Syllabus for Junior MMAW/TIG/GMAW Welder

Course Name	Junior MMAW/TIG/GMAW Welder
Sector	Capital Goods
Course Code	CGM/2023/JUWE/248
Level	3
Occupation	Junior Welder (MMAW/TIG/GMAW)
Job Description	Assist to weld in MMAW/TIG/GMAW
Course Duration	Total Duration Min 390 Hrs (T-90, P-180, OJT-60, ES-60) Max 570 Hrs (T-120, P-270, OJT-120, ES-60)
Trainees' Entry Qualification	Grade 10 OR Grade 8 with two years of (NTC/ NAC) after 8th OR Grade 8 pass and pursuing continuous schooling in regular school with vocational subject OR 8th grade pass with 2 yrs. relevant experience OR Previous relevant Qualification of NSQF Level 2 with one yr. experience OR Previous relevant Qualification of NSQF Level 2.5 with 6 months experience
Trainers Qualification	BE/B TECH in Mechanical Engineering or Automobile Engineering, Diploma in Mechanical Engineering or Automobile Engineering or ITI in Welder Trade.

Structure of Course:

No.	Module name	Outcome	Compulsory / Optional / Elective	Theory (Hrs.)	Practical (Hrs.)	OJT (Hrs.)	Total (Hrs.) [Multiple of 30]
1	Safe Working Practice in welding	Apply safe practices related to health and safety	Compulsory	10	20	0	30
2	Welding terminologies and related tools	Define basic terminologies and tools required for welding	Compulsory	10	20	0	30
3	Welding: Symbols and Electrodes	Define different welding positions and electrodes with applications	Compulsory	15	15	0	30
4	Basic principle of Arc welding	Demonstrate the process of arc welding to join various metals	Compulsory	35	55	30	120

No.	Module name	Outcome	Compulsory / Optional / Elective	Theory (Hrs.)	Practical (Hrs.)	OJT (Hrs.)	Total (Hrs.) [Multiple of 30]
5	Defects in Welding	Define various defects in welding on a job	Compulsory	5	25	0	30
6	Employability Skill	As per guided curriculum	Compulsory	60	--	--	60
7	MMAW/SMAW	Demonstrate the process to join MS plate by MMAW techniques	Elective	15	45	30	90
8	TIG/GTAW	Demonstrate the process of welding using TIG techniques	Elective	15	45	30	90
9	GMAW/MAG	Demonstrate the process of welding using MIG/MAG techniques	Elective	15	45	30	90
TOTAL:				**Min-150 Max-180**	**Min-180 Max-270**	**Min-60 Max-120**	**Min-390 Max-570**

Different Combination in which course may be offered

Course Name	Course Code	Course Duration	Full Marks
Junior MMAW/TIG/GMAW Welder [with 1 elective: MMAW/SMAW]	CGM/2023/JUWE/248 [with 1 elective: CGM/0705/OC6]	390 Hours	1000
Junior MMAW/TIG/GMAW Welder [with 1 elective: TIG/GTAW]	CGM/2023/JUWE/248 [with 1 elective: CGM/0705/OC6]	390 Hours	1000
Junior MMAW/TIG/GMAW Welder [with 1 elective: GMAW/MAG]	CGM/2023/JUWE/248 [with 1 elective: CGM/0705/OC6]	390 Hours	1000
Junior MMAW/TIG/GMAW Welder [with 1 & 2 elective: MMAW/SMAW & TIG/GTAW]	CGM/2023/JUWE/248 [with 1 & 2 elective: CGM/0705/OC6 & CGM/0705/OC7]	480 Hours	1100
Junior MMAW/TIG/GMAW Welder [with 2 & 3 elective: TIG/GTAW & GMAW/MAG]	CGM/2023/JUWE/248 [with 2 & 3 elective: CGM/0705/OC7 & CGM/0705/OC8]	480 Hours	1100
Junior MMAW/TIG/GMAW Welder [with 1 & 3 elective: MMAW/SMAW & GMAW/MAG]	CGM/2023/JUWE/248 [with 1 & 3 elective: CGM/0705/OC6 & CGM/0705/OC8	480 Hours	1100

