

**Syllabus for Asst. Fabricator and Fitter (Metal)**

<b>Course Name</b>	<b>Asst. Fabricator and Fitter (Metal)</b>
<b>Sector</b>	<b>Capital Goods</b>
<b>Course Code</b>	<b>CGM/2023/AFFM/147</b>
<b>Level</b>	<b>3</b>
<b>Occupation</b>	<b>Metal Cutting, Joining &amp; Assembly</b>
<b>Job Description</b>	<b>Fitting different component to form mechanical assembly</b>
<b>Course Duration</b>	<b>Total Duration 390 Hrs (T-90, P-180, OJT-60 and ES-60)</b>
<b>Trainees' Entry Qualification</b>	Grade 10 OR Grade 8 with two year of (NTC/ NAC) after 8 <sup>th</sup> 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
<b>Trainers Qualification</b>	BE/B TECH IN MECHANICAL ENGINEERING OR DIPLOMA IN MECHANICAL ENGINEERING OR ITI IN FITTER 5 YEARS FOR B.E/B. TECH OR 7 YEARS FOR DIPLOMA ENGINEERING OR 10 YEARS FOR ITI

**Structure of Course:**

<b>Module No.</b>	<b>Module name</b>	<b>Outcome</b>	<b>Theory (Hrs)</b>	<b>Practical (Hrs)</b>	<b>Total (Hrs) [Multiple of 30]</b>
1	<b>Health and safety practices at work</b>	Demonstrate health and safety practice at workplace	10	20	30
2	<b>Oxy-fuel cutting of metal &amp; metal alloys</b>	Demonstrate metal & metal alloys cutting using oxy-fuel	20	40	60
3	<b>Metal Arc Welding (MMAW)/ Shielded Metal Arc Welding (SMAW)</b>	Demonstrate permanent joints among different carbon and low alloy steel made assembly components using Manual Metal Arc Welding (MMAW)/Shielded Metal Arc Welding (SMAW)	30	60	90

4.	<b>Fitting operations on metal components</b>	Demonstrate assembly of different components using different fitting techniques	30	60	90
5.	<b>OJT</b>			60	60
6.	<b>Employability Skill</b>		60	--	60
TOTAL:			150	240	390

**SYLLABUS:****Module No. 1: Health and safety practices at work**

**Outcome:** Demonstrate health and safety practice at workplace

**Theory Content:**

- Need of safety,
- occupational health & safety,
- Personal Protective Equipment (PPE),
- Safe condition for prevention of accident- basic idea,
- First aid & First Aid Box,
- Fire extinguisher & its use,
- Different sign/slogan/banner/hoarding indicating warning against accident
- Safety rule, standards.

**Practical Content:**

- Use of appropriate Personal Protective Equipment (PPE) relevant to the task and work conditions.
- Testing the firefighting equipment to verify whether they belong to working condition or not.
- Use the appropriate type of fire extinguisher to extinguish different types of fires safely.
- Mock drill for using appropriate first aid to the injured personnel
- Demonstration of the process of carrying out appropriate documentation following a health and safety incident at work, including all the required information

**Tools & Equipment needed** : Personal Protective Equipment, Cleaning Equipment and Materials, Sanitizer, Soap, Mask, First Aid Box, Fire Extinguisher/ Chart related to use of Different Fire Extinguisher

**Module No. 2: Oxy-fuel cutting of metal & metal alloys**

**Outcome** Demonstrate metal & metal alloys cutting using oxy-fuel

**Theory Content:**

- Gas cutting- a brief idea,
- Equipment required- oxygen cylinder, acetylene cylinder, hose.
- Pressure regulator, flow control valve.
- Oxy-cutting flame, job holding devices to hold the job with working table.
- Hand tools: tong, hammer, chisel, divider, vernier scale, height gauge, caliper, scribe, etc.
- WPS & job order with drawing- a brief idea, Tip cleaner, wire brush (M.S.), cleaning agents

**Practical Content:**

- Read the drawing, WPS and job orders for identifying work requirements.
- Standard operating procedure to use tools, equipment and measuring instruments required during job.
- Set the oxy-gas cutting apparatus and cutting parameters as per the work instructions.
- Perform steps to light, adjust and extinguish the oxyacetylene flame
- Mark the correct measurements on the workpiece as specified in drawing or WPS.
- Procedure of cylinder valves and regulator for operating pressure to achieve required specifications.
- Various cutting operations correctly and produce thermal cuts in various forms of material.
- Measuring and comparing cut piece dimensions with the specified dimensions in the job orders.
- Appropriate inspection method to check the quality of cut workpieces.

