DRAFT Syllabus For Senior Welder (Gas & Electric)

Course Name	**Senior Welder (Gas & Electric)**
Course Code	STC-CGM/SWGE/0702
Occupation	Senior Welder / Welder
Job Description	Work as senior welder , performs arc, gas, TIG, MIG welding
Anticipated Volume of Training	1200 Hrs (Theory- 200 Hrs + Practical- 610 Hrs, Employability Skill-90 Hrs, OJT – 300 Hrs)
Trainees' Entry Qualification	Class 8 Pass + ITI (2 Yrs) with 2 years experience, OR Class 10 Pass + ITI (1Yr) after class 10 with 1 year experience, OR Class 10 Pass + ITI (2 yrs) after class 10, OR Class 10 Pass with 2 years experience, OR Class 10 Pass and pursing continuous regular schooling, OR 3 years diploma after class 10 or Class 12 Pass with 6 months experience, OR Previous Relevant Qualification of NSQF Level 3 with 2 yrs experience.
Trainers Qualification	BE/B TECH in Mechanical Engineering or Automobile Engineering, Diploma in Mechanical Engineering or Automobile Engineering or ITI In Welder Trade. 2 years for BE/B.TECH, 3 years for Diploma / ITI

Structure of Course:

Module No.	Outcome	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
1	Explain basic terms and tools used in welding	15	40	55
2	Demonstrate metal cutting and joining process by oxy-acetylene gas welding	50	110	160
3	Demonstrate MMAW to join two pieces of MS plate	40	130	170
4	Explain different Welding symbols from drawing & perform relevant welding	20	90	110
5	Demonstrate different types of pipe welding and plate welding	20	100	120
6	Explain the application of the following welding processes: Thermit, TIG and MIG	15	70	85
7	Explain different electrodes with proper application	20	30	50
8	Identify various welding defects on a job	20	40	60
TOTAL:		200	610	810

Employability Skill- 90 Hrs
OJT – 300 Hrs

SYLLABUS:

Module No. 1: Welding: terminology, types and applications

Outcomes:

Explain basic terms and tools used in welding

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

Module No. 2: .Cutting and Joining of metals using Oxy-Acetylene Gas

Outcomes:

Demonstrate metal cutting and joining process by oxy-acetylene gas welding

Theory Content:

2.1 Common gases used for cutting and joining metals

2.2 Generation of oxy-acetylene flame

2.3 Generation of oxy-acetylene flame

2.4 Types of oxyacetylene flames and its proper use

2.5 Acetylene and oxygen gas properties

2.6 Charging process of oxygen and acetylene gases

2.7 Color coding for different gas Cylinders

2.8 Gas regulators, types and uses

2.9 Acetylene gas Purifier, Hydraulic back pressure valve and Flash back arrestor

2.10 Gas welding filler rods, specifications and sizes

2.11 Gas welding fluxes – types and functions

2.12 Oxy acetylene gas welding Systems with working principle

2.13 Gas welding techniques - Rightward and Leftward techniques

2.14 Oxy-Acetylene Cutting Equipment- Principle and applications

2.15 Difference between gas welding blow pipe and gas cutting blow pipe

2.16 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

Module No. 3: Metal Arc Welding Process

Outcomes:

Demonstrate MMAW to join two pieces of MS plate

Theory Content:

3.1 Basic electricity terms related to arc welding

3.2 General idea about Arc welding power sources: Transformer, Generator, Rectifier and Inverter type welding machines

3.3 Advantages and disadvantages of A.C. and D.C. welding machine

3.4 Working of Manual Metallic Arc welding(MMAW)

3.5 Straight and Reverse polarity

3.6 Arc and its characteristics

3.7 Arc length and its effects in arc welding

3.8 Arc blow – causes and effects

3.9 Application area of Arc welding

3.10 Advantages and disadvantages of Arc welding

Practical Content:

3.1 Deposit straight line and weaved bead on M.S. Plate in flat position

3.2 Fillet weld “T” joint on MS Plate 10 mm thick in flat position(1F)

3.3 Fillet weld “Lap” joint on MS plate 10 mm thick in flat position(1F)
3.4 Open corner joint on MS plate 10 mm thick in flat position (1F)
3.5 Single “V” Butt joint on MS plate 10 mm thick in flat position(1G)
3.6 Straight line multi-layer bead practice on MS Plate 10 mm thick in Horizontal position (2F)

3.7 Fillet weld “T” joint on MS Plate 10 mm thick in Horizontal position (2F)

3.8 Fillet weld “Lap” joint on MS Plate 10 mm thick in Horizontal position (2F)

3.9 Single “V” Butt joint on MS Plate 10 mm thick in Horizontal position (2G)

3.10 Weaved bead practice on MS Plate 10 mm thick in Vertical Position(3F)

3.11 Fillet weld “T” joint on MS Plate 10 mm thick in Vertical position(3F)
3.12 Fillet weld “Lap” joint on MS Plate 10 mm thick in Vertical position(3F)
3.13 Open corner joint on MS plate 10 mm thick in Vertical position(3G)
3.14 Single “V” Butt joint on MS plate 10 mm thick in Vertical position(3G)
3.15 Fillet weld “T” joint on MS plate 10 mm thick in Overhead position(4F)
3.16 Fillet weld “Lap” joint on MS plate 10 mm thick in Overhead position(4F)
3.17 Single “V” Butt joint on MS plate 10 mm thick in Overhead position(4G)

