basic welding terminology and application of tools in welding process.	6	10	16
4	Cutting and Joining of	Demonstrate metal	6	10	16

Module No.	Module name	Outcome	Theory (Hrs)	Practical (Hrs)	Total (Hrs) [Multiple of 30]
	metals using Oxy-Acetylene Gas	cutting and joining process by oxy-acetylene gas welding			
5	Metal Arc Welding Process	Demonstrate MMAW to join two pieces of MS plate	4	12	16
6	Welding defects, causes and remedies	Identify various welding defects on a job	4	8	12
7	Employability Skill		2	4	6
		TOTAL:	27	53	80

SYLLABUS:

Module No. 1: Workplace Safety

Outcome: Apply Safe Working Practices
Mapped to CGM/0701/OC1

Theory Content:

- Maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements according to site policy.
- Recognize any unsafe situations according to site policy, and assess his report accordingly.
- Identify and take necessary precautions on fire and safety hazards and report according to site policy and procedures.

Practical Content:

- Recognize any unsafe situations according to site policy, and assess his report accordingly.
- Demonstrate Personal Productive Equipment (PPE) like: safety helmet, safety glove, and safety shoe, use the same as per related working environment.
- Demonstrate basic first aid & CPR and use them under different circumstances.
- Identify different fire extinguishers and use the same as per requirement in a mock drill.

Tools & Equipment Needed: First Aid box, Different types of fire extinguishers, PPE kits, Safety charts.

Module No. 2: Basic Engineering Drawing

Outcome: Practice & interpret technical drawings

Theory Content:

- Introduction of technical drawing and lettering
- Use and care drawing boards and different drawing instruments, Drawing sheets and their sizes.
- Explain Types of Lines: Horizontal, Vertical, Inclined, parallel lines.
- Concept of using Scales in Drawing – Enlarging, Full Size & Reducing Scale.

Practical Content:

Introduction of technical drawing and lettering

- How to begin a drawing – Layout of drawing sheet.
- Drawing of — i) Horizontal lines, ii) Vertical lines, iii) Inclined lines, iv) Parallel lines,
- Single stroke Lettering by conventional method.
- Dimensioning—System of Dimensioning

Geometrical Construction

- Geometrical construction of Polygons (Pentagon, Hexagon & Octagon) by general method.

Orthographic Projection of Line & Lamina

- Projector; Plane of projection – Vertical Plane, Horizontal Plane & Profile Plane. Concept of 1st angle
- Projection; 3rd angle Projection. Reference Line – Symbol of methods of projection. (Demonstration with models).
- Projection of Points, Lines & Lamina (Square, rectangular, triangular, hexagonal, pentagonal and circular) parallel to VP and angle with HP & vice versa.

Freehand Sketch

Introduction – Necessity.

b) Free hand sketches of rolled steel sections – i) T-section, ii) I-section, iii) Angle section, iv) Channel section, v) Circular section, vi) Rectangular Section, vii) Steel flat, viii) Double ended wrench, ix) Screw driver, x) Nail puller

Tools & Equipment needed: Drawing instrument box, Drawing instrument box, Set square celluloid 30°-60°, French-curves (set of 12 celluloid), T-Square or Mini drafter, Drawing board.

Module No. 3: Basic welding terminology and application of tools in welding process.

Outcome: Enumerate the basic welding terminology and application of tools in welding process.
CGM/0702/OC1

Theory Content:

1.1 Welding terms and definitions

1.2 Various Welding Processes and its applications: Gas and Arc welding

1.3 General idea about different processes of metal joining methods: Bolting, riveting, soldering, brazing, Seaming etc.

1.4 Welding joints and its use - butt, corner, edge, lap, and tee joint

1.5 Necessity of Edge preparation and Surface Cleaning before welding

1.6 Basic Welding tools

Practical Content:

1.1 Hack sawing, filing square to required dimensions

1.2 Marking out on MS plate and punching

1.3 Practice edge preparation for welding

Tools & Equipment needed: Hacksaw, File, Combination square, Steel rule, Center punch, Angle grinder, Chipping hammer, Wire brush, Welding machine.