**Tools & Equipment needed:**

- Oxygen cylinder - 7m<sup>3</sup>, acetylene cylinder 6m<sup>3</sup>, oxygen pressure regulator; acetylene pressure regulator; flashback arrestors; cutting torch; rubber hoses; cutting nozzles; trolley to secure oxygen and acetylene cylinders; chain to secure oxygen and acetylene cylinders; lighter/ flint; spanner set; spindle key; non-return valves; spade guides; radius guide; bevel guide; gas welding/ cutting table 822 cm x 92 cm x 60 cm; surface plate; scribe - 15 cm; dividers 20 cm; calliper outside 15 cm; prick punch; chisel cold flat - 19 mm; centre punch - 9 mm x 127 mm; rule 60 cm; two fold; brass topped to read inches and mm; hammer scaling 0.25 kg with handle; steel rule - 30 cm to read inch and milli-metre; Vernier calliper - digital - 0- 150 mm; ball peen hammer with handle - 0.25 kg; cross peen hammer with handle - 0.25 kg; holding tongs - 30 cm; wire brush - 15 cm x 3.7 cm and double ended spanner
- Fire extinguisher, welding helmet, Leather sleeves, leather safety gloves, leather aprons, safety glasses with side shields, ear plug, safety shoes and first-aid kit
- Tip cleaner, wire brush (M.S.), cleaning agents, cleaning cloth, waste container, dust pan and brush set

**Module No. 3: Metal Arc Welding (MMAW)/ Shielded Metal Arc Welding (SMAW)**

**Outcome:** Demonstrate permanent joints among different carbon and low alloy steel-made assembly components using Manual Metal Arc Welding (MMAW)/Shielded Metal Arc Welding (SMAW)

**Theory Content:**

Basic principle of welding process.  
 Basic process of MMAW welding.  
 Different types of welds and welding joints.  
 Different welding positions.  
 Method of understanding different common information those can be derived from the job orders, Welding Procedure Specification (WPS) and engineering drawings and instructions received from supervisor.  
 List tools, measuring instruments, equipment, accessories, consumables and input material required during welding work.  
 Brief ideas about the steps to be performed for checking the input material, tools and equipment before use.  
 List the steps to be performed for joint preparation process.  
 List the steps to be performed for MMAW process.  
 Finishing processes such as dimensions check, removing extra material, hammering workpiece into desired shape etc. as per the required specifications.  
 Post welding processes like inspection, cleaning, maintenance etc.  
 List the commonly occurring defects and their remedies in the welded workpieces.  
 Various testing techniques like visual, destructive and non-destructive.

**Practical Content:**

- Reading the drawing, WPS and job orders for identifying work requirements.
- Execute the standard operating procedure to use tools, equipment and measuring instruments required during job.
- Prepare the work area for welding activities.
- Show how to prepare the materials and joint for welding process.
- Install the work pieces and fixture on the apparatus and aligning with the electrodes.
- Apply appropriate methods to strike and maintain a stable welding arc.
- Prepare a butt joint maintaining correct angle of torch, travel speed, direction of weld and feed as per requirement during the welding operation.
- Prepare a Lap/T/ Square joint maintaining correct angle of torch, travel speed, direction of weld and feed as per requirement during the welding operation.
- Apply appropriate ways to check and repair the extra material and bulges from the hammered welded piece to get the desired shape as per the required specifications.
- Shut down the welding equipment and remove the workpiece after completion of welding activities.

- Employ appropriate testing methods like destructive and non-destructive tests for checking the quality of welded workpiece.
- Checking of common welding defects like porosity, crack, undercut, spattering, etc.

