

# **SYLLABUS**

**FOR THE TRADE OF**

**WELDER**  
**TRADE TECHNOLOGY**  
**MODULE -I**

**UNDER**

*CRAFT INSTRUCTOR'S TRAINING SCHEME*

**DESIGNED BY**  
**GOVERNMENT OF INDIA**  
**MINISTRY OF LABOUR (DGE&T)**  
**CENTRAL TRAINING INSTITUTE**  
**#10, ALANDUR ROAD**  
**Guindy: Chennai-32.**

## **GENERAL INFORMATION**

**1. NAME OF THE TRADE: WELDER**

**2. DURATION: 3 MONTHS**  
**Trade Technology-I module**

**3. ENTRY QUALIFICATION:**

**NTC and NAC**

**or**

**NTC With 1 year experience**

**or**

**NAC three years trade apprenticeship training**

**or**

**Passed Diploma in Mechanical Engg.,**

**or**

**Degree in mechanical Engg.,**

**4. WORKSHOP SPACE: 102 Sq.mtr.**

## LIST OF MEMBERS

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SYLLABUS FOR CRAFT INSTRUCTOR COURSE

TRADE – WELDER

TRADE TECHNOLOGY MODULE : 1

DURATION : 3 MONTHS.

WK. NO	EX.NO	PRACTICAL	THEORY
1		Introduction and importance of craftsman training in India. Familiarization with the institute. Importance of trade training, Machinery used in the trade as well as industries.	General discipline in the institute, importance of welding Aid, introduction to Gas, Arc welding and other welding processes.
2	IE	Fillet weld - lap joint on M.S (10 mm, thick plate) in flat position	Safety in MMAW, Gas welding and Gas cutting, Materials preparation method. Different process of metal joining -Bolting, Riveting, Soldering, Brazing and Seaming.
	IG	Butt Weld -Square butt joint on MS Sheet 3mm thick in D.H.P	
	GC-1	Oxy-Acetylene gas hand cutting on M.S. plate. Straight and Bevel cutting	
3	2E	Fillet weld – Open corner joint on M.S plate(10mm. thick) in D.H.P	Electrical terms and their definitions, uses of Electricity as applied to welding. Electricity-AC-DC-Types of electric welding and applications. Principle of Arc welding.
	2G	Fillet weld - Lap joint on M.S sheet (3mm.thick) in D.H.P	
	3E	Fillet weld- Tee joint on M.S. plate (10mm. thick) in D.H.P.	
4	3G	Fillet weld - Tee joint on M.S sheet (2mm.thick) in D.H.P.	Arc, Gas welding and Gas cutting equipments, tools and accessories. Common gases used for welding-Oxygen, Acetylene. Hydrogen, Coal gas etc. Types of oxy-Acetylene flame-setting-Temperature and uses. Chemistry of oxy-Acetylene flame.
	4E	Butt weld - Single vee butt joint on M.S plate (10mm. thick)in D.H.P	

	4G	Fillet weld - Open corner joint on M.S. plate (2mm. thick )in D.H.P	
5	5E	Straight line beads on 10mm. Thick M.S.plate in H/position	Nomenclature of weld joints-terms applied to each joint-Edge preparation-application. Necessity of welding machines –types- construction- Advantages and Disadvantages of each machine. Arc its characteristic's-Arc length – types- Uses-Advantages & Disadvantages of Arc Length, polarity-types uses and Identification of wrong polarity.
	5G	Fusion run with filler rod on 3mm M.S sheet in H/position	
	6E	Fillet weld –Lap joint on 10mm. thick M.S.plate in H/P.	
	6G	Fillet weld Lap joint on 2mm thick M.S. sheet in H/P	
6	7G	Fillet weld Tee joint on 2mm thick M.S Sheet in H.position.	Acetylene – properties – Acetylene Generator's-water to carbide and carbide to water-working principle care and maintenance. Purifier, H.B pressure valve and Flash back arrestor.
	7E	Fillet weld Tee joint on 6mm thick M.S plate in H/P.	
	8G	Fillet weld outside corner joint on 2mm thick M.S sheet in H/P.	
	8E	Fillet weld outside corner joint on 2mm thick M.S plate in H/P.	

7	9E	Butt weld single vee butt joint on M.S plate (6mm.thick) in H/P.	<p>Oxygen-properties-manufacturing methods, Gas cylinders of oxygen-D.A – description</p> <p>Charging methods and care &amp; maintenance. Manifold system-necessity –Limitation-care and maintenance.</p>
	9G	Butt weld square butt in H/P. 2mm thick M.S sheet in H/P.	
	10E	Straight line beads on M.S plate in vertical (upward) position.	
8	11E	Fillet weld Lap joint on M.S plate (10mm, thick) in V/P (u/w).	<p>Welding positions –Slope-Rotation. Electrode-types-objectives of flux coating-characteristics a flux, I.S.,B.S. and AWS. Specifications, criteria for choice a electrodes, effects of moisture pickup on electrode –uses and storage of electrode.</p>
	11G	Fillet weld Lap joint on 2mm thick M.S sheet in V/P.	
	12E	Fillet Tee joint on M.S plate (6mm thick) in V/P (v/W).	
	12G	Fillet weld Tee joint on M.S sheet 2mm. thick in V.P.	
9	13G	Fillet weld outside corner joint o M.S sheet 2mm thick in V/P .	<p>Gas Regulators –types-construction uses-care and maintenance, welding Blow pipes-types-uses-care and maintenance, Difference between L.P and H.P blow pipes.</p> <p>Gas cutting torch-uses construction- care and maintenance.</p>
	13E	Fillet weld outside corner joint on M.S 6mm thick plate in V.P (UW).	
	14G	Butt weld square butt joint on M.S sheet 2mm (or) 3mm thick in V.P.	
10	14E	Butt weld single vee butt joint on 10mm M.S plate in V/P.	<p>Arc blow –definition-effects methods to over come in practice. Distortion in welding-causes</p> <p>Effects. Methods employed to minimize its effects.</p>
	15E	Straight line beads on M.S plate in O.H.P.	
	15G	Fusion run with filler rod on M.S sheet 3mm thick in OHP.	

