

10. SYLLABUS CONTENT WITH TIME STRUCTURE

10.1 SYLLABUS CONTENT FOR PROFESSIONAL SKILL & KNOWLEDGE

First Semester
(Semester Code no.WLD - 01)
Duration: Six Month

LEARNING OBJECTIVES OF 1ST SEMESTER

1. Join MS sheet by Gas welding in different positions.
2. Join MS plate by SMAW in different positions.
3. Perform straight, bevel & circular cutting on MS plate by Oxy-acetylene cutting process.
4. Perform different type of MS pipe joints by Gas welding (OAW).
5. Weld different types of MS pipe joints by SMAW.
6. Weld Stainless steel, Cast iron, Brass & Aluminium by OAW or SMAW.
7. Perform Arc gauging on MS.
8. Apply safe working practices.
9. Comply environment regulation and housekeeping
10. Interpret & use Company terminology and technical communication

Week No	Professional Skills		Professional Knowledge
		Trade Practical	Trade Theory
1	F-01 F-02	<ul style="list-style-type: none"> - Induction training: - Familiarisation with the Institute. - Importance of trade Training - Machinery used in the trade. - Introduction to safety equipment and their use etc. - Hack sawing, filing square to dimensions. - 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 precautions in Shielded Metal Arc Welding, and Oxy-Acetylene Welding and Cutting.
2		<ul style="list-style-type: none"> - Setting up of Arc welding machine & accessories and Striking an arc - Setting of oxy-acetylene welding equipment, Lighting and setting of flame. 	<ul style="list-style-type: none"> - Introduction and definition of welding. - Arc and Gas Welding Equipments, tools and accessories . - Various Welding Processes and its applications . - Arc and Gas Welding terms and definitions.
3	OAW-01 OAW-02 OAGC-01	<ul style="list-style-type: none"> - Fusion run without and with filler rod on M.S. sheet 2 mm thick in flat position. - Edge joint on MS sheet 2 mm thick in flat position with out filler rod. - Marking and straight line cutting of MS plate. 10 mm thick by gas. 	<ul style="list-style-type: none"> - Different process of metal joining methods: Bolting, riveting, soldering, brazing, seaming etc. - Types of welding joints and its applications. Edge preparation and fit up for different thickness. - Surface Cleaning
4	SMAW-01	<ul style="list-style-type: none"> - Straight line beads on M.S. plate 10 mm thick in flat position. 	<ul style="list-style-type: none"> - Basic electricity applicable to arc welding and related electrical terms

	SMAW-02	- Weaved bead on M. S plate 10mm thick in flat position.	&definitions. - Heat and temperature and its terms related to welding - Principle of arc welding. And characteristics of arc .
5	OAW-03 SMAW-03	- Square butt joint on M.S. sheet 2 mm thick in flat Position . - Fillet “T” joint on M.S. Plate 10 mm thick in flat position.	- Common gases used for welding & cutting, flame temperatures and uses. - Chemistry of oxy-acetylene flame. - Types of oxy-acetylene flames and uses. - Oxy-Acetylene Cutting Equipment principle, parameters and application.
6	OAGC-02 OAW-04 SMAW-04	- Beveling of MS plates 10 mm thick. By gas cutting. - Open corner joint on MS sheet 2 mm thick in flat Position - Fillet lap joint on M.S. plate 10 mm thick in flat position.	- Arc welding power sources: Transformer, Motor Generator set, Rectifier and Inverter type welding machines and its care & maintenance.. - Advantages and disadvantages of A.C. and D.C. welding machines
7	OAGC-03 OAW-05 SMAW-05	- Circular gas cutting on MS plate 10 mm thick by profile cutting machine. - Fillet “T” joint on MS sheet 2 mm thick in flat position - Open Corner joint on MS plate 10 mm thick in flat position.	- Welding positions as per EN &ASME : flat, horizontal, vertical and over head position. - Weld slope and rotation. - Welding symbols as per BIS & AWS.
8	OAW-06 SMAW-06	- Fillet Lap joint on MS sheet 2 mm thick in flat position. - Single “V” Butt joint on MS plate 12 mm thick in flat position (1G) .	- Arc length – types – effects of arc length. - Polarity: Types and applications.
9	OAW-07 SMAW-07 SMAW-08	- Square Butt joint on M.S. sheet. 2 mm thick in Horizontal position . - Straight line beads and multi layer practice on M.S. Plate 10 mm thick in Horizontal position. - Fillet “ T” joint on M.S. plate 10 mm thick in Horizontal position.	- Calcium carbide properties and uses. - Acetylene gas properties and generating methods. - Acetylene gas Purifier, Hydraulic back pressure valve and Flash back arrestor
10	OAW-08 SMAW-09	- Fillet Lap joint on M.S. sheet 2 mm thick in horizontal position . - Fillet Lap joint on M.S. plate 10 mm thick in horizontal position .	- Oxygen gas and its properties - Production of oxygen by Air liquefaction . - Charging process of oxygen and acetylene gases - Oxygen and Dissolved Acetylene gas cylinders and Color coding for different gas cylinders. - Gas regulators, types and uses.
11	OAW-09 OAW-10 SMAW-10	- Fusion run with filler rod in vertical position on 2mm thick M.S sheet - Square Butt joint on M.S. sheet. 2 mm thick in vertical position - Single Vee Butt joint on M.S. plate 12 mm thick in horizontal position (2G).	- Oxy acetylene gas welding Systems (Low pressure and High pressure). Difference between gas welding blow pipe(LP & HP) and gas cutting blow pipe - Gas welding techniques. Rightward