**Tools & Equipment needed:**

Work bench with vice  
 Hammer, Chisel set, Centre punch 9mm x 127mm, Dividers 20 cm, Wire brush 15 cm x 3.7 mm, Spark lighter, Number punch 6 mm and letter punch 6 mm, Scriber 15 cm, Tongs holding  
 Steel rule, Screw driver set, Hacksaw frame adjustable 30 cm, Magnifying glass 15 cm, Weld measuring gauge fillet and butt, file set, Steel tape 182 cm flexible in case, Try square  
 Rubber hose clips, Spindle key (for opening cylinder valve), Pressure regulator oxygen double stage, Pressure regulator acetylene regulator, Tip cleaner, Outfit spanner  
 Power hacksaw, Portable grinder  
 Power source, MMAW welding set  
 welding helmet, Leather sleeves, leather safety gloves, leather aprons, safety glasses with side shields, ear plug, safety shoes  
 Tip cleaner, wire brush (M.S.), cleaning agents, cleaning cloth, waste container, dust pan and brush set

**Module No. 4:            Fitting operations on metal components**

**Outcome:**            Demonstrate assembly of different components using different fitting techniques

**Theory Content:**

Fitting – a brief idea  
 Different joining processes for joining of two or more materials in fabrication work  
 Example of various fabrication and fitting operations.  
 Mechanical joints  
 Types of fit – one brief idea  
 Holding devices for jobs  
 List of commonly used tools required for fitting work  
 Measuring tools used for fitting- name, identification, use  
 Marking tools used for fitting- name, identification, use  
 Hand tools used for fitting- name, identification, use

**Practical Content:**

Arrange the tools, measuring instruments, marking tools, work holding devices, equipment, components/ parts and sub-assemblies.  
 Apply appropriate ways to set work pieces safely.  
 Show how to mark the dimensions, range of features and templates on the equipment body.  
 Perform the procedure to carry out fabrication and fitting operations to produce machine components.  
 Perform appropriate inspection method to check the quality of fabricated components.  
 Prepare sample records consisting of information such as the type of tasks performed.

**Tools & Equipment needed:**

- Work bench with vice
- Ag4 grinding, wolf grinding, hand air grinding Power tool cables ,Chisel, drilling tools , jigs & fixtures , ropes , manual lifts , blocks & tables , straps , bolts , clamps, Cutting tools, hacksaws; hammers; punches; screwdrivers; sockets; wrenches; spanners; scrapers , measuring tools(rules/tapes, dividers/trammels, scribes, punches, scribing blocks, squares, protractor, depth/internal/external micrometres, callipers (Vernier, inside and outside, depth), gauges (height Vernier, feeler, bore/hole, slip, radius/profile, thread, plug), stick micrometres, dial stand and comparator, vee block with u-clamp) , , Hand Tools , Power tools , PPE , Drawing Tools , Cutting Machines , Hand Grinders etc
- welding helmet, Leather sleeves, leather safety gloves, leather aprons, safety glasses with side shields, ear plug, safety shoes
- Tip cleaner, wire brush (M.S.), cleaning agents, cleaning cloth, waste container, dust pan and brush set, liquid soap, hand towel

**Learning Outcome – Assessment Criteria**

Module No.	Outcome	Assessment Criteria
1	Demonstrate health and safety practice at workplace	<p><b>After completion of this module students will be able to:</b></p> <p>1.1. Explain the need of safety,</p> <p>1.2. Explain occupational health &amp; safety,</p> <p>1.3. Define Personal Protective Equipment (PPE)</p> <p>1.4. Demonstrate appropriate Personal Protective Equipment (PPE) relevant to the task and work conditions.</p> <p>1.5. State basic idea of Safe condition for prevention of accident.</p> <p>1.6. Describe First aid &amp; First Aid Box</p> <p>1.7. Explain Fire extinguisher &amp; its use</p> <p>1.8. Demonstrate the method of testing the firefighting equipment to verify whether they belong to working condition or not.</p> <p>1.9. Demonstrate the method of use the appropriate type of fire extinguisher to extinguish different types of fires safely.</p> <p>1.10. Demonstrate Different sign/slogan/banner/hoarding indicating warning against accident</p> <p>1.11. Describe Safety rule, standards.</p>