11	16E	Fillet weld Tee joint an M.S. plate 6mm thick in OHP.	Specification for filler rods and wires. For gas welding. Effect of Atmospheric on metals. Uses A gas welding flux and filler rods for different methods.
	16G	Fillet weld - Lap joint an M.S.sheet 2mm. thick in O.H.P.	
	17E	Fillet weld - Outside corner joint an M.S. plate 6mm thick in OHP.	
12	18E	Butt weld - Single vee butt joint as M.S. plate 10mm thick in OHP.	Effects of Alloying elements on weld ability.  -Revision- & Examination
	17 G	Filler weld - Outside corner joint as M.S. sheet 2mm thick in OHP.	
	18G	Butt weld square butt joint as M.S. sheet 2mm thick in OHP. [REVISION & Examination]	

## LIST OF TOOLS & EQUIPMENT

FOR THE TRADE OF WELDER (GAS AND ELECTRIC)  
(FOR A BATCH OF UNIT OF 12 TRAINEES)

S.NO	TRAINEE -KIT	FOR T.O.,	FOR TRAINEES
1.	Gloves pair leather	1 No	12 Nos
2.	Apron leather	1 No	12 Nos
3.	Screen welding helmet type	1 No	12 Nos
4.	Screen welding hand	1 No	12 Nos
5.	Goggles pair welder	1 No	12 Nos
6.	Hammer scaling 0.25kg.with handle	1 No	12 Nos
7.	Chisel cool flat 19mm	1 No	12 Nos
8.	Centre punch 9mm*127 mm	1 No	12 Nos
9.	Dividers 20 cm	1 No	12 Nos
10.	Caliper outsides 15 cm	1 No	12 Nos
11.	Rule 60 cm two fold brass tipped Read inches and mm	1 No	12 Nos
12.	Wire brush 15cm*3.7cm	1 No	12 Nos
13.	Spark lighter	1 No	12 Nos
14.	Chipping screen hand	1 No	12 Nos
15.	Safety boots for welders	1pair	12pairs
16.	Safety goggles	1pair	12pairs
17.	Square blade 15cm	1 No	12 Nos
18.	Scriber 15cm	1 No	12 Nos
19.	Tongs holding 30 cm	1 No	12 Nos

## SHOP OUT FIT

20.	Brass Rule 30cm or nickel chrome steel rule 30cm-	4 Nos
21.	Hammer ball peen 1kg. with handle	4 Nos
22.	Chisel cold cross 9 mm	8 Nos
23.	Screw Driver 25cm blade and 20 cm blade	1 each
24.	Leg vice on stand 150mm	1 No
25.	Number punch 6mm and letter punch 6mm	4 Nos
26.	Hacksaw frame adjustable 30cm	2 Nos
27.	Hammering blocks 5 cm thick 60 sq	4 Nos
28.	Magnifying glass 15 cm	2 Nos
29.	Weld measuring gauge fillet and butt	6 Nos
30.	File half round bastard 30 cm	6 Nos
31.	File flat 35cm rough	4 Nos
32.	Spanner 12mm and 15 mm double ended	1 set
33.	Spanner D.E. 6mm to 15mm 1.5 mm set	2each
34.	Clamps 10 cm 15 cm 20cm 30cm	1 No
35.	Hammer sledge double faced 3 kg	1 each
36.	Pipe wrench 25cm and 35 cm	3sets
37.	Steel tape 182 cm flexible in case	1 No.
38.	Tinman's square 60 cm * 30cm	1 No
39.	Welding torches with 10 nozzles 2 to 45 Low pressure with Nozzle	6 sets

40.	Equally Micro flow welding process hot	2 sets
41.	Rototec powder welding process cold	1 kit
42.	Earth clamp	1 kit
43.	Pipe cutter ( Cap. 50mm dia)	12nos
44.	Cutting troth Oxy- Acetylene with cutting nozzle 3/64	2 set
45.	Heavy duty cutting and sqouging blow pipe with Cutting and sqouging nozzles	1 set
46.	Electrode holder 400 amps	6 nos
47.	Welding rubber hose, oxygen and acetylene 8mm	65Mt. each
48.	Rubber hose clips	50nos
49.	Spindle key ( for opening cylinder valve)	8 nos
50.	Pressure regulator oxygen double stage	8 nos
51.	pressure regulator acetylene Regulators	8 nos
52.	Tip cleaner	8 nos
53.	Glass coloured 108mrn*82mrn*3mrn DIN 11 A 13A	16nos
54.	Glass white 108mrn*82mrn	32nos
55.	Outfit spanner	8 nos
56.	Rubber hose pipe black and red 5 mm	30mt
57.	Leather sleeves	12nos

## GENERAL Installation

58. Transformer welding continuous welding current with all Accessories 300A & 400 A	2each
59. Arc welding set rectifier type 300- 450 Amps continuous Welding current with all accessories	1 set
60. Welding generator DC rotary set 200 -300 amps with all Accessories	1 set
61. CO2/MIG welding machine complete 400 amps	2 set
62. TIG Welding set complete 300 amps AC/DC	2 set
63. Spot welding machine	1 set
64. projection welding machine	1 set
65) Weld inspection gauge ( fillet and universal)	1 set
66) submerged arc welding machine 1200 amps capacity -1 set	
67) Eutalloy powder spray kit	1 set
68) Rototec powder spray kit	1 set
69) Ultrasonic flaw detector	1 set
70) Dye penetrant kit	1 set
71) Air plasma cutting system	1 set
72) Universal seam welding machine 50kva welding Capacity 2mm thick on MS and SS	1 set
73) Oxygen and acetylene gas manifold system (working provision for atleast six trainees)	1 set

74) Empty gas cylinders	
A – carbon-di-oxide cylinder 32kg capacity	2 nos
B – Argon cylinder 7cubic meter capacity	2nos
C- oxygen cylinder 7 cubic meter	4 nos
D- D.A cylinder 7 cubic meter	2 nos
75) Auto darkening helmet	10 nos
76) Reference radio graphic films	1 set
77) personal computers latest version	1 set
78) Note book computer with latest version	5 nos
79) L.C.D projector	1 set
80) Pressure vessel welding codes ( book or C.D) I.B.R and ASME sec 9 –	Each 1 no
81) Structural welding codes D1.1 (Book or C.D)	1 nos
82) Electron beam welding Machine	1 set
83) Laser cutting machine	1 set
84) Welding cables to carry 350 amps with flexible rubber	- 54 mts
85) Lugs for cables	24 nos
86) Oxygen cutting machine(Line & circle )-	1 no
87) Gas welding table 822 cm*92 cm + 60 cm fire bricks on stand with positioned	6 nos
88) Arc welding table all metal with positioned 122cm *92cm*60cm -	6 nos
89) Trolley for cylinder (HP.Unit)	2 nos
90) Bench Shear hand capacity up to 5 mm	1no
91) D.E. grinder 30cm wheel motorized pedestal type	1no

