

**CERTIFICATE COURSE IN WELDER (GAS & ARC)
(6 MONTHS)**



**STATE BOARD OF TECHNICAL EDUCATION & TRAINING
SANKETHIKA VIDYA BHAVAN, MASAB TANK, TELANGANA, HYDERABAD.**

Syllabus for the Trade of “WELDER (Gas & ARC)

Duration : Six Months : 250 Hours

SUB CODE	NAME OF THE SUJECT	PERIODS/WEEK		TOTAL PERIODS PER 6 MONTHS	SCHEME OF EXAMINATION			
		Theory	Practicals		Duration Hours	Sessional Marks	End Exam Marks	Total Marks
WL-101	BASIC ARC WELDING	03	--	50	02	--	100	100
WL-102	BASIC GAS WELDING	03	--	50	02	--	100	100
WL-103	ARC WELDING LAB	--	06	75	03	40	60	100
WL-104	GAS WELDING LAB	--	06	75	03	40	60	100
	TOTAL	06	12	250	10	--	--	400

SUBJECT TITLE : **BASIC ARC WELDING**
SUBJECT CODE : **WL 101**
PERIODS/WEEK : **03**
PERIODS/YEAR : **50**

S.NO.	MAJOR TOPICS	NUMBER OF PERIODS
01	Introduction to ARC Welding	05
02	Definition & Principle of Arc Welding	05
03	Joints used I Arc Welding	10
04	Selection of Welding Electrodes & Classification	10
05	Arc welding Positions	10
06	Effect Length of Arc Welding	10
	TOTAL	50

Unit- 1 : Introduction to ARC Welding : Elementary First Aid. Importance of Welding in Industry - Safety precaution -Safety equipment -Metal Arc Welding, Arc Welding Equipment, Electrodes, tools and accessories.- Welding machine and electrode manufacturers and specifications - Various Welding Processes and its applications. - Arc Welding terms and definitions.

Unit- 2 : Basic electricity applicable to arc welding and related electrical terms & definitions. - Principle of arc welding

Unit- 3 : Power sources used in welding (AC, DC). Comparison of AC and DC machines - Types of welding joints and its applications. Edge preparation and fit up for different thickness and different joints like **V, J**

Unit- 4 : Selection of welding electrodes and electrode classification and codification as per BIS,AWS and BS Electrode flux coating material. - Electrode types, sizes and current setting of welding machine. - Effects of moisture pick up on electrodes and backing.

Unit- 5 : - Welding positions – flat-horizontal- vertical and over head position. Weld slope and rotation. - Metals: - Properties and uses of cast iron, wrought iron, plain carbon steels and alloy steels

Unit- 6 : DC Polarity and its uses - Arc length – types – effects of arc length. Copper welding by Arc process - Description of HF unit and suppressor.

SUBJECT TITLE : **BASIC GAS WELDING**
SUBJECT CODE : **WL 102**
PERIODS/WEEK : **03**
PERIODS/YEAR : **50**

S.NO.	MAJOR TOPICS	NUMBER OF PERIODS
01	Introduction to gas welding	05
02	Introduction to brazing welding	05
03	Operation with Gas Welding	10
04	Introduction to TIG Welding	10
05	Introduction to MIG Welding	10
06	Working with TIG Welding	10
	TOTAL	50

Unit-1 : Introduction to gas welding - Oxy-Acetylene Welding and Cutting. -Gas Welding Equipments, tools and accessories - Principle of gas welding. - Gas Welding terms and definitions. Consumables used in gas welding filler rods, specifications and sizes. Welding techniques – right and leftward methods. Common gases used for welding, their flame temperatures and uses. -Chemistry of oxy-acetylene flame. - Types of oxy-acetylene flames and uses.

Unit-2 : Oxygen and Acetylene gas cylinders and color coding for different gas cylinders. - -Brazing and bronze welding. -Edge preparation - Calcium carbide properties and uses. Manufacture of calcium carbide. Acetylene gas Generators and manufacturing methods and properties.