Module No.	Outcome	Assessment Criteria
2	Demonstrate metal & metal alloys cutting using oxy-fuel	<p><b>After completion of this module students will be able to:</b></p> <p>3.1. State a brief idea about gas cutting-,</p> <p>3.2. Name the location and use of the equipment required for oxy cutting such as oxygen cylinder, acetylene cylinder, hose, etc.</p> <p>3.3. State the location and use of Pressure regulator, flow control valve.</p> <p>3.4. Describe the nature, characteristics, identification and use of Oxy-cutting flame,</p> <p>3.5. Name different job holding devices to hold the job with working table during oxy-cutting.</p> <p>3.6. State different hand tools required for oxy-cutting operation along with their use such as tong, hammer, chisel, divider, vernier scale, height gauge, caliper, scribe, etc.</p> <p>3.7. Elaborate a brief idea on WPS &amp; job order with drawing,</p> <p>3.8. State different cleaning hand tools required at the end of oxy-cutting along with their use such as Tip cleaner, wire brush (M.S.), cleaning agents</p> <p>3.9. Demonstrate the method of reading the drawing, WPS and job orders for identifying work requirements.</p> <p>3.10. State a brief idea on Standard operating procedure to use tools, equipment and measuring instruments required during job.</p> <p>3.11. Set the oxy-gas cutting apparatus and cutting parameters as per the work instructions.</p> <p>3.12. Demonstrate sequential steps to light, adjust and extinguish the oxyacetylene flame</p> <p>3.13. Demonstrate the method of marking the correct measurements on the workpiece as specified in drawing or WPS.</p> <p>3.14. Demonstrate the method of operating cylinder valves and regulator for adjusting operating pressure to achieve required specifications.</p> <p>3.15. Demonstrate various oxu-cutting operations correctly and produce thermal cuts in various forms of material.</p> <p>3.16. Demonstrate the method of Measuring and comparing cut piece dimensions with the specified dimensions in the job orders.</p> <p>3.17. Demonstrate appropriate inspection method to check the quality of cut workpieces.</p>
3	Demonstrate permanent joints among different carbon and low alloy steel made assembly components using Manual Metal Arc Welding (MMAW)/Shielded Metal Arc Welding (SMAW)	<p><b>After completion of this module students will be able to:</b></p> <p>4.1. Discuss on basic principle of welding process.</p> <p>4.2. Explain basic process of MMAW welding.</p> <p>4.3. Name Different types of welds and welding joints with example.</p> <p>4.4. Describe different welding positions.</p> <p>4.5. Discuss method of understanding different common information those can be derived from</p>

Module No.	Outcome	Assessment Criteria
		<p>the job orders, Welding Procedure Specification (WPS) and engineering drawings and instructions received from supervisor.</p> <p>4.6. State the list of different types of tools, along with their specific use with example such as measuring instruments, equipment, accessories, consumables and input material required during welding work.</p> <p>4.7. Explain a brief idea about the steps to be performed for checking the input material, tools and equipment before use.</p> <p>4.8. Demonstrate the steps to be performed for joint preparation process.</p> <p>4.9. Demonstrate the steps to be performed for MMAW process.</p> <p>4.10. Demonstrate the finishing processes such as dimensions check, removing extra material, hammering workpiece into desired shape etc. as per the required specifications.</p> <p>4.11. Demonstrate the Post welding processes like inspection, cleaning, maintenance etc.</p> <p>4.12. Demonstrate the method of identification of commonly occurring defects and their remedies in the welded workpieces.</p> <p>4.13. Demonstrate the various testing techniques like visual, destructive and non-destructive test.</p> <p>4.14. Demonstrate the method of holding Work bench with vice</p>
4	Demonstrate assembly of different components using different fitting techniques	<p><b>After completion of this module students will be able to:</b></p> <p>5.1. Discuss a brief idea on Fitting.</p> <p>5.2. Describe different joining processes for joining of two or more materials in fabrication work</p> <p>5.3. State example of various fabrication and fitting operations.</p> <p>5.4. Describe a brief idea on Mechanical joints</p> <p>5.5. Explain one brief idea on types of fit.</p> <p>5.6. Discuss different holding devices for jobs along with their use in case of fitting work.</p> <p>5.7. Name different commonly used tools required for fitting work</p> <p>5.8. State name, identification &amp; use of different measuring tools used for fitting-</p> <p>5.9. Describe name, identification, use of different marking tools used for fitting.</p> <p>5.10. Discuss the name, identification, use of different Hand tools used for fitting.</p> <p>5.11. Demonstrate the method of Arranging the tools, measuring instruments, marking tools, work holding devices, equipment, components/ parts and sub-assemblies.</p> <p>5.12. Demonstrate the method of applying appropriate ways to set work pieces safely.</p>