Junior MMAW/TIG/GMAW Welder [with 1,2 &3 elective: MMAW/SMAW, TIG/GTAW & GMAW/MAG]	CGM/2023/JUWE/248 [with 1 & 2 elective: CGM/0705/OC6, CGM/0705/OC7 & CGM/0705/OC8	570 Hours	1200

SYLLABUS

Module-1: Safe Working Practice in welding

Outcome: Apply safe practices related to health and safety

Theory Content:

1.1 Importance of Good housekeeping

1.2 Different rack and their color code used in workshop

1.3 Importance of following the manufacturer's instructions and workplace safety guidelines

1.4 Standard procedures to communicate with higher authority about safety, cleanliness and emergency issues

1.5 Appropriate knowledge on first-aid box

1.6 Name of different types of fire extinguisher and their use

Practical Content:

1.1 Demonstrate good housekeeping of different equipment and materials related to welding

1.2 Appropriate first-aid technique in case of Arc eye, burns and electric shock

1.3 Demonstrate how to record and report all accidents, damages, and injuries

1.4 Demonstrate the correct use of fire extinguisher

1.5 Demonstrate how to free a person from electrocution safely

Tools & Equipment needed:

First-aid box, Chart of emergency numbers, Charts of safety guidelines, Charts of various fire types with appropriate fire extinguisher, Fire extinguisher, Sample Record books for all incidents

Module-2: Welding terminologies and related tools

Outcome: Define basic terminologies and tools required for welding

Theory Content:

2.1 Welding terms and their definitions

2.2 Various Welding Processes

2.3 Different metal joining methods: Bolting, riveting, soldering, brazing

2.4 Welding joints - butt, corner, edge, lap, and tee joint

2.5 Necessity of Edge preparation and Surface Cleaning before welding

2.6 Basic arc welding tools and their functions

Practical Content:

2.1 Identify different tools related to welding

2.2 Hack sawing, filing of MS plate as per the dimensions prescribed by trainer

2.3 Marking out on MS plate and punching

2.4 Practice edge preparation for welding

Tools & Equipment needed:

Bench Vice, 'V' Blocks with clamps, Try-square, Callipers, Odd-leg Calliper, Divider, Punches, Rule Steel, Saw, Chisel, Hammer, Files, punches, Grinding wheel, Anvil

Goggles and Gloves, Apron, Chipping hammer, Wire brush, Hand shield, Helmet, Protective clothing

Module-3: Welding: Symbols and Electrodes

Outcome: Define different welding positions and electrodes with applications

Theory Content:

3.1 Elements of welding symbol

3.2 Basic welding symbols and their location significance

3.3 Types of electrodes and their application areas

3.4 Relation with size of electrode and current range

Practical Content:

3.1 Recognize different electrodes from their coding

3.2 Make a chart for amperage usage for different diameter electrode

3.3 Demonstrate safe practice to store electrode

Tools & Equipment needed:

Carbon steel electrode, Mild Steel electrode – E 6013, E 7018, E 12018, Dryer

Module- 4: Basic principle of Arc welding

Outcome: Demonstrate the process of arc welding to join various metals

Theory Content:

4.1 Basic electricity terms related to arc welding

4.2 Arc welding equipment

4.3 Working principle of arc welding

4.4 Types of arc welding

4.5 Arc length and its characteristics, Arc blow and its effects

4.6 Different techniques of position welding: Flat and Vertical

4.7 Different welding steps to weld pipes: Joint Preparation, Pipe End Cleaning, Welding, Repairs

4.8 Different welding passes to weld pipes: Root, Hot, Fill, Cap

4.9 Different position used in pipe welding - 1G, 2G, 5G and 6G (Concept only)

Practical Content:

4.1 Demonstrate all care and basic maintenance of the arc welding equipment

4.2 Demonstrate of arc welding machine with different settings: current and voltage

4.3 Deposit straight line and weaved bead on M.S. Plate in flat position

4.4 Pipe welding "T" joint on MS pipe Ø 50 and 3 mm WT

4.5 Pipe welding butt joint on MS pipe Ø 50 and 5 mm WT in 1G position

OJT

Work in real job situation with special emphasis on basic safety and hazards in this domain

Assessor will check report prepared for this component of training of the course and assess whether competency has been developed to work in the real job situation with special emphasis on basic safety and hazards in this domain. (The trainee is expected to undertake work in actual workplace under any supervisor / contractor for **30 Hours.**)