Unit-3 : Acetylene gas Purifier, Hydraulic back pressure valve. Charging methods of oxygen and acetylene gases - Oxy-Acetylene Cutting Equipment principle and application. Gas regulators, types and uses. Welding and gas cutting torches and types - Principle of Gas cutting and description of flame cutting equipment -To know about the metals which can be cut by gas

Unit-4 : Introduction to TIG welding - Advantages of TIG over MMAW and gas welding -Power sources for TIG welding - Shielding gases used in TIG welding

Unit-5 : Introduction to MIG welding - Co₂ welding equipment and accessories. - Principe of Co₂ welding - Advantages and Disadvantages TIG over SMAW - Welding wires used in Co₂ welding and composition & solid flux cored wire.

Unit-6 : Shielding gases used in TIG welding. - Machine settings for welding low alloy steel, mild steel - Shielding gases for GMAW organ, Helium, Co₂, Argon+oxygen - Suggested gases, gas mixtures used in spray transfer. Weld quality inspection, common welding mistakes and appearance of good and defective welds - Types of Inspection methods -classification of destructive and NDT methods - -Types of Current, Effects of current and related problems.

SUBJECT TITLE : **ARC WELDING LAB**
SUBJECT CODE : **WL- 103**
PERIODS/WEEK : **06**
PERIODS/YEAR : **75**

S.NO.	MAJOR TOPICS	NUMBER OF PERIODS
01	Arc Welding Practice on Beads	12
02	Single V Butt Joint	12
03	Position Welding	12
04	Fillet Weld Butt Joint	12
05	Welding of cast Iron	12
06	Fillet Lap Joint	15
	TOTAL	75

Unit-1 : Setting up of Arc welding Apparatus.- Striking an arc- Hack sawing, filing square to dimensions. - Marking out on MS plate and punching. **Practice :** Straight line beads on M.S. 10 mm thick in flat position by 3.15 mm ϕ electrode - Weaved bead on M. S 10mm in flat position by 4 mm ϕ

Unit-2 : Square lap and butt joint on M.S. sheet. 5 mm thick in flat Position by arc. - Fillet Tee joint on M.S.10 mm in flat position by Arc. - Outside corner joint on MS 10 mm in flat Position by arc. - Fillet lap joint on M.S. 10 mm in flat position by Arc.

Fillet Tee joint on MS 10 mm in flat position by arc. - Fillet outside corner joint on MS 10 mm in Vertical position by arc. - Single V Butt joint on MS 10 mm in flat position by arc.

Unit-3 : Depositing of weaved beads on MS plates 10mm in vertical (upward position) - Depositing of weaved beads on MS plates 10mm in vertical (Downward position)

- Straight line beading on 10 mm MS plate in overhead position.
- Fillet weld on lap joint on 10 mm MS plate in overhead position.
- Fillet weld on T joint on 10 mm MS plate in overhead position.
- Fillet weld on T joint on 10 mm MS plate in horizontal position.
- Fillet Tee joint on MS 10 mm in Vertical position by Arc

Unit-4 :

- Single V Butt joint on MS 10 mm in vertical position by arc.
- Single V Butt joint on MS 10 mm in overhead position by arc.
- Fillet weld on lap joint on 10mm MS plate in vertical position.

Unit-5 :

- Welding of cast iron plates with V groove in flat position.
- Arc welding of 3mm copper sheet in flat position.
- Welding of Aluminum plates of 5mm in flat position.

Unit-6 :

- Fillet lap joint on M.S. 6 mm in flat position by Arc
- Fillet Tee joint on M.S. 6 mm in flat position by Arc
- Setting up of Arc and gas Apparatus.
- Lighting and setting of flame.
- Straight line Beads on M.S. 3 mm in flat position by arc

SUJECT TITLE : **GAS WELDING LAB**
SUBJECT CODE : **WL- 104**
PERIODS/WEEK : **06**
PERIODS/YEAR : **75**

S.NO.	MAJOR TOPICS	NUMBER OF PERIODS
01	Butt Joint	12
02	Fillet Weld T Joint	12
03	Position Welding	12
04	TIG Welding	12
05	V groove Welding	12
06	Testing on joints	15
	TOTAL	75

Unit-1 :