Module No.	Outcome	Assessment Criteria
		5.13. Show how to mark the dimensions, range of features and templates on the equipment body. 5.14. Perform the procedure to carry out fabrication and fitting operations to produce machine components. 5.15. Perform appropriate inspection method to check the quality of fabricated components. Prepare sample records consisting of information such as the type of tasks performed.
5	OJT	Work in real job situation with special emphasis on basic safety and hazards in this domain (OJT).
6	Employability Skill	<b>As per NCVET guided curriculum</b>

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

Sl No	Items Name	Specification	Qty
1	Welding helmet fiber		(20+1) nos.
2	Welding hand shield fiber		(20+1) nos.
3	Chipping hammer	with metal handle 250 Grams	(20+1) nos.
4	Chisel cold	flat 19 mm x 150 mm	(20+1) nos.
5	Centre punch	9 mm x 127 mm	(20+1) nos.
6	Dividers	200 mm	(20+1) nos.
7	Stainless steel rule	300mm	(20+1) nos.
8	Scriber	150 mm double point	(20+1) nos.
9	Flat Tongs	350mm long	(20+1) nos.
10	Hack saw frame	fixed 300 mm	(20+1) nos.
11	File half round	bastard 300 mm	(20+1) nos.
12	File flat	350 mm bastard	(20+1) nos.
13	Hammer ball pane	1 kg with handle	(20+1) nos.
14	Tip Cleaner		(20+1) nos.
15	Try square	6"	(20+1) nos.
16	Spindle key		4 Nos.
17	Screw Driver	300mm blade and 250 mm blade	1 each
18	Number punch	6 mm	2 sets
19	Letter punch	6 mm	2 sets
20.	Earth clamp	600A	6 Nos.
21.	Spanner D.E.	6 mm to 32mm	2 sets
22.	C-Clamps	10 cm and 15 cm	2 each
23.	Hammer sledge	double faced 4 kg	1 No.
24.	S.S tape	5 meters flexible in case	1 No.
25.	Electrode holder	600 amps	6 Nos.
26.	H.P. Welding torch	with 5 nozzles	2 sets
27.	CO2 Gas pressure regulator	with flow meter	2 set
28.	Argon Gas pressure regulator	with flow meter	2 set
29.	Metal rack	182 cm x 152 cm x 45 cm	1 No.