Module No. 4: Welding positions and symbols

Outcome:

Explain different Welding symbols from drawing & perform relevant welding

Theory Content:

4.1 Welding positions as per EN & ASME : flat, horizontal, vertical and overhead position
4.2 Weld type – Fillet and Groove
4.3 Brief idea about Weld slope and rotation
4.4 Basic idea about weld symbol and welding symbol as per AWS
4.5 Basic elements of welding symbol
4.6 Welding symbol terminology

Practical Content:

4.1 Making joint of two MS plate at flat, horizontal, vertical and overhead position with fillet and groove weld

4.2 Read out welding symbols from a given chart of welding symbols

Module No. 5: Pipe welding steps and position

Outcome:

Demonstrate different types of pipe welding and plate welding

Theory Content:

5.1 Meaning of pipe welding
5.2 Types of welding used for pipe welding
5.3 Steps of pipe welding
5.4 Various welding passes needed in pipe welding
5.5 Different position used in pipe welding - 1G, 2G, 5G and 6G
5.6 Difference between pipe welding and plate welding
5.7 Pipe development for Elbow joint, "T" joint, Y joint and branch joint

Practical Content:

5.1 Making Pipe joint at 45^0 and 90^0
5.2 Structural pipe welding butt joint on MS pipe Ø 50 and 3mm WT in 1G position.
5.3 Pipe welding –Elbow joint on MS pipe Ø50 and 3mm WT
5.4 Pipe welding "T" joint on MS pipe Ø 50 and 3mm WT
5.5 Pipe welding butt joint on MS pipe Ø 50 and 5 mm WT in 1G position

Module No. 6: . Some Special type of welding

Outcomes:

Explain the application of the following welding processes: Thermit, TIG and MIG

Theory Content:

6.1 General idea about Thermit welding- Thermit mixture, welding process and its application area
6.2 Basic idea about TIG and MIG welding process with their application
6.3 Difference between TIG and MIG welding

Practical Content:

6.1 Simulation on railroad joining by Thermit welding
6.2 Joining dissimilar materials with TIG welding
6.3 2G open root pipe joining by using MIG welding

Module No. 7: General idea on Electrodes

Outcomes:

Explain different electrodes with proper application

Theory Content:

7.1 Types of Electrodes with their application – Consumable and Non-consumable Electrode
7.2 Basic idea on Electrode flux and coating
7.3 Brief idea on relation with size of electrodes and current range – Standard Diameter and Length
7.4 Coding of electrode as per BIS, AWS

7.5 Idea about some special purpose electrodes with applications

Practical Content:

7.1 Use different types of electrodes for different welding process
7.2 Recognise different electrodes from their coding
7.3 Make chart for amperage usage for different diameter electrode

Module No. 8: Welding defects, causes and remedies

Outcomes:

Identify various welding defects on a job

Theory Content:

8.1 Brief idea about welding defects
8.2 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

8.3 Remedies of the above mentioned welding defects

Practical Content:

8.1 Non-destructive Testing of Welds – Visual Inspection

8.2 Simulation of Liquid or Dye Penetrant Inspection

8.3 Simulation of Magnetic Particle Inspection

8.4 Simulation of X-Ray Testing

ANNEXURE-I

LIST OF TOOLS AND EQUIPMENT			
WELDER (For batch of 20 Candidates)			
S No.	**Name of the Tools& Equipment**	**Specification**	**Quantity**
A. TRAINEES TOOL KIT (For each additional unit trainees tool kit Sl. 1-15 is required additionally)			
1.	Welding helmet fiber		20+1 Nos.
2.	Welding hand shield fiber		20+1 Nos.
3.	Chipping hammer	with metal handle 250 Grams	20+1 Nos.
4.	Chisel cold	flat 19 mm x 150 mm	20+1 Nos.
5.	Centre punch	9 mm x 127 mm	20+1 Nos.
6.	Dividers	200 mm	20+1 Nos.
7.	Stainless steel rule	300mm	20+1 Nos.
8.	Scriber	150 mm double point	20+1 Nos.
9.	Flat Tongs	350mm long	20+1 Nos.
10.	Hack saw frame	fixed 300 mm	20+1 Nos.
11.	File half round	bastard 300 mm	20+1 Nos.
12.	File flat	350 mm bastard	20+1 Nos.
13.	Hammer ball pane	1 kg with handle	20+1 Nos.
14.	Tip Cleaner		20+1 Nos.
15.	Try square	6”	20+1 Nos.
B. INSTRUMENTS AND GENERAL SHOP OUTFIT - For 2 (1+1) units no additional items are required			
TOOLS & EQUIPMENT			
16.	Spindle key		4 Nos.
17.	Screw Driver	300mm blade and 250 mm blade	1 each
18.	Number punch	6 mm	2 set
19.	Letter punch	6 mm	2 set
20.	Magnifying glass	100 mm dia.	2 Nos.
21.	Universal Weld measuring gauge		2 Nos.
22.	Earth clamp	600A	6 Nos.
23.	Spanner D.E.	6 mm to 32mm	2 sets
24.	C-Clamps	10 cm and 15 cm	2 each
25.	Hammer sledge	double faced 4 kg	1 No.
26.	S.S tape	5 meters flexible in case	1 No.
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	2 set
32.	Argon Gas pressure regulator	with flow meter	2 set
33.	Metal rack	182 cm x 152 cm x 45 cm	1 No.
34.	First Aid box		1 No.
35.	Steel lockers	with 8 Pigeon holes	2 Nos.
36.	Steel almirah / cupboard		2 Nos.
37.	Black board and easel with stand		1 No.
38.	Flash back arrester (torch mounted)		4 pairs
39.	Flash back arrester (cylinder mounted)		4 pairs
GENERAL SHOP OUTFIT			
40.	Welding Transformer	with all accessories (400A, OCV 60–100 V, 60% duty cycle)	1 set
41.	Welding Transformer (or) Inverterbased welding machine	with all accessories (300A, OCV 60 – 100 V, 60% duty cycle)	1 set
42.	D.C Arc welding rectifiers set with all accessories	(400 A. OCV 60 – 100 V, 60% duty cycle)	1 sets
43.	GMAW welding machine	400A capacity with air cooled torch, Regulator, Gas pre-heater, Gas hose and Standard accessories	1 set
44.	AC/DC GTAW welding machine	with water cooled torch 300 A, Argon regulator, Gas hose, water circulating system and standard accessories.	1 set
45.	Air Plasma cutting equipment	with all accessories, capacity to cut 12 mm clear cut	1 set
46.	Air compressor suitable for above air plasma cutting system.		1 No.
47.	Auto Darkening Welding Helmet		2 Nos.
48.	Spot welding machine	15 KVA with all accessories	1 set
49.	Portable gas cutting machine	capable of cutting Straight & Circular with all accessories	1 set
50.	Pedestal grinder fitted with coarse	300 mm dia.	1 No.
	and medium grain size grinding wheels		
51.	Bench grinder fitted with fine grain size silicon carbide green grinding wheel	150 mm dia.	1 No.

52.	AG 4 Grinder		2 Nos.
53.	Suitable gas welding table	with fire bricks	2 Nos.
54.	Suitable Arc welding table	with positioner	6 Nos.
55.	Trolley for cylinder (H.P. Unit)		2 Nos.
56.	Hand shearing machine capacity	cut 6 mm sheets and flats	1 No.
57.	Power saw machine	14''	1 No.
58.	Portable drilling machine	(Cap. 6 mm)	1 No.
59.	Oven, electrode drying	0 to 350°C, 10 kg capacity	1 No.
60.	Work bench	340x120x75 cm with 4 bench vices of 150 mm jaw opening	4 sets
61.	Oxy Acetylene Gas cutting blow pipe		2 sets
62.	Oxygen, Acetylene Cylinders **		2 each
63.	CO_2 cylinder **		2 Nos.
64.	Argon gas cylinder **		2 Nos.
65.	Anvil 12 sq. inches working area with stand		1 No.
66.	Swage block		1 No.
67.	Die penetrant testing kit		1 set
68.	Magnetic particle testing Kit #		1 set
69.	Fire extinguishers (foam type and CO_2 type)		1. No.
70.	Fire buckets with stand		4 Nos.
71.	Portable abrasive cut-off machine		1 No.
72.	Suitable Gas cutting table		1 No.
73.	Welding Simulators for SMAW/GTAW/GMAW		1 each (Optional)
C. CONSUMABLE			
74.	Leather Hand Gloves	14"	20 pairs
75.	Cotton hand Gloves	8"	20 pairs
76.	Leather Apron leather		20 Nos.
77.	S.S Wire brush	5 rows and 3 rows	20 Nos. each
78.	Leather hand sleeves	16"	20 pairs
79.	Safety boots for welders		20 pairs
80.	Leg guards leather		20 pairs
81.	Rubber hose clips	½"	20 Nos.
82.	Rubber hose oxygen	8 mm dia X 10 Mtr. long as per BIS	2 Nos.
83.	Rubber hose acetylene	8 mm dia X 10 Mtr. long as per BIS	2 Nos.
84.	Arc welding cables multi cored copper	400/ 600 amp as per BIS	45 mts. each
85.	Arc welding single coloured glasses	108 mm x 82 mm x 3 mm. DIN 11A &12 A	34 Nos.
86.	Arc welding plain glass	108 mm x 82 mm x 3 mm.	68 Nos.

87.	Gas welding Goggles	with Colour glass 3 or 4A DIN	34 Nos.
88.	Safety goggles plain		34 Nos.
89.	Spark lighter		6 Nos.
90.	AG 4 Grinding wheels		10 Nos.