92) Vice bench 10cm	6 nos
93) Power hacksaw	1no
94) Electrode drying oven thermostatically controlled Temp 0-250C, 10KGCap	1no
95) AG 7 grinder	1 no
96) portable grinding machine (Cap. 6mm)	1no
97) Braze weld equipment brazier that can be used with existing welding Transformer	1no
98) Fire extinguisher (foam type & CO2 type )	2 each
99) Metal rack 182 cm* 45 cm	1no
100) Instructor table (steel)	1 no
101) instructor chair (steel)	1 no
102) black board with easel	1no
103) first aid box	1no
104) welding helmet	6nos
105) Fire buckets with stand	3nos
106) Steel lockers with 8 pigeon holes	2nos

# **SYLLABUS**

**FOR THE TRADE OF**

**WELDER**  
**TRADE TECHNOLOGY**  
**MODULE -II**

**UNDER**

*CRAFT INSTRUCTOR'S TRAINING SCHEME*

**DESIGNED BY**  
**GOVERNMENT OF INDIA**  
**MINISTRY OF LABOUR (DGE&T)**  
**CENTRAL TRAINING INSTITUTE**  
**#10, ALANDUR ROAD**  
**Guindy: Chennai-32.**

## **GENERAL INFORMATION**

**1. NAME OF THE TRADE: WELDER**

**2. DURATION: 3 MONTHS**  
**Trade Technology-II module**

**3. ENTRY QUALIFICATION:**

**Should have completed TT module I on  
WELDER trade**

**4. WORKSHOP SPACE: 102 Sq.mtr.**

## LIST OF MEMBERS

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**SYLLABUS FOR CRAFT INSTRUCTOR COURSE**

**TRADE – WELDER**

**TRADE TECHNOLOGY MODULE : 2**

**DURATION : 3 MONTHS.**

1	1G	Butt weld –Pipe joint on M.S. pipe dia. 50mmx3mm .WT.1G (Rolling)	Welding technique-Right / Left Ward- Explanation-method-application. Welding of pipe-Difference between plate and pipe welding-positions-1G, 2G, 5G and 6G, procedure of pipe welding. Pipe Development drawings of Elbow, 90° Tee joint, 45° joint and Y joint.
	1E	Butt Weld - Pipe butt joint on M.S. pipe Ø150mm x 6mm. Wall thickness 1G Rolling	
	2E	Pipe L joint on M.S. pipe Ø 150mm x 6mm WT 1G Rolling	
	3E	Tee joint pipe 90degree Tee joint on M.S pipe dia 100mmx 6mm WT.	
2	4E	Pipe Branch joint 45degree on M.S pipe Ø 100mm x 5mm. WT.1G Rolling	Cast iron- types-determination of weld ability –pre heating methods, fusion welding of C.I by Arc and gas. Bronze welding of C.I..
	5E	Fillet Weld -Pipe flange joint (circular cutting ) on M.S. Plate 6mm thick, M.S pipe Ø 100mm x 5mm WT in 1G position	
	6E	Butt Weld –Single Vee butt joint on C.I, block 6mm thick in flat position.	
3	2G	Butt Weld –Square butt joint on brass sheet 3mm & 2mm in flat position.	Brass –types –properties,uses –fusion welding of brass. Copper-types-properties-uses. Fusion welding of copper. Bronze welding of copper by gas and arc..Stainless steel –types – properties –uses –weld decay – fusion welding of S.S. by arc/gas..Metal spray –methods and applications. Stellite – hard surfacing etc.
	3G	Fillet Weld –Tee joint on brass sheet 3mm & 2mm in flat position.	
	4G	Butt Weld –Square butt joint on copper sheet 3mm & 2mm in flat position	
	5G	Fillet Weld –Tee joint on copper sheet 2mm in flat position.	

4	6G	Butt weld -Square butt joint on Aluminium sheet 3mm & 2mm.	<p>Inspection of weld – before –during and after welding. Testing of weld – types –definition. N.D.T. such as Visual, test, Sound test, Magnetic, Liquid/ dye penetrant, X ray, Gamma ray and Ultrasonic test etc.,</p> <p>Destructive tests such as Nick break, Free bend, Guided bend (Root and Face bend) , Tensile test , Impact (Charpy and Izod), Hardness test (Brinell, Vickers &amp;Rockwell)etc.</p>
	7G	Fillet weld –Tee joint on Alumnium sheet the Tee 3mm & 2mm.	
	8G	Brazing of copper to brass tube (bell mouth joint)dia 25mm x2mm WT in flat position.	
5	PAC1	Plasma Arc cutting on non ferrous metals	<p>Oxy –Acetylene gas cutting of metals – cutability –faults in cutting. Cutting of metals by metallic and carbon electrodes. Gouging - methods –types –steps of gouging – Application. Plasma cutting of M.S.,S.S. and Aluminium.</p>
	AC1	Arc gouging with gouging electrodes on M.S plate above 12mm thick	
	AC2	Carbon arc gouging on M.S plate 12 mm thick	