Module No. 4: Cutting and Joining of metals using Oxy-Acetylene Gas

Outcome: Demonstrate metal cutting and joining process by oxy-acetylene gas welding
Mapped to CGM/0702/OC2

Theory Content:

2.1 Common gases used for cutting and joining metals
2.2 Generation of oxy-acetylene flame
2.3 Types of oxyacetylene flames and its proper use
2.4 Acetylene and oxygen gas properties
2.5 Charging process of oxygen and acetylene gases
2.6 Color coding for different gas Cylinders
2.7 Gas regulators, types and uses
2.8 Acetylene gas Purifier, Hydraulic back pressure valve and Flash back arrestor
2.9 Gas welding filler rods, specifications and sizes
2.10 Gas welding fluxes – types and functions
2.11 Oxy acetylene gas welding Systems with working principle
2.12 Gas welding techniques - Rightward and Leftward techniques
2.13 Oxy-Acetylene Cutting Equipment- Principle and applications
2.14 Difference between gas welding blow pipe and gas cutting blow pipe
2.15 Piercing a hole and profile cutting process

Practical Content:

2.1 Setting of oxy-acetylene welding equipment, Lighting and setting of flame
2.2 Fusion run without and with filler rod on MS sheet 2 mm thick in flat - Horizontal and Vertical position
2.3 Edge joint on MS sheet 2 mm thick in flat position without filler rod
2.4 Square butt joint on MS sheet 2 mm thick in flat, horizontal and vertical position
2.5 Fillet lap joint on MS sheet 2 mm thick in flat and Horizontal position
2.6 Square Butt joint on Brass sheet 2 mm thick in flat position (1G)
2.7 Setting up Oxy-acetylene cutting torch and make straight cuts (freehand)
2.8 Perform marking and straight line cutting on MS plate 10 mm thick by gas within the accuracy ± 2mm
2.9 Marking and perform Bevel cutting on MS plate 10 mm thick by gas cutting

Tools & Equipment needed: Oxy-Acetylene gas cylinders, Torch, Gas cylinders, Charging equipment, Color-coded gas cylinders, Gas regulators, Acetylene gas purifier, Hydraulic back pressure valve, Flashback arrestor, Gas welding filler rods, Gas welding flux, Oxy-acetylene cutting torch, Gas welding blowpipe, MS sheet (2 mm thick), Brass sheet (2 mm thick), MS plate (10 mm thick). Bevel cutting tool.

Module No. 5: Metal Arc Welding Process

Outcome: Demonstrate MMAW to join two pieces of MS plate
Mapped to CGM/0702/OC3

Theory Content:

5.1 Basic electricity terms related to arc welding
5.2 General idea about Arc welding power sources: Transformer, Generator, Rectifier and Inverter type welding machines
5.3 Advantages and disadvantages of A.C. and D.C. welding machine
5.4 Working of Manual Metallic Arc welding(MMAW)
5.5 Straight and Reverse polarity
5.6 Arc and its characteristics
5.7 Arc length and its effects in arc welding
5.8 Arc blow – causes and effects

5.9 Application area of Arc welding
5.10 Advantages and disadvantages of Arc welding

Practical Content:

5.1 Deposit straight line and weaved bead on M.S. Plate in flat position
5.2 Fillet weld "T" joint on MS Plate 10 mm thick in flat position(1F)
5.3 Fillet weld "Lap" joint on MS plate 10 mm thick in flat position(1F)
5.4 Open corner joint on MS plate 10 mm thick in flat position (1F)
5.5 Single "V" Butt joint on MS plate 10 mm thick in flat position(1G)
5.6 Straight line multi-layer bead practice on MS Plate 10 mm thick in Horizontal position (2F)
5.7 Fillet weld "T" joint on MS Plate 10 mm thick in Horizontal position (2F)
5.8 Fillet weld "Lap" joint on MS Plate 10 mm thick in Horizontal position (2F)
5.9 Single "V" Butt joint on MS Plate 10 mm thick in Horizontal position (2G)
5.10 Weaved bead practice on MS Plate 10 mm thick in Vertical Position(3F)
5.11 Fillet weld "T" joint on MS Plate 10 mm thick in Vertical position(3F)
5.12 Fillet weld "Lap" joint on MS Plate 10 mm thick in Vertical position(3F)
5.13 Open corner joint on MS plate 10 mm thick in Vertical position(3G)
5.14 Single "V" Butt joint on MS plate 10 mm thick in Vertical position(3G)
5.15 Fillet weld "T" joint on MS plate 10 mm thick in Overhead position(4F)
5.16 Fillet weld "Lap" joint on MS plate 10 mm thick in Overhead position(4F)
5.17 Single "V" Butt joint on MS plate 10 mm thick in Overhead position(4G)

Tools & Equipment needed: Welding machine, Electrodes, MS plate (various thicknesses).

Module No. 6: Welding defects, causes and remedies

Outcome: Identify various welding defects on a job
Mapped to CGM/0702/OC8

Theory Content:

7.1 Brief idea about welding defects
7.2 Some common types of welding defects with their causes- Porosity and Blowholes, Undercut, Cracks, Incomplete fusion, Slag inclusion, Incomplete penetration, spatter, Distortion, Hot tear, Misalignment
7.3 Remedies of the above mentioned welding defects

Practical Content:

7.1 Non-destructive Testing of Welds – Visual Inspection
7.2 Simulation of Liquid or Dye Penetrant Inspection
7.3 Simulation of Magnetic Particle Inspection

Tools & Equipment needed: Welded specimens with defects, Welding helmet, Welding gloves, Liquid or dye penetrant inspection kit, Magnetic particle inspection kit.

Module No. 7: Employability Skills

Detail Content

- **Basic English Skills**

1. Converse using basic English sentences.
2. How to Greet others
3. Read and interpret text written in basic English
4. Write a short note/paragraph / letter using basic English

- **Communication Skills**

1. Demonstrate how to communicate effectively using verbal and nonverbal communication Etiquette.
2. Discuss the significance of working collaboratively with others in a team

- **Financial Skills**

1. Outline the importance of selecting the right financial institution, product and service
2. Demonstrate how to carry out offline and online financial transactions, safely and securely like net banking, wallet payment, UPI.
3. List the common components of salary and compute income, expenditure, taxes, investments etc.

- **Essential Digital Skills**

1. Familiarization of working with computer
2. Discuss the significance of displaying responsible online behavior while browsing using various social media platforms, e-mails, etc., safely and securely
3. Send email with attachment. Receive email and download attachment

- **Customer Service Skills**

1. Explain the significance of identifying customer needs and responding to them in a professional manner.
2. Discuss the significance of maintaining hygiene and dressing appropriately

Learning Outcome – Assessment Criteria

Module No.	Outcome	Assessment Criteria
1	Apply Safe Working Practices	**After completion of this module students will be able to:** • Apply and maintain Safe Working Practices • Recognize any unsafe situations according to site policy. • Identify fire and safety and fire hazards • Identify different fire extinguishers and use them as per requirements.
2	Practice & interpret technical drawings	**After completion of this module students will be able to:** 2.1 Draw plane figures applying drawing instruments with proper layout and folding of drawing sheets. 2.2 Construct Line, Lettering, Dimensioning, and Scale – Plain, Diagonal 2.3 Draw plan, elevation, side view of different objects with appropriate type of lines and dimensions as per standard convention. 2.4 Draw simple geometrical figure like square, rectangle, circle using CAD. 2.5 Describe different welding positions as per EN and ASME

