

1	Name of Syllabus	<b>C. C. IN STRUCTURAL WELDING (303147)</b>												
2	Max. Nos of Student	25 Students												
3	Duration	6 Months												
4	Type	Full Time												
5	Nos Of Days / Week	6 Days												
6	Nos Of Hours /Days	7 Hrs												
7	Space Required	Laboratory = 1000 Sq feet <u>Class Room = 200 Sq feet</u> TOTAL = 1200 Sq feet												
8	Entry Qualification	S.S.C. + Any one Welding course of MSBVE Pass OR SSC + ITI Welding / COE in P&M / Fabrication/ HSC Vocational / Diploma / Degree in Mechanical / Production Group												
9	Objective Of Syllabus/ introduction	Awareness of Safety precautions. Awareness of Fundamental Welding. Awareness of Sheet metal work Awareness of Structural Welding. Awareness as Fastening												
10	Employment Opportunity	The trainee will either to be able to take up jobs with agencies which Develop, Maintain, Repair Work as Structural Welder or with working experience will be in a position to start his own independent Business.												
11	Teacher’s Qualification	Diploma in Mechanical/Fabrication Engineering. With 3 year Teaching experience in Structural Welding.												
12	Training System	Training System Per Week <table><tr><td>Theory</td><td>Practical</td><td>Total</td></tr><tr><td>12 Hours</td><td>30 Hours</td><td>42 Hours</td></tr></table>							Theory	Practical	Total	12 Hours	30 Hours	42 Hours
Theory	Practical	Total												
12 Hours	30 Hours	42 Hours												
13	Exam. System	Sr. No.	Paper Code	Name of Subject	TH/PR	Hours	Max. Marks	Min. Marks						
		1	30314711	Structural Welding	TH-I	3 hrs	100	35						
		2	30314721	Basic Sheet metal work, Fastening, Welding	PR-I	3 hrs	100	50						
		3	30314722	Structural Welding	PR-II	6 hrs	200	100						
				TOTAL			400	185						

► **STRUCTURAL WELDING**

<b>TOPIC</b>	<b>PRACTICAL - II</b>	<b>THEORY - I</b>
<b><u>STRUCTURAL WELDING</u></b>	<ul style="list-style-type: none"> <li>- Familiarisation with the machinery used in the trade</li> <li>- Introduction to safety equipment and their use</li> <li>- Setting up Gas cutting equipment and cutting MS Flats to required size</li> <li>- Setting up SMAW Welding equipment and making straight and wearing bead on MS in all positions</li> <li>- Practice on plasma cutting</li> <li>- Practice on gouging techniques</li> </ul>	<ul style="list-style-type: none"> <li>- Out line of the subjects to be covered</li> <li>- Importance of structural welding</li> <li>- Welding processes - brief description, Classification and application</li> <li>- Welding terms and definitions</li> <li>- Principles of Oxy-Acetylene Cutting and equipments required.</li> <li>- Principles of shielded metals arc welding, its advantages and limitations.</li> <li>- Types of weld joints.</li> </ul>
	<ul style="list-style-type: none"> <li>- Weld joint preparation for fillet welds ( cutting to size, fit up, tack weld etc. )</li> <li>- Fillet, Lap and T joint on MS flat by SMAW, position - 1F</li> <li>- Fillet, lap and T joint on MS flat by SMAW position - 2F</li> <li>- Inspection &amp; clearance using LPI testing</li> </ul>	<ul style="list-style-type: none"> <li>- Basic Electricity applicable to welding</li> <li>- Arc welding power source AC / DC - advantages and disadvantages</li> <li>- Types of metal and their characteristics</li> <li>- Classification of steel and their Weldability</li> <li>- Heat affected zone and requirement for pre-heating and maintaining inter pass temperature</li> <li>- Welding symbols and their importance</li> <li>- Welding positions and necessity of positional welding</li> <li>- Weld joint edge preparation</li> <li>- Welding procedure and techniques - Tack welding, root run welding, intermediate and cover pass welding, cleaning, checking etc.</li> </ul>
	<ul style="list-style-type: none"> <li>- Weld joint preparation for fillet welds ( cutting to size, fit up, tack weld etc. )</li> <li>- Fillet, lap and T joint on MS flat by SMAW, position - 3F</li> <li>- Fillet, lap and T joint on MS flat by SMAW position - 4F</li> <li>- Inspection &amp; clearance using LPI testing</li> </ul>	<ul style="list-style-type: none"> <li>- Welding tools and accessories</li> <li>- Arc and its characteristics</li> <li>- Polarity types and application</li> <li>- Arc length</li> <li>- Welding fixtures and clamps</li> <li>- Coated electrodes - Types, description and coding as per BIS,AWS etc.</li> <li>- Standard size and length of electrodes</li> <li>- Selection of electrodes and coating factor Electrode storage and necessity of backing</li> </ul>