6	TIG1	Fusions runs without filler rod on Aluminium sheet 3mm in flat position.	Introduction to TIG.welding – equipment – advantages of TIG welding over MMAW and Oxy –Acetylene welding. Power source for TIG –types –applications- care and maintenance – High frequency unit – parts –constructions and uses. D.C. suppressor unit –constructions – application.
	TIG2	Fusions runs with filler rod on Aluminium sheet 3mm in flat position.	
	TIG3	Fillet weld –Tee joint on Aluminium sheet 3mm in flat position.	
	TIG4	Butt weld – Square butt joint on Aluminium sheet 3mm in flat position	
7	TIG5	Fillet weld –Outside corner joint on Aluminium sheet 3mm in flat position	Tungsten electrodes –types –sizes –uses, Argon gas –properties-uses. Defects in TIG – causes – corrections. Atomic hydrogen Arc welding (AHAW)-equipments –applications,. Plasma Arc welding (PAW)- types –equipments –applications –advantages and disadvantages. Electron Beam welding (EBW)-equipments –applications advantages –disadvantages. Thermit welding –equipment- Thermit mixtures – types –applications. Friction welding –equipment –application etc. Linde welding –process.
	TIG6	Butt weld – Square butt joint on Aluminium pipe dia 50mm x 3mm WT in flat position	
	TIG7	Fusions runs with filler rod on Stainless steel sheet 2mm in flat position.	
	TIG8	Fillet weld –Lap joint on Stainless steel sheet 2mm in flat position.	
8	TIG9	Fillet weld –Outside corner joint on S.S. sheet 2mm in flat position	Codes and standards , Structural welding codes, pressure vessels welding codes and pipe line weldingcodes. Quality control and quality assurance etc..Welding Procedure Specifications (WPS) and Procedure Qualification Records (PQR).
	TIG10	Butt weld –Square butt joint on S.S. sheet 2mm in flat position	
	TIG11	Butt weld on M.S Pipe dia 50mm x 3mm WT in 1G position.	
	TIG12	Fillet weld - Tee joint on M.S. Pipe 60mm OD x3mm WT.	
9	CO <sub>2</sub> -1	Straight line beads on M.S. plate (10mm)in flat position.	Introductions to CO2 welding –equipment and accessories. Description of CO2 welding set with diagram. Mode of metal transfer in CO2 welding –dip or short circuiting transfer, spray transfer (free transfer )- Globular transfer (intermittent), MIG.Pulsed Arc welding –synergic pulse MIG welding.
	CO <sub>2</sub> -2	Fillet weld –Tee joint on M.S plate 12 mm in flat position	
	CO <sub>2</sub> -3	Fillet weld –Outside corner joint on M.S plate 12 mm in flat position	

10.	CO2-4	Fillet weld- Lap joint on M.S. plate 50 x12mm thick in DHP	Welding wires used in CO <sub>2</sub> welding –its composition- diameters – applications. Various gas mixtures and its applications in CO <sub>2</sub> welding. Wire feed system – types –applications –limitations –care and maintenance. Tables / data related to CO <sub>2</sub> welding, information on solid flux cored wires.
	CO2-5	Straight line beads on M.S. plate 10 mm thick in HP	
	CO2-6	Fillet weld Tee joint on M.S. plate 10 mm thick in flat.	
11.	SAW 1	Straight line practice on M.S. plate (15 mm and above thick of M.S) in flat position.	Submerged Arc welding (SAW) principle of the process –equipment – weld procedure – Advantages. Electro slag/gas welding –equipment- applications- advantages-disadvantages. Ultrasonic welding –equipment – applications –advantages-disadvantages.
	SAW 2	<b>Butt weld</b> -Single vee butt joint on 15 mm and above thickness of M.S. plate in flat.	
	SAW 3	Fillet weld- Tee joint on M.S. plate 8 to 20 mm thick in flat.	
12.	SPOT 1	Lap joint on M.S sheet 3mm and 2mm by spot welding	Resistance welding –Principle of resistance welding-types –applications – advantages. Laser Beam welding (LBW) – equipment – applications etc.,  REVISION AND EXAMINATION.
	SPOT 2	Lap joint on S.S.Sheet. 2mm and 1.6mm by spot welding.	
	SEAM 1	Lap joint on M.S.Sheet. 1.6mm and 2mm by seam welding.	

## LIST OF TOOLS & EQUIPMENT

FOR THE TRADE OF WELDER (GAS AND ELECTRIC)  
(FOR A BATCH OF UNIT OF 12 TRAINEES)

S.NO	TRAINEE -KIT	FOR T.O., FOR TRAINEES	
1.	Gloves pair leather	1 No	12 Nos
2.	Apron leather	1 No	12 Nos
3.	Screen welding helmet type	1 No	12 Nos
4.	Screen welding hand	1 No	12 Nos
5.	Goggles pair welder	1 No	12 Nos
6.	Hammer scaling 0.25kg.with handle	1 No	12 Nos
7.	Chisel cool flat 19mm	1 No	12 Nos
8.	Centre punch 9mm*127 mm	1 No	12 Nos
9.	Dividers 20 cm	1 No	12 Nos
10.	Caliper outsides 15 cm	1 No	12 Nos
11.	Rule 60 cm two fold brass tipped Read inches and mm	1 No	12 Nos
12.	Wire brush 15cm*3.7cm	1 No	12 Nos
13.	Spark lighter	1 No	12 Nos
14.	Chipping screen hand	1 No	12 Nos
15.	Safety boots for welders	1pair	12pairs
16.	Safety goggles	1pair	12pairs
17.	Square blade 15cm	1 No	12 Nos
18.	Scriber 15cm	1 No	12 Nos
19.	Tongs holding 30 cm	1 No	12 Nos

## SHOP OUT FIT

20.	Brass Rule 30cm or nickel chrome steel rule 30cm-	4 Nos
21.	Hammer ball peen 1kg. with handle	4 Nos
22.	Chisel cold cross 9 mm	8 Nos
23.	Screw Driver 25cm blade and 20 cm blade	1each
24.	Leg vice on stand 150mm	1 No
25.	Number punch 6mm and letter punch 6mm	4 Nos
26.	Hacksaw frame adjustable 30cm	2 Nos
27.	Hammering blocks 5 cm thick 60 sq	4 Nos
28.	Magnifying glass 15 cm	2 Nos
29.	Weld measuring gauge fillet and butt	6 Nos
30.	File half round bastard 30 cm	6 Nos
31.	File flat 35cm rough	4 Nos
32.	Spanner 12mm and 15 mm double ended	1 set
33.	Spanner D.E. 6mm to 15mm 1.5 mm set	2each
34.	Clamps 10 cm 15 cm 20cm 30cm	1 No
35.	Hammer sledge double faced 3 kg	1each
36.	Pipe wrench 25cm and 35 cm	3sets
37.	Steel tape 182 cm flexible in case	1 No.
38.	Tinman's square 60 cm * 30cm	1 No
39.	Welding torches with 10 nozzles 2 to 45 Low pressure with Nozzle	6 sets