Tools & Equipment needed:

Single phase MS welding machine, Welding cables, able Connectors and Lugs, Electrode, Electrode holder, chipping hammer, Wire brush, Hand screen, Protective clothing, Pipe Jack Stands, Centering Head for pipes

Module- 5: Defects in Welding

Outcome: Define various defects in welding on a job

Theory Content:

5.1 Some common types of welding defects - Porosity and Blowholes, Undercut, Cracks, Poor fusion, Slag inclusion, Incomplete penetration, spatter, Distortion, Hot tear, Misalignment

5.2 Different methods such as to identify the defects with the help of a chart

Practical Content:

5.1 Non-destructive Testing of Welds – Visual Inspection

5.2 Simulation of Liquid or Dye Penetrant Inspection

Tools & Equipment needed:

Fillet Weld Gauge, Dye Penetrant Test Kit (Cleaner, Penetrant and Developer), Liquid Penetrant Test Kit (Cleaner, Penetrant and Developer), Welding Defects Chart

Module- 6: Employability Skills **(60 Hrs)**

Key Learning Outcomes

Introduction to Employability Skills Duration: 1.5 Hours

After completing this programme, participants will be able to:

1. Discuss the Employability Skills required for jobs in various industries
2. List different learning and employability related GOI and private portals and their usage

Constitutional values - Citizenship Duration: 1.5 Hours

3. Explain the constitutional values, including civic rights and duties, citizenship, responsibility towards society and personal values and ethics such as honesty, integrity, caring and respecting others that are required to become a responsible citizen
4. Show how to practice different environmentally sustainable practices.

Becoming a Professional in the 21st Century Duration: 2.5 Hours

5. Discuss importance of relevant 21st century skills.
6. Exhibit 21st century skills like Self-Awareness, Behavior Skills, time management, critical and adaptive thinking, problem-solving, creative thinking, social and cultural awareness, emotional awareness, learning to learn etc. in personal or professional life.
7. Describe the benefits of continuous learning.

Basic English Skills Duration: 10 Hours

8. Show how to use basic English sentences for everyday conversation in different contexts, in person and over the telephone
9. Read and interpret text written in basic English
10. Write a short note/paragraph / letter/e -mail using basic English

Career Development & Goal Setting Duration: 2 Hours

11. Create a career development plan with well-defined short- and long-term goals

Communication Skills Duration: 5 Hours

12. Demonstrate how to communicate effectively using verbal and nonverbal communication etiquette.
13. Explain the importance of active listening for effective communication
14. Discuss the significance of working collaboratively with others in a team

Diversity & Inclusion Duration: 2.5 Hours

15. Demonstrate how to behave, communicate, and conduct oneself appropriately with all genders and PwD
16. Discuss the significance of escalating sexual harassment issues as per POSH act.

Financial and Legal Literacy Duration:5 Hours

17. Outline the importance of selecting the right financial institution, product, and service
18. Demonstrate how to carry out offline and online financial transactions, safely and securely
19. List the common components of salary and compute income, expenditure, taxes, investments etc.
20. Discuss the legal rights, laws, and aids

Essential Digital Skills Duration: 10 Hours

21. Describe the role of digital technology in today's life
22. Demonstrate how to operate digital devices and use the associated applications and features, safely and securely
23. Discuss the significance of displaying responsible online behavior while browsing, using various social media platforms, e-mails, etc., safely and securely
24. Create sample word documents, excel sheets and presentations using basic features
25. utilize virtual collaboration tools to work effectively

Entrepreneurship Duration: 7 Hours

26. Explain the types of entrepreneurship and enterprises
27. Discuss how to identify opportunities for potential business, sources of funding and associated financial and legal risks with its mitigation plan
28. Describe the 4Ps of Marketing-Product, Price, Place and Promotion and apply them as per requirement
29. Create a sample business plan, for the selected business opportunity

Customer Service Duration: 5 Hours

30. Describe the significance of analyzing different types and needs of customers

31. Explain the significance of identifying customer needs and responding to them in a professional manner.
32. Discuss the significance of maintaining hygiene and dressing appropriately