	<ul style="list-style-type: none"> <li>- Weld joint preparation for pipe fillet welding</li> <li>- Pipe to plate fillet weld flange joint on MS by SMAW, position - 5 F</li> <li>- Pipe to pipe fillet weld on MS pipes by SMAW, position -5F</li> </ul>	<ul style="list-style-type: none"> <li>- Effect of Heat on Weldments</li> <li>- Welding distortion and stresses</li> <li>- Methods of controlling distortion by various methods</li> <li>- Methods of relieving stress on Weldments</li> <li>- Advantages of welded structures over riveted structures</li> </ul>
	<ul style="list-style-type: none"> <li>- Weld joint preparation for plate groove welding</li> <li>- Full penetration Single "V" butt joint on MS Flat by SMAW in 1G &amp; 2G Positions</li> <li>- Full penetration single "V" butt joint on MS Flat by SMAW in 3G &amp; 4G Positions</li> <li>- Root pass welding &amp; LPI testing</li> <li>- Cover pass welding &amp; inspection</li> </ul>	<ul style="list-style-type: none"> <li>- Types of Steel sections / forms used in structural fabrication and their standard sizes</li> <li>- Importance of structural welding and workmanship</li> <li>- Necessity of Qualifying welders, welding operators and tack welders</li> <li>- Necessity of Qualifying the welding procedure</li> <li>- Positions of test plates for filter welds and groove welds</li> <li>- Types of Fillet welded and groove welded joints on statically loaded structures.</li> </ul> <p>Types of fillet welded and groove welded joints on dynamically loaded structures</p>
	<ul style="list-style-type: none"> <li>- Setting up DC TIG welding equipment and making beading practice on MS in down hand position</li> <li>- Square butt joint on M.S Sheet by TIG Welding in down hand position</li> </ul>	<ul style="list-style-type: none"> <li>- TIG Welding equipments</li> <li>- Advantages of TIG Welding process</li> <li>- Power source types AC/DC</li> <li>- Types of polarity and application</li> <li>- Accessories - HF unit and DC Suppressor</li> <li>- Tungsten electrode, types, sizes and uses</li> <li>- Types of shielding gases</li> </ul>
	<ul style="list-style-type: none"> <li>- Full penetration Single "V" butt on M.S. flat by TIG and SMAW, positions 1G &amp; 2G</li> <li>- Root pass welding by TIG &amp; LPI testing</li> <li>- Cover pass by SMAW, inspection &amp; clearance</li> </ul>	<ul style="list-style-type: none"> <li>- Procedure of structural fabrication</li> <li>- Planning for structural members, marking and edge preparation, assembling, tack welding, measurement of weldment size, root pass welding, inspection of root pass welding, making cover pass and Inspection &amp; Testing etc.</li> </ul>

	<ul style="list-style-type: none"> <li>- Full penetration Single "V" butt join on M.S. Flat by TIG and SMAW, positions 3G &amp; 4 G</li> <li>- Root pass welding by TIG &amp; LPI testing</li> <li>- Cover pass by SMAW, inspection &amp; clearance</li> </ul>	<ul style="list-style-type: none"> <li>- Necessity of root pass welding by TIG.</li> <li>- Inspection of root pass welding by die - penetrant testing</li> <li>- Preparation for TIG Welding under drift conditions</li> <li>- Necessity of back purging</li> </ul>
	<ul style="list-style-type: none"> <li>- Double "V" butt joint on MS Flats in dissimilar thickness in down hand positions by SMAW</li> <li>- Root Inspection</li> <li>- Back Gouging</li> <li>- Adopting weld sequence for controlling distortion</li> </ul>	<ul style="list-style-type: none"> <li>- Types of Tubular structures used on structural fabrication</li> <li>- Development of templates for marking and preparation of pipe elbow,</li> <li>- T, Y and K joints ( Similar and dissimilar diameter pipe connections )</li> </ul>
	<ul style="list-style-type: none"> <li>- Pipe Elbow and T joints on MS pipes by SMAW in flat position</li> <li>- Pipe Y and K connection on M.S. pipe by SMAW, positions –Horizontal</li> </ul>	<ul style="list-style-type: none"> <li>- Welding defects causes and remedy.</li> <li>- Procedure of rectifying, weld defects - Gouging methods / grinding, testing with die penetrant, pre-heating and re welding</li> </ul>
	<ul style="list-style-type: none"> <li>- Practice on CO2 welding and Flux Cored Arc Welding</li> <li>- Practice on Automatic Submerged Arc Welding machine</li> </ul>	<ul style="list-style-type: none"> <li>- Introduction to MIG / Flux cored arc welding - Advantages</li> <li>- Power source - Wire feeder - Electrode wires - shielding gases - Types of metal transfer and welding parameters</li> <li>- Introduction to Submerged arc welding (SAW). Advantage, limitation, Equipment and operating conditions.</li> </ul>
	<ul style="list-style-type: none"> <li>- Manufacturing of simple structures with L angles, I section and channel sections using welding fixture by SMAW.</li> <li>- Correction of distortion by cold / hot method</li> <li>- Manufacturing of I - Section using M.S. Flat by SMAW</li> <li>- Adapting skip welding / back step welding method for controlling distortion</li> <li>- Preparation of WPS &amp; PQR</li> <li>- Weld test specimen - preparation as per a standard</li> <li>- Inspection &amp; Testing</li> </ul>	<ul style="list-style-type: none"> <li>- Types of welding defects, cause and remedy</li> <li>- Inspection and testing of weldments</li> <li>- Visual inspection kits and Gauges</li> <li>- Non-destructive testing methods</li> <li>- Structural welding codes and standards</li> <li>- Writing procedure for WPS and PQR</li> <li>- Requirement for qualification in different codes</li> <li>- Qualification procedure under various codes</li> <li>- Different tests and inspection involved in qualification</li> </ul>