40.	Equally Micro flow welding process hot	2 sets
41.	Rototec powder welding process cold	1 kit
42.	Earth clamp	1 kit
43.	Pipe cutter ( Cap. 50mm dia)	12nos
44.	Cutting troth Oxy- Acetylene with cutting nozzle 3/64	2 set
45.	Heavy duty cutting and sqouging blow pipe with Cutting and sqouging nozzles	1 set
46.	Electrode holder 400 amps	6 nos
47.	Welding rubber hose, oxygen and acetylene 8mm	65Mt. each
48.	Rubber hose clips	50nos
49.	Spindle key ( for opening cylinder valve)	8 nos
50.	Pressure regulator oxygen double stage	8 nos
51.	pressure regulator acetylene Regulators	8 nos
52.	Tip cleaner	8 nos
53.	Glass coloured 108mrn*82mrn*3mrn DIN 11 A 13A	16nos
54.	Glass white 108mrn*82mrn	32nos
55.	Outfit spanner	8 nos
56.	Rubber hose pipe black and red 5 mm	30mt
57.	Leather sleeves	12nos

## GENERAL Installation

58. Transformer welding continuous welding current with all Accessories 300A & 400 A	2each
59. Arc welding set rectifier type 300- 450 Amps continuous Welding current with all accessories	1 set
60. Welding generator DC rotary set 200 -300 amps with all Accessories	1 set
61. CO2/MIG welding machine complete 400 amps	2 set
62. TIG Welding set complete 300 amps AC/DC	2 set
63. Spot welding machine	1 set
64. projection welding machine	1 set
65) Weld inspection gauge ( fillet and universal)	1 set
66) submerged arc welding machine 1200 amps capacity -1 set	
67) Eutalloy powder spray kit	1 set
68) Rototec powder spray kit	1 set
• 69) Ultrasonic flaw detector	1 set
• 70) Dye penetrant kit	1 set
• 71) Air plasma cutting system	1 set
72) Universal seam welding machine 50kva welding Capacity 2mm thick on MS and SS	1 set
73) Oxygen and acetylene gas manifold system (working provision for atleast six trainees)	1 set

74) Empty gas cylinders		
A – carbon-di-oxide cylinder 32kg capacity		2 nos
B – Argon cylinder 7cubic meter capacity		2nos
C- oxygen cylinder 7 cubic meter		4 nos
D- D.A cylinder 7 cubic meter		2 nos
75) Auto darkening helmet		10 nos
76) Reference radio graphic films		1 set
77) personal computers latest version		1 set
78) Note book computer with latest version		5 nos
79) L.C.D projector		1 set
80) Pressure vessel welding codes ( book or C.D) I.B.R and ASME sec 9 –		Each 1 no
81) Structural welding codes D1.1 (Book or C.D)		1 nos
82) Electron beam welding Machine		1 set
83) Laser cutting machine		1 set
84) Welding cables to carry 350 amps with flexible rubber	-	54 mts
85) Lugs for cables		24 nos
86) Oxygen cutting machine(Line & circle )-		1 no
87) Gas welding table 822 cm*92 cm + 60 cm fire bricks on stand with positioned		6 nos
88) Arc welding table all metal with positioned 122cm *92cm*60cm -		6 nos
89) Trolley for cylinder (HP.Unit)		2 nos
90) Bench Shear hand capacity up to 5 mm		1no
91) D.E. grinder 30cm wheel motorized pedestal type		1no

92) Vice bench 10cm	6 nos
93) Power hacksaw	1no
94) Electrode drying oven thermostatically controlled Temp 0-250C, 10KGCap	1no
95) AG 7 grinder	1 no
96) portable grinding machine (Cap. 6mm)	1no
97) Braze weld equipment brazier that can be used with existing welding Transformer	1no
98) Fire extinguisher (foam type & CO2 type )	2 each
99) Metal rack 182 cm* 45 cm	1no
100) Instructor table (steel)	1 no
101) instructor chair (steel)	1 no
102) black board with easel	1no
103) first aid box	1no
104) welding helmet	6nos
105) Fire buckets with stand	3nos
106) Steel lockers with 8 pigeon holes	2nos

# **SYLLABUS**

**FOR THE TRADE OF**

**WELDER**  
**ENGINEERING TECHNOLOGY**  
**MODULE -III**

**UNDER**

*CRAFT INSTRUCTOR'S TRAINING SCHEME*

**DESIGNED BY**  
**GOVERNMENT OF INDIA**  
**MINISTRY OF LABOUR (DGE&T)**  
**CENTRAL TRAINING INSTITUTE**  
**#10, ALANDUR ROAD**  
**Guindy: Chennai-32.**

## GENERAL INFORMATION

1. NAME OF THE TRADE:WELDER
2. DURATION:ONE YEAR  
MODULE I:TRADE TECHNOLOGY  
MODULE II: TRADE TECHNOLOGY  
MODULE III:ENGINEERING TECHNOLOGY  
MODULE IV: TRAINING METHIDODOLOGY
3. ENTRY QUALIFICATION:  
NTC AND NAC  
OR  
NTC WITH ONE YEAR EXPERIENCE IN WELDER TRADE  
OR  
NAC THREE YEAR APPRENTICESHIP TRAINING  
OR  
PASS IN DIPLOMA IN MECHANOCAL ENGG.,  
OR  
DEGREE IN MECHANICAL
4. WORKSPACE: 102 Sq.mtr

## LIST OF MEMBERS

1. Shri. D. Vijayakumar  
Principal/Joint Director  
Central Training Institute for Instructors  
Guindy, Chennai – 600032.
2. Shri. M.S. Balakrishnan  
Deputy Director of Training  
Central Training Institute for Instructors  
Guindy, Chennai – 600032.
3. Shri. R. Murugarajan  
Assistant Director of Training  
Central Training Institute for Instructors  
Guindy, Chennai – 600032.
4. Shri. V.L. Ponmozhi  
Training officer  
Central Training Institute for Instructors  
Guindy, Chennai – 600032.
5. Shri. M. Tamizharasan  
Deputy Director of Training  
Advanced Training Institute  
Guindy, Chennai – 600032.
6. Shri. M. Kumaravel  
Assistant Director of Training  
Advanced Training Institute  
Guindy, Chennai – 600032.
7. Shri.V. Muralidharan  
Fabrication engineer,L&T Ltd  
Mappakkam,Chennai.
8. Shri.K. Murugesan  
A.T.O.,Govt. ITI, Guindy, Chennai – 600032
9. Shri.R. Kumaraguru  
Training Officer  
RDAT,Guindy , Chennai -600032.
10. Shri.S. Bakthavatchalu  
Training Officer (Retd),CTI, Guindy, Chennai -600032.