Getting Ready for apprenticeship & Jobs Duration: 8 Hours

33. Create a professional Curriculum Vitae (CV)
34. Use various offline and online job search sources such as employment exchanges, recruitment agencies, and job portals respectively
35. Discuss the significance of maintaining hygiene and confidence during an interview
36. Perform a mock interview
37. List the steps for searching and registering for apprenticeship opportunities

Module- 7: MMAW/SMAW

Outcome: Demonstrate the process to join MS plate by MMAW techniques

Theory Content:

7.1 Introduction to Manual Metal Arc Welding
7.2 Equipment and process
7.3 Straight and Reverse polarity: Applications
7.4 Application area of MMAW/SMAW
7.5 Electrodes used in MMAW/SMAW

Practical Content:

7.1 Fillet weld “Lap” joint on MS plate 8 mm thick in flat position(1F)
7.2 Fillet weld “Tee” joint on MS plate 8 mm thick in flat position(1F)
7.3 Fillet weld “Lap” joint on MS Plate 8 mm thick in Horizontal position (2F)
7.4 Fillet weld “Tee” joint on MS Plate 8 mm thick in Horizontal position (2F)

OJT

Work in real job situation with special emphasis on basic safety and hazards in this domain

Assessor will check report prepared for this component of training of the course and assess whether competency has been developed to work in the real job situation with special emphasis on basic safety and hazards in this domain. (The trainee is expected to undertake work in actual workplace under any supervisor / contractor for **30 Hours.**)

Tools & Equipment needed:

MMAW Transformer, Welding cables, Electrode holder, chipping hammer, Wire brush, Hand screen, PPE

Module- 8: TIG/GTAW

Outcome: Demonstrate the process of welding using TIG techniques

Theory Content:

8.1 TIG welding: Process and equipment
8.2 Tungsten electrodes – Types and uses
8.3 Filler Materials: basic concept
8.4 Application area of TIG welding

Practical Content:

8.1 Fillet weld outside corner joint on MS sheet 3.15 mm
8.2 Fillet weld Tee joint on MS sheet 3.15 mm flat position
8.3 Fillet weld "Lap" joint on MS plate 8 mm thick in flat position(1F)
8.4 Fillet weld "Tee" joint on MS plate 8 mm thick in flat position(1F)

OJT

Work in real job situation with special emphasis on basic safety and hazards in this domain

Assessor will check report prepared for this component of training of the course and assess whether competency has been developed to work in the real job situation with special emphasis on basic safety and hazards in this domain. (The trainee is expected to undertake work in actual workplace under any supervisor / contractor for **30 Hours.**)

Tools & Equipment needed:

TIG welding machine, Welding Torch or Gun, Gas Regulator, Flow-Meter, Nozzle, Tungsten electrode, Electrode holder, Filler metal rod, Shielding gas, Personal safety equipment including TIG welding gloves

Module- 9: GMAW/MAG

Outcome: Demonstrate the process of welding using MAG techniques

Theory Content:

9.1 Introduction to MIG and MAG
9.2 Shielding gases for GMA welding
9.3 CO2 welding: Equipment and process
9.4 Applications of CO2 welding
9.5 Welding wires for CO2 welding

Practical Content:

9.1 Straight beads single layer on MS plate 10 mm position flat

9.2 Fillet weld Tee joint on MS plate 10 mm position flat

9.3 Fillet weld Lap joint on MS plate 10 mm position flat

9.4 Fillet weld inside corner joint on MS sheet 10 mm position flat

OJT

Work in real job situation with special emphasis on basic safety and hazards in this domain

Assessor will check report prepared for this component of training of the course and assess whether competency has been developed to work in the real job situation with special emphasis on basic safety and hazards in this domain. (The trainee is expected to undertake work in actual workplace under any supervisor / contractor for **30 Hours.**)

Tools & Equipment needed:

MIG welding machine, Welding Torch or Gun, Gas Regulator, Flow-Meter, Nozzle, contact tip, Gas preheaters, shielding gas, wire feeding unit, wire spool, CO_2 cylinder, He & Argon cylinder, Anti-spatter spray