- Butt weld single V butt joint MS plate 8 mm flat position
- Fillet Lap joint on MS sheet 3 mm in flat position by gas.
- Fillet T joint on MS sheet 3 mm in flat position by gas.
- Fillet Lap joint on MS sheet 3 mm MS Sheet in vertical by gas.
- Fillet Tee joint on MS sheet 3 mm in vertical position by gas.
- Square butt joint on M.S. sheet. 2 mm thick in flat Position by gas.
- Outside corner joint on MS 2 mm in flat Position by gas.
- Pipe butt joint on SS/CS pipe dia. 50 mm x 3 mm wall thickness in flat position by gas welding
- Pipe 90° elbow joint on Aluminium pipe dia. 50 mm x 3 mm wall thickness in flat position by gas welding

Unit-2 :

- Setting of gas cutting equipment
- Straight cutting on MS plate 10mm thick
- Circular cutting on MS plate 10mm thick in flat position
- Profile cutting on Gusset plate
- Hole cutting practice on MS plate
- Square Butt joint on M.S. sheet. 3 mm flat over head position by gas
- Fillet Tee joint on M.S. 6 mm in over head position by Arc
- Butt joint on MS sheet 3mm in flat position
- Fillet weld outside corner joint on MS sheet 3mm in flat position
- Fillet weld T joint on MS sheet 3mm in flat position

Unit-3 :

- Fillet weld outside corner joint on SS sheet 3 mm flat position
- Butt weld square butt joint on Aluminum sheet 3 mm flat position
- Butt weld of copper plates 5mm square joint in flat position.
- Arc welding of MS plate 10mm in 1G, 2G, 3G and 4G position.

Unit-4 :

- Pipe butt weld joint on MS pipe 25x3mm position 1G, 2G, 5G and 6G TIG welding
- Setting up of CO₂ welding machine with all accessories.
- Straight line beads on MS plate 5mm flat position.
- Fillet weld of 10mm plate on lap joint in flat position
- Fillet weld of 10mm plate on T joint in flat position
- V groove weld on 10mm plate on butt joint in flat position.

Unit-5 :

- Setting up of Co₂ welding machine with all accessories.
- Straight line beads on MS plate 5mm flat position.
- Fillet weld of 10mm plate on lap joint in flat position
- Fillet weld of 10mm plate on T joint in flat position
- V groove weld on 10mm plate on butt joint in flat position.

Unit-6 :

- Testing of weld joints by visual inspection ,
- Dye penetrant test,
- Magnetic particle test

Week No.	Practical	Theory	Workshop Calculation & Sciences
1	Induction training: <ul style="list-style-type: none"> - Familiarization with the Institute. - Importance of trade Training - Machinery used in the trade. <ul style="list-style-type: none"> - Introduction to safety equipment and their use etc. - Setting up of Arc welding Apparatus. - Striking an arc Hack sawing, filing square to dimensions. <ul style="list-style-type: none"> - Marking out on MS plate and punching 	<ul style="list-style-type: none"> - General discipline in the Institute - Elementary First Aid. - Importance of Welding in Industry - Safety precaution - Safety equipment - Metal Arc Welding, - Arc Welding Equipments, Electrodes, tools and accessories. - Welding machine and electrode manufacturers and specifications - Various Welding Processes and its applications. <p><u>Arc Welding terms and</u></p>	<ul style="list-style-type: none"> - Calculation to the Trade skill and fundamental Arithmetical operations Addition, Subtraction, Multiplication and Division. General simplifications - Fraction-Addition, Subtraction, multiplication and Division-Problems
2	Straight line beads on M.S. 10 mm thick in flat position by 3.15 mm ϕ electrode <ul style="list-style-type: none"> - Weaved bead on M. S 10mm in flat position by 4 mm ϕ electrode 	<ul style="list-style-type: none"> - Basic electricity applicable to arc welding and related electrical terms & definitions. - Principle of arcwelding 	Measurement of scale, tape, vernier and micrometer