		-	and Leftward techniques.
12	SMAW- 11 OAW-11 SMAW-12	- Weaved bead on M.S Plate 10mm in vertical position. - Fillet “T” joint on M.S sheet 2 mm thick in vertical position . - Fillet “T” joint on M.S. plate 10 mm thick in vertical position.	- Arc blow – causes and methods of controlling. - Distortion in arc & gas welding and methods employed to minimize distortion - Arc Welding defects, causes and Remedies.
13	OAW-12 SMAW-13	- Structural pipe welding butt joint on MS pipe Ø 50 and 3mm WT in 1G position. - Fillet Lap joint on M.S. Plate 10 mm in vertical position.	- Specification of pipes, various types of pipe joints, pipe welding positions, and procedure. - Difference between pipe welding and plate welding.
14	SMAW-14 OAW-13	- Open Corner joint on MS plate 10 mm thick in vertical position. - Pipe welding - Elbow joint on MS pipe Ø 50 and 3mm WT.	- Pipe development for Elbow joint, “T” joint, Y joint and branch joint - Manifold system
15	OAW-14 SMAW-15	- Pipe welding “T” joint on MS pipe Ø 50 and 3mm WT. - Single “V” Butt joint on MS plate 12 mm thick in vertical position (3G) .	- Gas welding filler rods, specifications and sizes. - Gas welding fluxes – types and functions. - Gas Brazing & Soldering : principles, types fluxes & uses - Gas welding defects, causes and remedies.
16	OAW-15 SMAW-16	- Pipe welding 45 ° angle joint on MS pipe Ø 50 and 3mm WT. - Straight line beads on M.S. plate 10mm thick in over head position.	- Electrode : types, functions of flux, coating factor, sizes of electrode Coding of electrode as per BIS, AWS, - Effects of moisture pick up. - Storage and baking of electrodes. - Special purpose electrodes and their applications.
17	SMAW-17 SMAW-18	- Pipe Flange joint on M.S plate with MS pipe Ø 50 mm X 3mm WT - Fillet “T” joint on M.S. plate 10 mm thick in over head position.	- Weldability of metals, importance of pre heating, post heating and maintenance of inter pass temperature.
18	SMAW-19 SMAW-20	- Pipe welding butt joint on MS pipe Ø 50 and 5 mm WT. in 1G position. - Fillet Lap joint on M.S. plate 10 mm thick in over head position.	- Classification of steel. - Welding of low, medium and high carbon steel and alloy steels.
19	SMAW-21 SMAW-22	- Single “V” Butt joint on MS plate 10mm thick in over head position(4G) - Pipe butt joint on M. S. pipe Ø 50mm WT 6mm (1G Rolled).	- Effects of alloying elements on steel - Stainless steel : types- weld decay and weldability.
20	OAW-16 SMAW -23 OAW-17	- Square Butt joint on S.S. sheet. 2 mm thick in flat position. - Square Butt joint on S.S. Sheet 2 mm thick in flat position. - Square Butt joint on Brass sheet 2 mm thick in flat position.	- Brass – types – properties and welding methods. - Copper – types – properties and welding methods.

