

Syllabus For Senior Welder (Gas & Electric)

<b>Course Name</b>	<b>SENIOR WELDER (GAS &amp; ELECTRIC), V2</b>
<b>Course Code</b>	STC-CGM/SWGE/0702, V2
<b>Occupation</b>	Senior Welder / Welder
<b>Job Description</b>	Work as senior welder , performs arc, gas, TIG, MIG welding
<b>Anticipated Volume of Training</b>	720 Hrs (Theory- 150 Hrs + Practical- 360 Hrs, Employability Skill-60Hrs, OJT – 150 Hrs)
<b>Trainees' Entry Qualification</b>	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 pursuing 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.
<b>Trainers Qualification</b>	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)	OJT (Hrs)	Total (Hrs)
1	Enumerate the basic welding terminology and application of tools in welding process	20	40		60
2	Demonstrate metal cutting and joining process by oxy-acetylene gas welding	40	80		120
3	Demonstrate MMAW to join two pieces of MS plate	20	70		90
4	Explain different Welding symbols from drawing & perform relevant welding	20	40		60
5	Demonstrate different types of pipe welding and plate welding	20	70		90
6	Explain the application of the following welding processes: Thermit, TIG and MIG	10	20		30
7	Explain different electrodes with proper application	10	20		30
8	Identify various welding defects on a job	10	20		30
9	<b>OJT</b>			150	150
10	<b>Employability skill</b>	60			60
<b>TOTAL:</b>		<b>210</b>	<b>360</b>	<b>150</b>	<b>720</b>

**SYLLABUS:**

**Module No. 1:** Enumerate the basic welding terminology and application of tools in welding process.

**Outcome:** Enumerate the basic welding terminology and application of tools in welding process.

**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

**Outcome:** 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  $\pm 2\text{mm}$
- 2.9 Marking and perform Bevel cutting on MS plate 10 mm thick by gas cutting

**Module No. 3: Metal Arc Welding Process**

**Outcome:** 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<sup>0</sup> and 90<sup>0</sup>
- 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

**Outcome:** 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

**Outcome:** 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**Outcome:** 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

**Learning Outcome–Assessment Criteria**

Module	Outcome	Assessment Criteria
1	Enumerate the basic welding terminology and application of tools in welding process	<p><b>After completion of this module students will be able to:</b></p> <p>1.1 Define basic terminologies related to welding</p> <p>1.2 Classify the various welding processes (Gas &amp; Arc welding) with applications</p> <p>1.3 Explain different methods of metal joining i.e riveting, soldering, brazing etc.</p> <p>1.4 Identify different welding joints</p> <p>1.5 Explain the need of edge preparation before welding</p> <p>1.6 Identify different basic welding tools</p>
2	Demonstrate metal cutting and joining process by oxy-acetylene gas welding	<p><b>After completion of this module students will be able to:</b></p> <p>2.1 Explain different types of oxy-acetylene flames along with its generation and uses</p> <p>2.2 Outline the charging process, colour code, regulator of oxygen &amp; acetylene cylinder</p> <p>2.3 Describe basic functions of Acetylene gas Purifier, Hydraulic back pressure valve and Flash back arrestor</p> <p>2.4 Explain the function filler rods (with specification and size) and fluxes</p> <p>2.5 Explain the components and working principle of oxy-acetylene gas welding process</p> <p>2.6 Demonstrate the cutting and piercing of MS plate by gas cutting</p> <p>2.7 Demonstrate the joining process of MS plate into different joints like lap, butt, edge etc.</p>

Module	Outcome	AssessmentCriteria
3	Demonstrate MMAW to join two pieces of MS plate	<p><b>After completion of this module students will be able to:</b></p> 3.1 Outline basic terminologies of electricity and power sources required for arc welding 3.2 Explain working of MMAW 3.3 Describe polarity (straight and reverse) 3.4 Explain arc length with its effects on arc welding 3.5 Explain the causes and effects of arc blow 3.6 State the advantages, disadvantages of arc welding with its applications 3.7 Demonstrate fillet weld of different joints on 10 mm thick MS plate in different positions
4	Explain different Welding symbols from drawing & perform relevant welding	<p><b>After completion of this module students will be able to:</b></p> 4.1 Describe different welding positions as per EN and ASME 4.2 Describe weld type, slope and rotation 4.3 Explain basic terminologies and elements of welding symbols 4.4 Interpret basic welding symbols from a given chart
5	Demonstrate different types of pipe welding and plate welding	<p><b>After completion of this module students will be able to:</b></p> 5.1 Describe different welding process used for joining pipes 5.2 Explain the different positions and steps in pipe welding 5.3 Compare between pipe and plate welding 5.4 Demonstrate the joining of MS pipe for different joints
6	Explain the application of the following welding processes: Thermit, TIG and MIG	<p><b>After completion of this module students will be able to:</b></p> 6.1 Explain basic idea of thermit welding and its application 6.2 Describe basic idea of TIG and MIG welding and its application
7	Explain different electrodes with proper application	<p><b>After completion of this module students will be able to:</b></p> 7.1 Explain different types of electrodes along with their applications 7.2 Describe the function(s) of flux and coating used in electrodes 7.3 Recognize electrodes from the code as per BIS
8	Identify various welding defects on a job	<p><b>After completion of this module students will be able to:</b></p> 8.1 Explain the different types of welding defects with their causes and remedies 8.2 Identify different welding defects from a given job by visual inspection