3	<p>Square lap and butt joint on M.S. sheet. 5 mm thick in flat Position by arc.</p> <p>Fillet Tee joint on M.S. 10 mm in flat position by Arc.</p> <p>Outside corner joint on MS 10 mm in flat Position by arc.</p> <p>- Fillet lap joint on M.S. 10 mm in flat position by Arc.</p>	<ul style="list-style-type: none"> - Power sources used in welding (AC, DC). Comparison of AC and DC machines - Types of welding joints and its applications. Edge preparation and fit up for different thickness and different joints like V, J 	<ul style="list-style-type: none"> - Decimal-Addition, Subtraction, Multiplication, and Division-Problems.
4	<ul style="list-style-type: none"> - Fillet Tee joint on MS 10 mm in flat position by arc. - Fillet outside corner joint on MS 10 mm in Vertical position by arc. - Single V Butt joint on MS 10 mm in flat position by arc. 	<ul style="list-style-type: none"> - Selection of welding electrodes and electrode classification and codification as per BIS, AWS and BS - Electrode flux coating material. - Electrode types, sizes and current setting of welding machine. - Effects of moisture pick up on electrodes and backing. 	<ul style="list-style-type: none"> - Conversion of Fraction to Decimal and vice-versa.
5	<ul style="list-style-type: none"> - Depositing of weaved beads on MS plates 10mm in vertical (upward position) - Depositing of weaved beads on MS plates 10mm in vertical (Downward position) 	<ul style="list-style-type: none"> - Welding positions – flat-horizontal- vertical and over head position. Weld slope and rotation. - Metals: - Properties and uses of cast iron, wrought iron, plain carbon steels and alloy steels 	<ul style="list-style-type: none"> - System of Units - British, Metric and S.I. Units for Length, Mass, Area, Volume, Capacity, time. Conversions between British and Metric Systems.
6	<ul style="list-style-type: none"> - Straight line beading on 10 mm MS plate in overhead position. - Fillet weld on lap joint on 10 mm MS plate in overhead position. - Fillet weld on T joint on 10 mm MS plate in overhead position. - Fillet weld on T joint on 10 mm MS plate in horizontal position. - Fillet Tee joint on MS 10 mm in Vertical position by Arc 	<ul style="list-style-type: none"> - DC Polarity and its uses - Arc length – types – effects of arc length. 	

7	<ul style="list-style-type: none"> - Single V Butt joint on MS 10 mm in vertical position by arc. - Single V Butt joint on MS 10 mm in overhead position by arc. - Fillet weld on lap joint on 10mm MS plate in vertical position. 		
8	<ul style="list-style-type: none"> - Welding of cast iron plates with V groove in flat position. - Arc welding of 3mm copper sheet in flat position. - Welding of Aluminum plates of 5mm in flat position. 		
9	<ul style="list-style-type: none"> - Welding of steel pipes in 1G, 2G, 3G and 4G position. - Welding of Non ferrous 40mm pipes in 5G and 6G positions. 		Properties and uses of Cast iron, Plain carbon steels and alloy steels
10	<ul style="list-style-type: none"> - Setting up of Arc and gas Apparatus. - Lighting and setting of flame. - Straight line Beads on M.S. 3 mm in flat position by arc - Square Butt joint on M.S. sheet. 3 mm in flat position by gas 		
11	<ul style="list-style-type: none"> - Fillet lap joint on M.S. 6 mm in flat position by Arc - Fillet Tee joint on M.S. 6 mm in flat position by Arc 	<ul style="list-style-type: none"> - Introduction to gas welding - Oxy-Acetylene Welding and Cutting. - Gas Welding Equipments, tools and accessories - Principle of gas welding. - Gas Welding terms and definitions. - Consumables used in gas welding filler rods, specifications and sizes. 	<ul style="list-style-type: none"> - -
12	<ul style="list-style-type: none"> - Butt weld single V butt joint MS plate 8 mm flat position - Fillet Lap joint on MS sheet 3 mm in flat position by gas. - Fillet T joint on MS sheet 3 mm in flat position by gas. 	<ul style="list-style-type: none"> - Common gases used for welding, their flame temperatures and uses. - Chemistry of oxy-acetylene flame. - Types of oxy-acetylene flames and uses. 	<p>Square roots:</p> <ul style="list-style-type: none"> - The Square and Square root of a Whole Number and Decimal, - Shop Problems. - Pythagoras Theorem- - Shop Problems.