21	OAW-18 SMAW-24 AG-01	- Square Butt & Lap joint on M.S. sheet 2 mm thick by brazing. - Single “V” butt joint C.I. plate 6mm thick in flat position. - Arc gouging on MS plate 10 mm thick.	- Aluminium and its alloys, properties and weldability, Welding methods - Arc cutting & gouging,
22	OAW-19 OAW-20	- Square Butt joint on Aluminium sheet. 3 mm thick in flat position . - Bronze welding of cast iron (Single “V” butt joint) 6mm thick plate	- Cast iron and its properties types. - Welding methods of cast iron.
23	Industrial Training / Project Work		
24	Industrial Training / Project Work		
25	Revision		
26	Examination		

Abbreviations:

SMAW - Shielded Metal Arc Welding
OAW - Oxy-Acetylene gas Welding
OAGC - Oxy-Acetylene Gas Cutting
F - Fitting
WT - Wall Thickness.

Second Semester
(Semester Code no.WLD - 02)
Duration: Six Month

LEARNING OBJECTIVES OF 2ND SEMESTER

1. Apply safe working practices.
2. Comply environment regulation and housekeeping
3. Interpret & use Company terminology and technical communication
4. Join MS sheets/plates by GMAW in different positions using different modes of metal transfer.
5. Join Aluminium, Stainless Steel sheets by GTAW in different position.
6. Weld different type of pipe joints by GTAW.
7. Cut ferrous and nonferrous metal using plasma Arc cutting.
8. Join MS & Stainless Steel sheets by resistance spot welding.
9. Join Copper sheets by OAW in flat position.
10. Join similar & dissimilar metals by brazing operation.
11. Repair Cast Iron machine parts by welding.
12. Test welded joint by Dye penetrant & Magnetic particle testing methods.

Week No	Professional Skills		Professional Knowledge
	Trade Practical		Trade Theory
1	GMAW- 01 GMAW - 02	<ul style="list-style-type: none"> - Machinery used in the trade. - Introduction to safety equipment and their use etc. - Setting up of GMAW welding machine & accessories and Striking an arc - Depositing straight line beads on M.S Plate. - Fillet weld – “T” joint on M.S plate 10mm thick in flat position by Dip transfer. 	<ul style="list-style-type: none"> - Safety precautions in Gas Metal Arc Welding, and Gas Tungsten Arc welding. - Introduction to GMAW - equipment – accessories. - Various other names of the process. (MIG/MAG/CO₂ welding.)
2	GMAW -03 GMAW -04 GMAW -05	<ul style="list-style-type: none"> - Fillet weld – Lap joint on M.S. sheet 3mm thick in flat position by Dip transfer. - Fillet weld – “T” joint on M.S.sheet 3mm thick in flat position by Dip transfer. - Fillet weld – corner joint on M.S.sheet 3mm thick in flat position by Dip transfer. 	<ul style="list-style-type: none"> - Advantages of GMAW welding over SMAW , limitations and applications - Process variables of GMAW. - Modes of metal transfer – dip or short circuiting transfer, spray transfer (free flight transfer) and globular transfer (intermittent transfer)and Pulsed metal transfer.

3	GMAW -06 GMAW -07	- Butt weld – Square butt joint on M.S sheet 3mm thick in flat position - Butt weld – Single “V” butt joint on M.S plate 10 mm thick by Dip transfer in flat position..	- Wire feed system – types – care and maintenance. - Welding wires used in GMAW, standard diameter and codification as per AWS.
4	GMAW -08 GMAW -09	- Fillet weld – “T” joint on M.S plate 10mm thick in Horizontal position by Dip transfer. - Fillet weld – corner joint on M.S plate 10mm thick in Horizontal position by Dip transfer.	- Types of shielding gases and gas mixtures used in GMAW and its applications. - Flux cored arc welding – description, advantage, welding wires, coding as per AWS.
5	GMAW -10 GMAW -11	- Fillet weld – “T” joint on M.S. sheet 3mm thick in Horizontal position by Dip transfer. - Fillet weld – corner joint on M.S.sheet 3mm thick in Horizontal position by Dip transfer.	- Edge preparation of various thicknesses of metals for GMAW. - GMAW defects, causes and remedies
6	GMAW -12 GMAW -13	- Fillet weld – “T” joint on M.S plate 10mm thick in vertical position by Dip transfer. - Fillet weld – corner joint on M.S plate 10mm thick in vertical position by dip transfer.	- Heat input and techniques of controlling heat input during welding. - Heat distribution and effect of faster cooling
7	GMAW -14 GMAW -15	- Fillet weld – Lap joint on M.S. sheet 3mm thick in vertical position by Dip transfer. - Fillet weld – corner joint on M.S. sheet 3mm thick in vertical position by Dip transfer.	- Pre heating & Post Weld Heat Treatment - Use of temperature indicating crayons
8	GMAW -16	- Fillet weld – Lap and “T” joint on M.S sheet 3mm thick in over head position by Dip transfer.	- Submerged arc welding process – principles, equipment, advantages and limitations
9	GMAW -17	- Tee Joints on MS Pipe Ø 60 mm OD x 3 mm WT 1G position – Arc constant (Rolling)	- Electro slag and Electro gas welding processes–principles, equipments, advantages and limitations
10	GMAW -18 GMAW -19	- Depositing bead on S.S sheet - Butt joint on Stainless steel 2 mm thick sheet in flat position by Dip transfer.	- Thermit welding process- types, principles, equipments, thermit mixture types and applications. - Use of backing strips and backing bars
11	GTAW -01 GTAW -02	- Depositing bead on Aluminium sheet 2 mm thick in flat position. - Square butt joint on Aluminium sheet 1.6mm thick in flat position.	- GTAW process - brief description Difference between AC and DC welding, equipments , polarities and applications. - Various other names of the process (TIG, Argonarc) - Power sources for GTAW - AC