**Practical - I - Basic Sheet metal work, Fastening, Welding.**

Topic	Practical
<b>Basic Sheet metal work, Fastening, Welding.</b>	Safety in shop floor - Tools & equipments – Safety - Identification and uses of tools & accessories – Mallets, nylon hammers, bench vice, sheet formers, strips and shears etc.
	Practice in scribing of straight line, bisection of straight lines with marking tools - Planishing of sheet metal - Practice on hand soldering method ( Lead & Tin )
	Practice in cutting sheet metal to different shapes using various types of snips & Nibbling machines - Folding / bending sheet metal 90° using wooden mallet
	Practice on removing Dents of spherical and hemi spherical articles. - Practice on cutting cylinder obliquely to make 90° L piece with equal diameter and join them at right angle
	Riveting – Identification of Rivets – Selection of Rivets and Riveting practice for zig zag, chain Diamond Riveting
	Identification of fasteners used on sheet metal works - Fabrication by threaded Fasteners – Simple joints.
	Practice on sheet metal - Seams, Grooved seam, Locked Grooved Seam, Pane down seam, Bottom Lock seam, Clip Lock, Double bottom Lock, Scrap joint etc., - Tube bending by hand making 60° off set “ T ” piece (round)  Exercise involving practical work on Aluminium sheet, using Pop Rivet, Aluminium Windows with extruded sections. - Make simple railing square frame doors. - Making a dust pan cover and handle riveted

**TOOLS, MACHINERY, EQUIPMENTS etc**

Sl.No	Description of tools	QTY
<b>List of Hand Tools</b>		
1	Gloves pair leather	10 Nos
2	Apron leather	10 Nos
3	Screen welding helmet type	10 Nos
4	Screen welding hand	10 Nos
5	Goggles pair welder	10 Nos
6	Hammer scaling 0.25 kg. With handle	10 Nos

Sl.No.	Description of tools	QTY
7	Chisel cold flat 19 mm	10 Nos
8	Centre punch 9mm x 127 mm	10 Nos
9	Dividers 20 cm	10 Nos
10	Caliper outside 15 cm	10 Nos
11	Rule 60 cm two fold brass tipped to read inches and mm	10 Nos
12	Wire brush (M.S)	10 Nos
13	Spark lighter	10 Nos
14	Chipping screen hand	10 Nos
15	Safety boots for welders	10 Nos
16	Wire brush (S.S)	

List of Shop Outfit	
17	Brass Rule 30 cm or nickel chrome steel rule 30 cm
18	Hammer ball pin 1 Kg with handle
19	Chisel cold cross 9 mm
20	Screw Driver 25 cm blade and 20 cm blade
21	Leg vice on stand 150 mm
22	Number punch 6 mm and letter punch 6 mm
23	Hacksaw frame adjustable 30 cm
24	Hammering blocks 5 cm thick 60 sq
25	Magnifying glass x 6
26	Weld measuring gauge fillet and universal
27	File half round bastard 30 cm
28	File flat 35 cm rough
29	Spanner 12 mm and 15 mm double ended
30	Spanner D E 6 mm to 15 mm be 1.5 mm set of Nos.
31	Pipe wrench 25 cm and 35 cm
32	Steel tape 10m flexible in case
33	"Tinmans" square 60cm x 30 cm
34	Earth clamps
35	Pipe Cutter
36	Cutting torch Oxy-Acetylene with cutting nozzle
37	Heavy duty cutting, blow pipe with cutting nozzles
38	Electrode holder 400 amps
39	Welding rubber hose, oxygen and acetylene 8 mm
40	Rubber hose clips
41	Spindle key (for opening cylinder valve)
42	Pressure regulator oxygen double stage
43	Pressure regulator acetylene Regulators
44	Tip cleaner
45	Glasses coloured 108 x 82 x 3 mm DIN 9A 11 A & 13 A
46	Glass white 108 mm x 82 mm
47	Outfit spanner
48	Rubber hose pipe black and red 5 mm
49	Leather sleeves

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