Module No.	Outcome	Assessment Criteria
		2.6 Describe weld type, slope and rotation 2.7 Explain basic terminologies and elements of welding symbols 2.8 Interpret basic welding symbols from a given chart
3	Enumerate the basic welding terminology and application of tools in welding process.	**After completion of this module students will be able to:** 3.1 Define basic terminologies related to welding 3.2 Classify the various welding processes (Gas & Arc welding) with applications 3.3 Explain different methods of metal joining i.e riveting, soldering, brazing etc. 3.4 Identify different welding joints 3.5 Explain the need of edge preparation before welding 3.6 Identify different basic welding tools
4	Demonstrate metal cutting and joining process by oxy-acetylene gas welding	**After completion of this module students will be able to:** 4.1 Explain different types of oxy-acetylene flames along with its generation and uses 4.2 Outline the charging process, colour code, regulator of oxygen & acetylene cylinder 4.3 Describe basic functions of Acetylene gas Purifier, Hydraulic back pressure valve and Flash back arrestor 4.4 Explain the function filler rods (with specification and size) and fluxes 4.5 Explain the components and working principle of oxy-acetylene gas welding process 4.6 Demonstrate the cutting and piercing of MS plate by gas cutting 4.7 Demonstrate the joining process of MS plate into different joints like lap, butt, edge etc.
5	Demonstrate MMAW to join two pieces of MS plate	**After completion of this module students will be able to:** 5.1 Outline basic terminologies of electricity and power sources required for arc welding 5.2 Explain working of MMAW 5.3 Describe polarity (straight and reverse) 5.4 Explain arc length with its effects on arc welding 5.5 Explain the causes and effects of arc blow 5.6 State the advantages, disadvantages of arc welding with its applications 5.7 Demonstrate fillet weld of different joints on 10 mm thick MS plate in different positions
6	Identify various welding defects on a job	**After completion of this module students will be able to:** 6.1 Explain the different types of welding defects with their causes and remedies 6.2 Identify different welding defects from a given job by visual inspection 6.3 Carryout the visual inspection to ascertain the quality weld.

Module No.	Outcome	Assessment Criteria
7	Employability Skill	As per guided curriculum

List of Tools, Equipment & materials needed for 30 Trainees (Practical)

S No.	Name of the Tools & Equipment	Specification	Quantity
A.TRAINEES TOOL KIT(For each additional unit trainees tool kit Sl.1-15 is requiredadditionally)			
1.	Welding helmet fiber		30+1Nos.
2.	Welding hand shield fiber		30+1Nos.
3.	Chipping hammer	with metal handle250Grams	30+1Nos.
4.	Chisel cold	Flat 19mmx150mm	30+1Nos.
5.	Centre punch	9mmx127mm	30+1Nos.
6.	Dividers	200 mm	30+1Nos.
7.	Stainless steel rule	300mm	30+1Nos.
8.	Scriber	150mmdoublepoint	30+1Nos.
9.	Flat Tongs	350mmlong	30+1Nos.
10.	Hacksaw frame	fixed 300mm	30+1Nos.
11.	File half round	Bastard 300mm	30+1Nos.
12.	File flat	350mm bastard	30+1Nos.
13.	Hammer ball pane	1 kg with handle	30+1Nos.
14.	Tip Cleaner		30+1Nos.
15.	Try square	6”	30+1Nos.
B. INSTRUMENTS AND GENERAL SHOP OUTFIT -For 2(1+1)units no additional items arerequired			
TOOLS&EQUIPMENT			
16.	Spindle key		4 Nos.
17.	Screw Driver	300mm blade and250mm blade	1 each
18.	Number punch	6mm	2set
19.	Letter punch	6mm	2set
20.	Magnifying glass	100mmdia.	2 Nos.
21.	Universal Weld measuring gauge		2 Nos.
22.	Earth clamp	600A	6 Nos.
23.	Spanner D.E.	6mmto32mm	2 sets
24.	C-Clamps	10 cm and15cm	2 each
25.	Hammer sledge	Double faced 4 kg	1No.
26.	S.S tape	5 meters flexible incase	1No.
27.	Electrode holder	600 amps	6 Nos.
28.	H.P. Welding torch	With 5 nozzles	2 sets
29.	Oxygen Gas Pressure	Regulator double stage	2 Nos.