Learning Outcome – Assessment Criteria

Module No.	Outcome	Assessment Criteria
1	Apply safe practices related to health and safety	**After successful completion of this module students will be able to:** 1.1 Explain the good housekeeping process 1.2 Explain the standard communication process to higher authorities 1.3 Use fire extinguisher 1.4 Use the first aid box properly 1.5 Explain the process to free a person from electrocution safely
2	Define basic terminologies and tools required for welding	**After successful completion of this module students will be able to:** 2.1 Define basic terms related to welding 2.2 List different joining methods 2.3 Describe different welding joints 2.4 Demonstrate the process of edge preparation 2.5 Explain the name of the basic welding tools with their function

Module No.	Outcome	Assessment Criteria
3	Define different welding positions and electrodes with applications	**After successful completion of this module students will be able to:** 3.1 Describe the basic elements of welding symbol 3.2 Explain the types of electrodes with their application
4	Demonstrate the process of arc welding to join various metals	**After successful completion of this module students will be able to:** 4.1 Explain the basic electricity terms relates to arc welding 4.2 Explain the principle of arc welding with equipment required 4.3 Name different arc welding process 4.4 Describe the parameters: arc length and arc blow 4.5 Demonstrate flat and horizontal welding position 4.6 Demonstrate different positions for pipe welding
5	Define various defects in welding on a job	**After successful completion of this module students will be able to:** 5.1 Name some common types of welding defects 5.2 Demonstrate the Liquid or Dye Penetrant Inspection process
6	Employability Skill	As per NCVET guided curriculum
7	Demonstrate the process to join MS plate by MMAW techniques	**After successful completion of this module students will be able to:** 7.1 Explain the process of SMAW with equipment required 7.2 Explain straight and reverse polarity 7.3 Name the electrodes used for MMAW
8	Demonstrate the process of welding using TIG techniques	**After successful completion of this module students will be able to:** 8.1 Explain the process of TIG with equipment required 8.2 Describe the need of filler materials 8.3 List the application of TIG welding
9	Demonstrate the process of welding using MIG/MAG techniques	**After successful completion of this module students will be able to:** 9.1 Describe the term MIG and MAG 9.2 Name the shielding gases for GMAW 9.3 Explain the process of CO_2 welding with equipment required 9.4 List the application of CO_2 welding

List of Tools, Equipment & materials needed for 30 Trainees (Practical)

Sl No	Items Name	Specification	Qty
1.	Welding helmet fiber	Shape - Dust Mask, Mask Type – Shade Type, Mask Application - Welding Mask, Material - Superfine Fiber	30+1 Nos.
2.	Welding hand shield fiber	Visor Thickness - 10mm	30+1 Nos.
3.	Chipping hammer	Metal handle, 250 Grams	30+1 Nos.
4.	Chisel cold	flat 19 mm x 150 mm	30+1 Nos.
5.	Centre punch	9 mm x 127 mm	30+1 Nos.
6.	Dividers	200 mm	30+1 Nos..
7.	Stainless steel rule	300mm	30+1 Nos.
8.	Scriber	150 mm double point	30+1 Nos.
9.	Flat Tongs	350mm long	30+1 Nos.
10.	Hack saw frame	fixed 300 mm	30+1 Nos.
11.	File half round	bastard 300 mm	30+1 Nos.
12.	File flat	350 mm bastard	30+1 Nos.
13.	Hammer ball pane	1 kg with handle	30+1 Nos.
14.	Try square	6”	30+1 Nos.
15.	Screw Driver	250 - 300 mm blade length	1 each
16.	Magnifying glass	100 mm dia.	2 Nos.
17.	Universal Weld measuring gauge	Measuring Range - 0-20 mm, Material - Stainless Steel	2 Nos.
18.	Earth clamp	600A	6 Nos.
19.	Spanner D.E.	6 mm to 32mm	2 sets
20.	C-Clamps	10 cm and 15 cm	2 each
21.	Hammer sledge	double faced 4 kg	1 No.
22.	S.S tape	5 meters flexible in case	1 No.
23.	Electrode holder	600 amps	6 Nos.
24.	CO_2 Gas pressure regulator	with flow meter	2 set
25.	Argon Gas pressure regulator	with flow meter	2 set
26.	Metal rack	182 cm x 152 cm x 45 cm	1 No.
27.	First Aid box	Standard First Aid Kit	1 No.
28.	Steel lockers	with 8 Pigeon holes	2 Nos.
29.	Steel almirah / cupboard	Standard Size	2 Nos.
30.	Black board and easel with stand	Standard size	1 No.
31.	Welding Transformer	with all accessories (400A, OCV 60 -100 V, 60% duty cycle)	1 set
32.	Welding Transformer (or) Inverter based welding machine	with all accessories (300A, OCV 60 – 100 V, 60% duty cycle)	1 set
33.	D.C Arc welding rectifiers set with all accessories	(400 A. OCV 60 – 100 V, 60% duty cycle)	1 set
34.	GMAW welding machine	400A capacity with air cooled torch, Regulator, Gas pre-heater, Gas hose and Standard accessories	1 set
35.	AC/DC GTAW welding machine	with water cooled torch300 A, Argon regulator, Gas hose, water circulating system and standard accessories.	1 set
36.	Auto Darkening Welding Helmet	Dark Shades: Group 1 : Shade 5, 7 Group 2 : Shade 8, 9, 10, 11, 12	2 Nos.
37.	Pedestal grinder fitted with coarse	300 mm dia.	1 No.
38.	Medium grain size grinding wheels	Medium 30-60	
39.	Bench grinder fitted with fine grain	150 mm dia.	1 No.