13	<ul style="list-style-type: none"> - Fillet Lap joint on MS sheet 3 mm MS Sheet in vertical by gas. - Fillet Tee joint on MS sheet 3 mm in vertical position by gas. - 	<ul style="list-style-type: none"> - Oxygen and Acetylene gas cylinders and color coding for different gas cylinders. - Braze and bronze welding. - Edge preparation 	
14	<ul style="list-style-type: none"> - Square butt joint on M.S. sheet. 2 mm thick in flat Position by gas. - Outside corner joint on MS 2 mm in flat Position by gas. - 	<ul style="list-style-type: none"> - Calcium carbide properties and uses. - Manufacture of calcium carbide. Acetylene gas Generators and manufacturing methods and properties. 	
15	<ul style="list-style-type: none"> - Pipe butt joint on SS/CS pipe dia. 50 mm x 3 mm wall thickness in flat position by gas welding - Pipe 90° elbow joint on Aluminium pipe dia. 50 mm x 3 mm wall thickness in flat position by gas welding. 	<ul style="list-style-type: none"> - Acetylene gas Purifier, Hydraulic back pressure valve. Charging methods of oxygen and acetylene gases 	
16	<ul style="list-style-type: none"> - Setting of gas cutting equipment - Straight cutting on MS plate 10mm thick - Circular cutting on MS plate 10mm thick in flat position - Profile cutting on Gusset plate - Hole cutting practice on MS plate - Square Butt joint on M.S. sheet. 3 mm flat over head position by gas - Fillet Tee joint on M.S. 6 mm in over head position by Arc 	<ul style="list-style-type: none"> - Oxy-Acetylene Cutting Equipment principle and application. - Gas regulators, types and uses. Welding and gas cutting torches and types - Principle of Gas cutting and description of flame cutting equipment - To know about the metals which can be cut by gas 	
17	<ul style="list-style-type: none"> - Butt joint on MS sheet 3mm in flat position - Fillet weld outside corner joint on MS sheet 3mm in flat position - Fillet weld T joint on MS sheet 3mm in flat position 		-
18	<ul style="list-style-type: none"> - Fillet weld outside corner joint on SS sheet 3 mm flat position - Butt weld square butt joint on Aluminium sheet 3 mm flat position 	-	

19	<ul style="list-style-type: none"> - Butt weld of copper plates 5mm square joint in flat position. - Arc welding of MS plate 10mm in 1G, 2G, 3G and 4G position. - Pipe butt weld joint on MS pipe 25x3mm position 1G,2G,5G and 6G TIG welding 	-	
20	<ul style="list-style-type: none"> -Setting up of Co₂ welding machine with all accessories. -Straight line beads on MS plate 5mm flat position. -Fillet weld of 10mm plate on lap joint in flat position - Fillet weld of 10mm plate on T joint in flat position -V groove weld on 10mm plate on butt joint in flat position. 	-	
21	<ul style="list-style-type: none"> - Fillet weld of 10mm plate on T joint in horizontal position - Straight line beading on 10 MS plate in vertical position. - Fillet weld of 10mm plate on T joint in vertical position -Butt weld single V joint on MS plate 10mm in horizontal position. -Corner joint on 10mm MS plate in flat position. V Groove welding on 10mm MS plate in overhead position. 	-	
22	Testing of weld joints by visual inspection ,Dye penetrant test, Magnetic particle test	-	
23-26	On job training for four weeks.		

LIST OF TOOLS & EQUIPMNT FOR THE TRADE OF “WELDER (GAS & ELECTRIC)”
Tools & Equipment's for 30 trainees

Trainees Kit – (As per the below table)

SI. No.	Name of the items	Quantity
1	Hand Gloves	31 nos.
2	Apron leather	31 nos.
3	Welding helmet	31 nos.
4	Welding handshield	31 nos.
5	Gas welding Goggles with Colour glass	31 nos.
6	Chipping hammer	31 nos.
7	Chisel cold flat 19 mm x 150 mm	31 nos.
8	Centre punch 9 mm x 127 mm	31 nos.
9	Dividers 200 mm	31 nos.
10	Caliper outside 150 mm	31 nos.
11	Stainless steel rule 300mm	31 nos.
12	Wire brush 5 rows and 3 rows	31 nos.
13	Leather sleeves 16”	31 nos.
14	Safety boots for welders	31 nos.
15	Safety goggles	31 nos.
16	Scriber 150 mm	31 nos.
17	Tongs holding 350mm	31 nos.