## ANNEXURE-I

LIST OF TOOLS AND EQUIPMENT			
WELDER (For a batch of 20 Candidates)			
S No.	Name of the Tools & Equipment	Specification	Quantity
<b>A. TRAINEE TOOLKIT (For each additional unit trainee toolkit Sl.1-15 is required additionally)</b>			
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 19mm x 150mm	20+1 Nos.
5.	Centre punch	9mm x 127mm	20+1 Nos.
6.	Dividers	200 mm	20+1 Nos.
7.	Stainless steel rule	300mm	20+1 Nos.
8.	Scriber	150mm double point	20+1 Nos.
9.	Flat Tongs	350mm long	20+1 Nos.
10.	Hacksaw frame	fixed 300mm	20+1 Nos.
11.	File half round	bastard 300mm	20+1 Nos.
12.	File flat	350mm 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>B. INSTRUMENTS AND GENERAL SHOP OUTFIT - For 2(1+1) units no additional items are required</b>			
<b>TOOLS &amp; EQUIPMENT</b>			
16.	Spindle key		4 Nos.
17.	Screw Driver	300mm blade and 250mm blade	1 each
18.	Number punch	6mm	2 set
19.	Letter punch	6mm	2 set
20.	Magnifying glass	100mm dia.	2 Nos.
21.	Universal Weld measuring gauge		2 Nos.
22.	Earth clamp	600A	6 Nos.
23.	Spanner D.E.	6mm to 32mm	2 sets
24.	C-Clamps	10 cm and 15cm	2 each
25.	Hammers sledge	double faced 4 kg	1 No.
26.	S. Stape	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 <sub>2</sub> 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.	Blackboard and easel with stand		1 No.
38.	Flashback arrester (torch mounted)		4 pairs
39.	Flashback arrester (cylinder mounted)		4 pairs
<b>GENERAL SHOP OUTFIT</b>			
40.	Welding Transformer	with all accessories (400A, OCV 60–100V, 60% duty cycle)	1 set
41.	Welding Transformer (or) Inverter based welding machine	with all accessories (300A, OCV 60–100V, 60% duty cycle)	1 set
42.	D.C Arc welding rectifiers set with all accessories	(400 A. OCV 60–100V, 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 compressors 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	150mm dia.	1 No.
52.	AG4 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 6mm 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.	Workbench	340x120x75cm 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 <sub>2</sub> 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 <sub>2</sub> 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)
<b>C. CONSUMABLE</b>			
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.	Arcweldingcables multicored copper	400/600 ampasperBIS	45 mts.each
85.	Arcweldingsinglecolouredglasses	108 mm x82 mmx3mm. DIN11A &12A	34Nos.
86.	Arcweldingplainglass	108 mm x82 mmx3mm.	68Nos.
87.	GasweldingGoggles	with Colour glass 3 or 4ADIN	34Nos.
88.	Safetygogglesplain		34Nos.
89.	Sparklighter		6 Nos.
90.	AG4Grindingwheels		10Nos.

### **Marks Distribution**

Outcome	Outcome Code	Total Th Marks	Total Pr Marks
Enumerate the basic welding terminology and application of tools in welding process	CGM/0702/OC1	20	60
Demonstrate metal cutting and joining process by oxy-acetylene gas welding	CGM/0702/OC2	40	90
Demonstrate MMAW to join two pieces of MS plate	CGM/0702/OC3	20	70
Explain different Welding symbols from drawing & perform relevant welding	CGM/0702/OC4	20	60
Demonstrate different types of pipe welding and plate welding	CGM/0702/OC5	20	70
Explain the application of the following welding processes: Thermit, TIG and MIG	CGM/0702/OC6	10	50
Explain different electrodes with proper application	CGM/0702/OC7	10	50
Identify various welding defects on a job	CGM/0702/OC8	10	50
Work in real job situation with special emphasis on basic safety and hazards in this domain (OJT).	CGM/0702/OC9	0	300
Employability Skill-60 Hrs	DGT/VSQ/N0102	50	0