11. Shri.S. Anil Kumar  
H.O.D./Mechanical  
Shri Balaji polytechnic College.  
Kolappakkam, Vandaloor, Chennai -600048
12. Shri.R. Sankaran  
H.O.D./Mechanical  
Valliammai Polytechnic College  
S.R.M Nagar, Kattangulathur,  
Kanchipuram - 603203
13. Shri. M. Kumar  
Lecturer, Tool and Die Making.  
Murugappa Polytechnic College,  
S.M. Nagar, Chennai -600062.
14. Shri. P. S. Viswanathan,  
Deputy manager,  
Training and Development,  
M/s Ashok Leyland, Chennai.
15. Shri.A. N. Lakshminathan  
Training Officer (Retd)  
498, 22<sup>nd</sup> street , TNHB colony  
Korattur, Chennai-600080.
16. Shri.K. Vadivelu  
A.T.O., (Retd)  
5/12, vimala Nagar,  
pallikaranai, Chennai-600100.
17. Shri.K. Srinivasan  
Welding consultant  
Plot No.6/3, Ist main road  
Balaji nagar, Nanganallur, Chennai
18. Shri.N. Ravichandran  
Jayasri engineers ,  
Barathi Nagar, I st Main road,  
Vengaiwasal, selaiyur, Chennai-73.

## **Work shop science and calculation:**

1. Importance of Science and calculation to the Trade Skill.
2. Engineering Materials Classification, Physical and Mechanical Properties of metals.
3. Engineering Metals:  
( FERROUS: Pig Iron, Cast Iron, Wrought Iron & Steel)  
(Non-Ferrous: Aluminium, copper, Lead, Tin, Zinc, ...Etc)  
Ore to metal; Manufacturing process of metals: Properties: Grade & its Uses. Engineering materials : Properties and Grade its uses.
4. Units & measurements -Related problems.
5. Mass and weight, Density, Specific gravity -Related problems.
6. Heat & Temperature – units, Specific Heat, latent heat, co-efficient of linear expansion, thermal capacity, transmission, Thermometric Scale, temperature measuring instruments - Related problems.
7. Heat Treatment- Purpose of heat treatment, methods ,in different metals and alloys.
8. Dynamics': Speed, Velocity and acceleration - Related problems.
9. Motion under the Force gravity. Newton's Laws of motion, Parallelogram law of force, Lamias Theorem - Related problems.
10. Work, Power & Energy -Related problems.
11. Simple Machines: stress, strain, young's module, types of Lever, factors of Safety effort and load, mechanical advantage velocity ratio, Efficiency of machine -Related problems.
12. Stresses in sand casting & die casting Fatigue stresses, Strain gauge, stress Analysis, Stresses /Strain Relation Ship.
13. Friction- Define, Merits, Demerits, Normal Reaction, Limiting Friction, Laws of limiting friction, Co-efficient of Friction – Shop related Problems.
14. Electrical Principles- Electrical charges, Atom molecule, current Electricity, Resistance, Capacitors, transformers.----- Etc, AC & DC Fundamental relations

## **Work shop Science & Calculation:**

Simple Arithmetic problems.( Addition , subtraction, Multiplication, Division, Fraction, Decimal Fraction, Ratio & Proportion, Percentages & its Conversions – Related to our Trade Practices .

Algebra- Simple equations. Simultaneous and Quadratic equations.

Logarithms –Simple Addition, subtraction, Multiplication, Division, Problems on Power and roots by using Tables.

Trigonometry: Simple trigonometry formulaic, finding the Value, Proof that Etc.

Mensuration- Areas square, Rectangle, equilateral triangle, Isosceles triangle, Right- Angled triangle, Scale lane triangle Problem Pythagoras' theorem. Areas Circle, Circular, ring, Hexagon, Sector, Ellipse – Related shop problems.

Volume and Weight of simple solid bodies such as cube, cylinder, hollow cylinder, square prism, rectangular prism, Triangular prism – related shop problems.

## Work shop science and calculation:

### UNIT-I

Importance of Science and calculation to the Trade Skill.

Engineering Materials Classification, Physical and Mechanical Properties of metals.

Engineering Metals:

( FERROUS: Pig Iron, Cast Iron, Wrought Iron & Steel)

(Non-Ferrous: Aluminium, copper, Lead, Tin, Zinc, ...Etc)

Ore to metal; Manufacturing process of metals: Properties: Grade & its Uses.

Engineering materials : Properties and Grade its uses.

### UNIT-II

Units & measurements -Related problems.

Mass and weight, Density, Specific gravity -Related problems.

### UNIT-III

Heat & Temperature – units, Specific Heat, latent heat, co-efficient of linear expansion, thermal capacity, transmission, Thermometric Scale, temperature measuring instruments - Related problems.

Heat Treatment- Purpose of heat treatment, methods ,in different metals and alloys.

### UNIT-IV.

Dynamics': Speed, Velocity and acceleration - Related problems.

Motion under the Force gravity. Newton's Laws of motion, Parallelogram law of force, Lamias Theorem - Related problems.

### UNIT-V.

Work, Power & Energy -Related problems.

### UNIT-VI.

Simple Machines: stress, strain, young's module, types of Lever, factors of Saftey effort and load, mechanical advantage velocity ratio, Efficiency of machine -Related problems.

Stresses in sand casting & die casting Fatigue stresses, Strain gauge, stressAnaysis, Stresses /Strain Relation Ship.

Frication- Define, Merits, Demerits, Normal Reaction, Limiting Frication, Laws of limiting friction, Co-efficient of Friction – Shop related Problems.

### UNIT-VII.

Electrical Principles- Electrical charges, Atom molecule, current Electricity, Resistance, Capacitors, transformers.- Etc, AC & DC Fundamental relations.