General Machinery Shop outfit (as per the table)

SI. No.	Name and Description of Tools	Quantity
18	Stainless steel rule 300mm	31
19	Hammer ball peen 1 kg with handle	31
20	Spark lighter	4
21	Spindle key	2
22	Screw Driver 300mm blade and 250 mm blade	1 each
23	Tip cleanerset	2
24	Number punch 6 mm and 1 set letter punch 6 mm	1 set
25	Hacksaw frame fixed 300 mm	4
26	Arc welding coloured glasses 108 mm x 82 mm x 3 mm. DIN 11 A & 12 A	31nos
27	Magnifying glass 100 mm .dia	2
28	Weld measuring gauge fillet and butt	1 each
29	File half round bastard 350 mm.	31 nos.
30	File flat 350 mm rough	31 nos.
31	Earth clamp	6

32	Spanner D.E. 6 mm to 32mm	2 sets
33	Clamps 10 cm and 15 cm	4 each
34	Hammer sledge double faced 4 kg	1
35	Pipe wrench 25 cm and 35 cm	1 each
36	Steel tape 5 meters flexible in case	1
37	Electrode holder 400 amps	6
38	H.P. Welding torch No. 2 with nozzle nos. 1,2,3, 5 & 7	2 sets
39	Rubber hose clips $\frac{3}{4}$ "	10
40	Welding rubber hose, oxygen 8mm. dia x 5mts.long	2
41	Welding rubber hose Acetylene 8mm. dia x 5mts. long	2
42	Gas Pressure regulator oxygen double stage	2
43	Gas Pressure regulator acetylene double stage	2

General Installation

46	D.C Arc welding rectifiers 16 sets with all accessories (400 A. OCV 60–100 V, 60% duty cycle)	16 sets
47	Welding Generator DC rotary set 200-300 amps with all accessories	1 set
48	Suitable gas welding table	6 sets
49	Suitable Arc welding table with positioner	6
50	Trolley for cylinder (H.P. Unit)	2
51	Bench shear capacity up to 5 mm	1
52	Pedestal grinder fitted with coarse and medium grain size grinding wheels dia. 300 mm	2
53	Work bench 340x120x75 cm with 4 bench vices of 125 mm jaw opening	8 no's
54	Power hacksawmachine	1
55	AG 7 Grinder	1
57	Portable drilling machine (Cap. 6 mm)	1
58	Fire extinguishers (foam type and CO ₂ type)	1
59	Metal rack 182 cm x 152 cm x 45 cm	3
60	Instructor's table and Chair(Steel)	1 set
61	Blackboard or whiteboard	1
62	First Aid box	1
63	Fire buckets with stand	4
64	Steel lockers with 8 Pigeon holes	2
65	Oven, electrode drying 0 to 250°C, 10 kg capacity	1
66	Oxy Acetylene Gas cutting blow pipe	2 sets
67	Oxygen, Acetylene Cylinders	1 each
68	CO ₂ Arc welding machine 400A capacity with air cooled torch, regulator, gas preheater, Gas hose and standard accessories	1 set

69	AC/DC TIG welding machine with Air cooled torch 300 A, Argon regulator, gas hose, water circulating pump and standard accessories	1 set
70	Bench grinder fitted with fine grain size silicon carbide green grinding wheel dia. 150 mm	1
71	Die penetrant testing kit	1 set
72	Magnetic particle testing Kit	1 set
73	Braze weld equipment Braizer	1 no.
74	Tip Cleaner	8 nos.

General Furniture

Sl. No	Names & Description of Furniture	Quantity
1.	Work bench 250x120x75 with four vices of 12.5 cm	4
2.	Locker with 8 drawers (standard size)	2
3.	Metal Rack 180x150x45cm	2
4.	Steel almirah / cupboard	1
5.	Black board and easel	1
6.	Instructor's Desk or table	1
7.	Chair	1