Sl No	Items Name	Specification	Qty
	size silicon carbide green grinding wheel		
40.	AG 4 Grinder	Power Consumption - 750W, Usage/Application - Industrial Disc Diameter - 100 mm Disc Dia Weight - 1.8kg	2 Nos.
41.	Suitable Arc welding table	with positioner	6 Nos.
42.	Hand shearing machine capacity	cut 6 mm sheets and flats	1 No.
43.	Power saw machine	14''	1 No.
44.	Portable drilling machine	(Cap. 6 mm)	1 No.
45.	Oven, electrode drying	0 to 350°C, 10 kg capacity	1 No.
46.	Work bench	340x120x75 cm with 4 bench vices of 150 mmjaw opening	4 sets
47.	CO_2 cylinder		2 Nos.
48.	Argon gas cylinder		2 Nos.
49.	Anvil 12 sq. inches working area with stand		1 No.
50.	Swage block		1 No.
51.	Die penetrant testing kit		1 set
52.	Fire extinguishers (foam type and CO_2 type)		1. No.
53.	Fire buckets with stand		2 Nos.
54.	Portable abrasive cut-off machine		1 No.
55.	Leather Hand Gloves	14"	30 pairs
56.	Cotton hand Gloves	8"	30 pairs
57.	Leather Apron leather		30 Nos.
58.	S.S Wire brush	5 rows and 3 rows	30 Nos. each
59.	Leather hand sleeves	16"	30 pairs
60.	Safety boots for welders		30 pairs
61.	Leg guards' leather		30 pairs
62.	Arc welding cables multi cored copper	400/ 600 amp as per BIS	45 mts. each
63.	Arc welding single-coloured glasses	108 mm x 82 mm x 3 mm. DIN 11A &12 A	30 Nos.
64.	Arc welding plain glass	108 mm x 82 mm x 3 mm.	30 Nos.
65.	Safety goggles plain		30 Nos.

Marks Distribution

Outcome	Outcome Code	Type	Total Th marks	Total Pr marks	Total OJT marks
Apply safe practices related to health and safety	CGM/0705/OC1	Compulsory	20	110	0
Define basic terminologies and tools required for welding	CGM/0705/OC2	Compulsory	20	110	0
Define different welding positions and electrodes with applications	CGM/0705/OC3	Compulsory	30	100	0
Demonstrate the process of arc welding to join various metals	CGM/0705/OC4	Compulsory	50	170	100
Define various defects in welding on a job	CGM/0705/OC5	Compulsory	10	130	0
Employability Skill-60 Hrs	DGT/VSQ/N0102	Compulsory	50	0	0
Demonstrate the process to join MS plate by MMAW techniques	CGM/0705/OC6	Elective	20	40	40
Demonstrate the process of welding using TIG techniques	CGM/0705/OC7	Elective	20	40	40
Demonstrate the process of welding using MIG/MAG techniques	CGM/0705/OC8	Elective	20	40	40
Full Marks: Minimum1000 (Th 200, Prac. 660, OJT 140) with 1 Elective Maximum marks 1100 ((Th 220, Prac. 700, OJT 180) with 2 Elective Maximum marks 1200 ((Th 240, Prac. 740, OJT 220) with 3 Elective					