## Work shop Science & Calculation:

### UNIT-VIII.

Simple Arithmetic problems.( Addition , subtraction, Multification, Division, Fraction, Decimal Fraction, Ratio & Proportion, Percentages & its Conversions – Related to our Trade Practices .

Algebra- Simple equations. Simultaneous and Quadratic equations.

### UNIT-VIII.

Logarithms –Simple Addition, subtraction, Multification, Division, Problems on Power and roots by using Tables.

### UNIT-IX.

Trigonometry: Simple trigonometry formulaic, finding the Value, Proof that Etc.

### UNIT-IX.

Mensuration- Areas square, Rectangle, equilateral triangle, Isosceles triangle, Right- Angled triangle, Scale lane triangle Problem Pythagoras' theorem. Areas Circle, Circular, ring, Hexagon, Sector, Ellipse – Related shop problems.

Volume and Weight of simple solid bodies such as cube, cylinder, hollow cylinder, square prism, rectangular prism, Triangular prism – related shop problems.

## **Engineering Drawing:**

- 1. Importance of Engineering Drawing and its Knowledge.  
Letters, Numbers and alphabets as per BIS SP- 46-1988.  
Use of Drawing Instruments. Material convention.**
- 2. Free hand Sketching of Straight lines, Rectangles, Circles, polygons etc.**
- 3. Use of abbreviation and symbols for drawing; Importance of putting the Dimensions on the Drawing as per BIS SP -46-1988.**
- 4. Freehand Sketching with dimension, Scale and Proportionate Sketching.  
Scales- Types of Scale and applications, etc.**
- 5. Isometric Views and Oblique Views with Dimensions of Such as Cube, Rectangular, block, cylinder etc.**
- 6. Explanation of Simple Orthographic Projection and III rd Angle As per**
- 7. BIS SP-46-1988.**
- 8. Explanation of Simple Orthographic Projection and I st Angle As per**
- 9. BIS SP-46-1988.**
- 10. Sketching the views Solid bodies When viewed perpendicular to their surfaces and axes.**
- 11. Freehand sketching of plan and elevation of simple objects like Hexagonal bar, Square bar, Circular bar, Tapered bar and Hollow bar, etc.**
- 12. Views of Simple Hollow Solid Bodies with Dimensions.**
- 13. Basic Symbols of Electricals & Circuits.**
- 14. Construct the Orthographic Projection from the given Isometric view of Shaped Blocks in I st angle method.**
- 15. Construct the Orthographic Projection from the given Isometric view of Shaped Blocks in III rd angle method.**
- 16. Exercise on reading of Drawing, related to Missing lines and Missing Views.**
- 17. Simple Isometric Drawing from the given Orthographic Views of simple Objects.**
- 18. Casting Finishing Symbols.**
- 19. Freehand Sketching of Rivets washers nuts , bolts, Hand tools, Riveted joints, Screw , Keys, joints and with dimensions from samples as per BIS.**

## DRAFT SYLLABUS FOR ENGINEERING TECHNOLOGY MODULE

**Duration : 3 months. (12 weeks)**

<b>WEEK NO</b>	<b>Work shop science &amp; Calculation</b>	<b>Engineering Drawing</b>	<b>Remarks</b>
<b>1</b>	<p>Fraction – simple, complex &amp; decimals, Simplification, L.C.M</p> <p>Square roots: Whole Numbers &amp; Fractions. Use of Simple pocket Calculator (Non Scientific) in shop calculation Practice.</p> <p>Units – System of units, Conversion between Metric &amp; British system of units.</p> <p>Metals: Mechanical properties of materials. Ferrous &amp; non-ferrous metals &amp; their allays – properties, composition &amp; their uses.</p>	<p>Line practice – straight line &amp; inclined line. Types of Line &amp; their uses. Conventional symbol of materials. Free hand sketching of Hand tools. Free hand sketching of Electrical hand tools.</p>	
<b>2</b>	<p>Ratio &amp; proportions – shop problems. Percentage – shop problems &amp; applications. Heat – treatment: Critical temperatures, Annealing, Normalizing, Tempering, Hardening, Case- hardening. Mass, speed, velocity, acceleration. Equations of plane motion &amp; motion under force of gravity – applications.</p>	<p>Dimensioning techniques. Use of reduced &amp; enlarged scales.</p>	
<b>3</b>	<p>Logarithm &amp; Antilogarithm – Characteristics &amp; Mantissa. General laws of logarithm. Simplifications using Logarithm: Practice on different exercises. Algebra : Simplifications, different algebraic formulae &amp; applications. Newton's three laws of motion – prove that <math>p=m.a</math> Force &amp; Weight – Their units, applications. Work – Power – Energy:</p>	<p>Practice on Isometric views of simple objects. Symbols. Orthographic projection – difference between 1<sup>st</sup> angle and 3<sup>rd</sup> angle projections. Orthographic view of simple blocks in 3<sup>rd</sup> angle method.</p>	

	<p>definitions, units, B.H.P., I.H.P. &amp; efficiency of an engine.</p>		
4	<p>Solving Equations – Simple, quadratic &amp; simultaneous equations, transpositions etc. Problems on Algebra – shop problems.          Potential energy &amp; Kinetic energy – applications.          Energy calculation in domestic &amp; industrial circuits.          Simple stress &amp; strain – different types.          Elastic limit, ultimate strength, safe stress, factor of safety.</p>	<p>Orthographic views of different blocks in 3<sup>rd</sup> angle projection.</p>	
5	<p>Mensuration:          Area of different triangles square, rectangle, trapezium, rhombus, parallelogram, circle, semi circle, sector, segment etc. – shop problems.          Basic electricity – Current, Voltage, EMF, resistance, Ohm’s Law, series &amp; parallel circuits.          Hook’s Law, Young’s Modulus of elasticity, Poisson’s ratio – shop problems.          Lever – different types, working principle.          Moment of a lever – technical problems.</p>	<p>Practice on Orthographic view - 3<sup>rd</sup> angle projections.</p>	
6	<p>Mensuration – Area &amp; perimeter of an ellipse, shop problems.          Volume of solids &amp; hollow bodies – prism and pyramids.          Volume of cube, cuboids, Rectangular solids, hexagonal prism, triangular prism etc. Shop problems.          Specific resistance, temperature co-efficient of resistance applications.          Composition &amp; resolution of forces.          Law of parallelogram of forces. Lami’s Theorem shop problems.</p>	<p>Practice on Orthographic views - 3<sup>rd</sup> angle projections.</p>	
7	<p>Volume &amp; surface area of solid &amp; hollow cylinders, hexagonal, triangular, square pyramids, etc.,          Applications &amp; shop problems.          Heating effects of electric</p>	<p>Practice on Orthographic views of different objects in 1<sup>st</sup> angle projection. (Casting Component diagram )</p>	