			&DC
12	GTAW -03 GTAW -04	- Fillet weld – “T” joint on Aluminium sheet 1.6 mm thick in flat position. - Fillet weld – Outside corner joint on Aluminium sheet 2 mm thick in flat position.	- Tungsten electrodes –types & uses, sizes and preparation - GTAW Torches- types, parts and their functions - GTAW filler rods and selection criteria
13	GTAW -05	- Butt weld - Square butt joint on Stainless steel sheet 1.6 mm thick in flat position with purging gas	- Edge preparation and fit up. - GTAW parameters for welding of different thickness of metals - Pulsed TIG welding - brief description, pulse parameters slope up and slope down.
14	GTAW -06	- Fillet weld – “T” joint on Stainless steel sheet 1.6 mm thick in flat position.	- Argon / Helium gas properties – uses. - GTAW Defects, causes and remedy.
15	GTAW -07	- Pipe butt joint on Aluminium pipe Ø 50 mm x 3 mm WT in Flat position.	- Friction welding process- equipment and application - Laser beam welding (LBW)and Electron beam welding(EBW)
16	GTAW -08 PAC-01	- “T” Joints on MS Pipe Ø 50 mm OD x 3 mm WT, position – Flat - Straight cutting on ferrous and non ferrous metals	- Plasma Arc Welding (PAW) and cutting (PAC) process – equipments and principles of operation. - Types of Plasma arc, advantages and applications.
17	RW-01 RW-02	- Lap joint on Stainless steel sheet by Resistance Spot welding - MS sheets joining by Resistance Spot welding	- Resistance welding process -types, principles, power sources and welding parameters. - Applications and limitations.
18	OAW-01 OAW-02	- Square butt joint on Copper sheet 2mm thick in flat position. - “T” joint on Copper to MS sheet 2mm thick in flat position by Brazing	- Metalizing – types of metalizing principles, equipments, advantages and applications - Manual Oxy – acetylene powder coating process- principles of operation and applications
19	OAW-03 OAW-04	- Silver brazing on S.S Sheet with copper sheet “T” joint. - Silver brazing on copper tube to tube’	- Welding codes and standards - Reading of assembly drawing - Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR)
20	SMAW-01 SMAW-02	- Repair welding of broken C.I machine parts . - Hard surfacing practice on M.S round rod Ø 25 mm by using Hard facing electrode.	- Hard facing/ surfacing necessity, surface preparation, various hard facing alloys and advantages of hard facing .
21	I&T-01	- Testing of weld joints by	- Weld quality inspection, common

	I&T-02 I&T-03	visualinspection . - Inspection of welds by using weld gauges. - Dye penetrant test, - Magnetic particle test.	welding mistakes and appearance of good and defective welds - Weld gauges & its uses
22	I&T-04 I&T-05 I&T-06	- Nick- break test. - Free bend test. - Fillet fracture test.	- Types of Inspection methods - Classification of destructive and NDT methods - Welding economics and Cost estimation.
23	Industrial training / Project work		
24	Industrial training / Project work		
25	Revision		
26	Examination		

Abbreviations:

SMAW	- Shielded Metal Arc Welding
OAW	- Oxy-Acetylene Gas Welding
OAGC	- Oxy-Acetylene Gas Cutting
GMAW	- Gas Metal Arc Welding
GTAW	- Gas Tungsten Arc Welding
PAC	- Plasma Arc Cutting
RW	- Resistance Welding
I&T	- Inspection & Testing
WT	- Wall Thickness.