30.	First Aid box		1 No.
31.	Steel lockers	with 8 Pigeon holes	2 Nos.
32.	Steel almirah / cupboard		2 Nos.
33.	Black board and easel with stand		1 No.
34.	Flash back arrester (torch mounted)		4 pairs
35.	Flash back arrester (cylinder mounted)		4 pairs
36.	Welding Transformer (or) Inverter based welding machine		01 nos.
37.	D.C Arc welding rectifiers set with all accessories		01 nos.
38.	GMAW welding machine		01 nos.
39.	Auto Darkening Welding Helmet		01 nos.
40.	Pedestal grinder fitted with coarse and medium grain size grinding wheels	300 mm dia.	01 nos.
41.	Bench grinder fitted with fine grain size silicon carbide green grinding wheel	150 mm dia.	01 nos.
42.	Suitable gas welding table	with fire bricks	2 Nos.
43.	Suitable Arc welding table	with positioner	4 Nos.
44.	Trolley for cylinder (H.P. Unit)		2 Nos.
45.	Hand shearing machine capacity	cut 6 mm sheets and flats	01 nos.
46.	Oven, electrode drying	0 to 350°C, 10 kg capacity	01 nos.
47.	Work bench	340x120x75 cm with 4 bench vices of 150 mm jawopening	02 nos.
48.	Oxygen, Acetylene Cylinders		2 each
49.	CO2 cylinder		1 no.
50.	Argon gas cylinder		1 no.
51.	Fire extinguishers (foam type and CO2 type)		1. No.
52.	Fire buckets with stand		04 nos.
53.	Oxy Acetylene Gas cutting blow pipe		2 sets
54.	Leather Hand Gloves	14"	20 pairs
55.	Cotton hand Gloves	8"	20 pairs
56.	Leather Apron leather		20 Nos.
57.	S.S Wire brush	5 rows and 3 rows	20Nos. each
58.	Leather hand sleeves	16"	20 pairs
59.	Safety boots for welders		20 pairs
60.	Leg guards leather		20 pairs
61.	Rubber hose clips	½"	20 Nos.
62.	Rubber hose oxygen	8 mm dia X 10 Mtr. Long as per BIS	2 Nos.
63.	Rubber hose acetylene	8 mm dia X 10 Mtr. Long as per BIS	08 nos.
64.	Arc welding cables multi cored copper	400/ 600 amp as per BIS	45 mts. each
65.	Vernier caliper	0mm -150mm	1 No.

66	Micrometer outside	0 to 25mm	1 No.
67	D.E. Spanner G.P	6mm to 32mm (Set of 12 spanners)	2 set
68	D.E. Grinder Pedestal motorized	200 mm	1 No.
69	Bench vice	120mm, 150mm	2 each
70	Screw Driver	250mm	2 Nos
71	Vernier Height gauge range	500 mm	1 No
72	Oxy Acetylene Gas Welding Torch (H.P) with	5 nozzles	2 sets
73	Oxy-Acetylene gas cutting torch with cutting nozzle	0.8 mm and 1.2 mm	2 set
74	Welding Transformer with all accessories	400A , OCV 60 - 100 V, 60% duty cycle	2 sets
75	Welding Transformer or Invertors with all accessories	300A , OCV 60 - 100 V, 60% duty cycle	2 sets
76	D.C .Arc welding rectifiers set with all accessories	400A,OCV 60-100V,60% duty cycle	1 set
77	Welding cables to carry 400 A with flexible rubber as per BIS		30 mtr
78	Trolley for cylinders		2 nos.
79	Lugs for Cables		21(20 +1) Nos.
80	Oxygen and D.A cylinders (may be hired)		#2 each
81	Leather Hand Gloves	14 "	20+1 Nos.
82	Cotton hand gloves	8 "	20+1 Nos.
83	Leather hand sleeves	16 "	20+1 Nos.
84	Leg guards leather		20+1 Nos.
85	Leather Apron		20+1 Nos.
86	Gas welding Goggles with filter glass 3A		20+1 Nos.
87	Spark lighter		6 Nos.
88	Safety boots for welders		20+1 Nos.
89	Arc welding filter glasses DIN 9A 11 A & 13 A	108 mm x 82 mm x 3 mm	20+1 Nos.
90	Plain glasses for helmets	108 mm x 82 mm x 3 mm	32 nos.
91	Rubber hose clips		20+1 Nos.

### Marks Distribution

Outcome	Outcome Code	Total Th marks	Total Pr marks
Demonstrate health and safety practice at workplace	CGM/0703/OC1	20	130
Demonstrate metal & metal alloys cutting using oxy-fuel	CGM/0703/OC2	30	160
Demonstrate permanent joints among different carbon and low alloy steel made assembly components using Manual Metal Arc Welding (MMAW)/Shielded Metal Arc Welding (SMAW)	CGM/0703/OC3	50	180

## SYLLABUS

Demonstrate assembly of different components using different fitting techniques	CGM/0703/OC4	50	180
Work in real job situation with special emphasis on basic safety and hazards in this domain (OJT).	CGM/0703/OC5	0	150
Employability Skill-60 Hrs	DGT/VSQ/N0102	50	0