30.	Acetylene Gas Pressure	Regulator double stage	2 Nos.
31.	CO_2 Gas pressure regulator	With flow meter	2set
32.	Argon Gas pressure regulator	With flow meter	2set
33.	Metal rack	182 cmx152cmx45cm	1No.
34.	First Aid box		1No.
35.	Steel lockers	with 8Pigeonholes	2 Nos.
36.	Steel almirah /cupboard		2 Nos.
37.	Blackboard and easel with stand		1No.
38.	Flash back arrester(torch mounted)		4pairs
39.	Flash back arrester(cylinder mounted)		4pairs
GENERAL SHOP OUTFIT			
40.	Welding Transformer	with all accessories(400A,OCV 60–100V, 60%dutycycle)	1set
41.	Welding Transformer (or)Inverter based welding machine	with all accessories(300A,OCV60 –100V, 60%dutycycle)	1set
42.	D.C Arc welding rectifiers set with all accessories	(400 A. OCV60–100V, 60%dutycycle)	1 sets
43.	GMAW welding machine	400A Capacity with air cooled torch, Regulator, Gas pre-heater, Gas hose and Standard accessories	1set
44.	AC/DCGTAW welding machine	with water cooled torch300 A, Argon regulator, Gas hose, water circulating system and standard accessories.	1set
45.	Air Plasma cutting equipment	with all accessories, capacity tocut 12mm clear cut	1set
46.	Air compressor suitable for above airplasma cutting system.		1No.
47.	Auto Darkening Welding Helmet		2 Nos.
48.	Spot welding machine	15KVA with allaccessories	1set
49.	Portable gas cutting machine	Capable of cutting Straight & Circular with all accessories	1set
50.	Pedestal grinder fitted with coarse	300mmdia.	1No.

	And medium grain size grindingwheels		
51.	Bench grinder fitted with fine grain size silicon carbide green Grinding wheel	150mmdia.	1No.
52.	AG4 Grinder		2Nos.
53.	Suitable gas welding table	With firebricks	2Nos.
54.	Suitable Arc welding table	With positioner	6 Nos.
55.	Trolley for cylinder(H.P. Unit)		2 Nos.
56.	Hands hearing machine capacity	cut6mm sheet sandflats	1No.
57.	Power saw machine	14''	1No.
58.	Portable drilling machine	(Cap.6 mm)	1No.
59.	Oven, electrode drying	0to350°C,10 kg capacity	1No.
60.	Workbench	340x120x75cmwith4 bench vices of 150 Mm jaw opening	4 sets
61.	Oxy Acetylene Gas cutting blowpipe		2 sets
62.	Oxygen, Acetylene Cylinders**		2 each
63.	CO_2cylinder**		2Nos.
64.	Argon gas cylinder **		2Nos.
65.	Anvil12 sq. inches working area with stand		1No.
66.	Swage block		1No.
67.	Die penetrant testing kit		1set
68.	Magnetic particle testing Kit#		1set
69.	Fire extinguishers(foamtypeandCO_2 type)		1.No.
70.	Fire buckets with stand		4 Nos.
71.	Portable abrasive cut-off machine		1No.
72.	Suitable Gas cutting table		1No.
73.	Welding Simulators for SMAW/GTAW/GMAW		1 each (Optional)
C.CONSUMABLE			
74.	Leather Hand Gloves	14"	20 pairs
75.	Cotton hand Gloves	8"	20pairs
76.	Leather Apron leather		20Nos.
77.	S.S Wire brush	5 rowsand3 rows	20Nos. each
78.	Leather hand sleeves	16"	20pairs
79.	Safety boots for welders		20 pairs
80.	Leg guards leather		20 pairs
81.	Rubber hose clips	½"	20Nos.
82.	Rubber hose oxygen	8 mmdiaX10Mtr.long as per BIS	2 Nos.
83.	Rubber hose acetylene	8mmdiaX10Mtr.long as per BIS	2 Nos.