	<p>current – applications.  <b>Density, Specific gravity &amp; Archimedes principle – applications.</b>  <b>Principle – applications.</b>  <b>Determination of specific gravity of solids &amp; liquids using Archimedes principle – applications.</b></p>		
8	<p><b>Volume &amp; surface area of a cone, taper cylinder, solid &amp; hollow sphere, Hemi sphere – applications &amp; technical problems.</b>  <b>Kirchhoff’s Law – Voltage law &amp; Current law, applications in different combination, solving problems.</b>  <b>Heat &amp; Temperature – Their units, Effects of heat, Specific heat, Latent heat.</b></p>	<p><b>Orthographic views</b>  <b>Different objects of Ist angle Projection.</b></p>	
9	<p><b>Trigonometry – properties of triangles &amp; acute angles, Different system of units for measuring angles.</b>  <b>Trigonometric Ratios &amp; Functions – different formulae, trigonometric proof, height &amp; distance problems, taper calculations, - technical problems.</b>  <b>Sensible heat, Thermal capacity, Water equivalent of heat – applications.</b>  <b>Temperature – Different thermometric scales &amp; conversions between them, temperature measuring instruments.</b>  <b>Difference between heat &amp; temperature.</b>  <b>Thermal contact &amp; Thermal expansion – co –efficient of Liner, Superficial &amp; Cubical expansions – shop problems.</b></p>	<p><b>Orthographic views of different objects in 1<sup>st</sup> angle projection. (Casting Component diagram )</b></p>	
10	<p><b>Simple machine: load, effort, Mechanical Advantage , Velocity Ratio &amp; efficiency of a machine.</b>  <b>Simple pulley block, simple wheel &amp; axle.</b>  <b>Differential wheel &amp; axle, simple screw jack – technical problems.</b></p>	<p><b>Orthographic views of different objects in 1<sup>st</sup> angle projection.</b></p>	

<b>11</b>	<b>Cost and Estimation of Over head Value of Welding.</b>	<b>Orthographic views of different objects in 1<sup>st</sup> angle projection.</b>	
<b>12</b>	<b>Review on general mathematics &amp; sciences, solving old Question paper. Review on electrical trade base calculations &amp; Question papers. FINAL TEST &amp; FINAL EVALUATIONS.</b>	<b>Basic Symbols of Electricals &amp; Circuits. Review on the courses &amp; Question papers.  FINAL TEST &amp; FINAL EVALUATIONS.</b>	
<b>13</b>			

**NOTE: 1. Trainees are allowed to use simple pocket calculator (Non – scientific) during class – room practice & Examinations.**

**2. Trainees are suggested to use frequently the Mini drafting Machine during practice of Drawing & in Examinations.**

**3. "WELDER" Trade related Calculations & Drawings may be taught under related Trade Faculty.**

## ENGINEERING TECHNOLOGY

### ENGG. DRG/ WSC- THEORY CLASS –EQUIPMENTS / TOOLS / ACCESSORIES

1. Junior drafting machine - Each1
2. Set of set square (45°, 30°/60°) (celluloid material) - Each1
3. Circular template (celluloid material) - Each1
4. Protractor (celluloid material) - Each1
5. Square and rectangle template (celluloid material) - 1 by 2
6. Set of French curves (celluloid material) - 1 by 2
7. Compass & divider Box (celluloid material) - Each1
8. Scales
  - a. Full scale (Wood or celluloid) -Each 1set
  - b. Enlarged scale (Wood or celluloid) -Each1set
  - c. Reduced scale (Wood or celluloid) -Each 1set
9. Geometrical Box set- class work (celluloid or wood) -Each 1set
10. Glass Board 8' × 4' - 1No
11. White Board 8' × 4' - 1No
12. Interactive Board with accessories - 1No
13. Computer with Auto-CAD software - 1No

## ENGINEERING TECHNOLOGY

### SCIENCE LAB-EQUIPMENTS & ACCESSORIES

1. Different metal models
  - Ferrous metal -1 set
  - Non ferrous metal -1 set
  - Alloys -1 set
2. Density
  - Volume and Weight calculation of solid models  
(Cube, Cuboids, cylinder, cone, sphere etc.)
  - Vernier Caliper -1no
  - Micrometer -1no
  - Physical balance with weight box -1set
  - ELECTRONIC BALANCE - 5kg (max) - 1unit
  - Spring balance (0.1 to 1kg) -2sets
  - Lactometer -1no
  - Hydrometer -1no
  - Beakers 50cc, 100cc, 200cc -3nos each
  - Cylindrical glass jar -4nos
  - Graduated cylindrical jar(100cc, 500cc) -2nos each
3. Magnet
  - Rectangular solid bar -2nos
  - U-type -1no
4. Pressure
  - Barometer - 1no
  - Manometer - 1no
5. Levers
  - Cutting pliers, scissors, claw hammer - Each 1No
  - Nut cracker, wheel barrow, Trolley - Each 1No
  - Coal tongs, safety valve - Each 1No
  - Cycle Bell - 1No

## 6. Simple Machine

- Pulley block (Model) -1No
- Wheel and axle (Model) -1No
- Wheel and differential axle (Model) -1No
- Screw Jack (Model) -1No
- Pulleys
  - Fixed pulleys -1Set
  - Movable pulleys -1Set

## 7. Work power & energy

- Work calculation – model -1No
- Energy conversion – model -1No
- Power calculation - model -1No

## 8. Friction

- Inclined plane- model -1No
- Application of friction – model -1No

## 9. Heat

- Heat transformation equipments (Different metal rods) -1Set
- Scales of temperature - model -1set
- Thermometers ( $^{\circ}\text{C}$ ,  $^{\circ}\text{F}$ ,  $^{\circ}\text{R}$ ) -2Each
- Calorimeter -1no
- Thermos flask -1no
- Pyrometer
  - Thermocouple -1no
  - Optical -1no