

## 13.1.0 STRUCTURAL FABRICATION TECHNOLOGY I

### 13.1.1 Introduction

Structural fabrication technology is the design, fabrication and construction of rigid support members for various applications. The technology involves the design, force analysis and simulation to obtain strong structures.

The module unit will impart in the trainee the competencies required to design and fabricate metal structures for use in diverse sector of economy. Trainees undertaking this module unit will require knowledge of engineering drawing, engineering materials, mathematics and engineering science

### 13.1.2 General Objectives

By the end of the module unit the trainee should be able to:

- demonstrate safe working habits in a workshop environment
- understand the working principle of tools and equipment used in metal structural fabrication
- acquire knowledge and skills to design and estimate materials for a given job and task
- fabricate metal structures to required specification
- develop skills and attitudes necessary to care for and maintain tools and equipment used in workshop

### 13.1.3 Module Unit Summary and Time Allocation

#### STRUCTURAL FABRICATION TECHNOLOGY

Code	Sub-Module Init	Content	Theory Hrs	Pract Hrs	Time Hrs
13.1.0.1	Sheet Metal Materials	- Types of sheet materials - Property of sheet metal materials - Uses of sheet metal	2	2	4
13.1.0.2	Sheet metal tools and equipment	- Marking out tools - Cutting tools - Forming tools	4	10	14
13.1.0.3	Sheet metal joints and seams	- Types of joints - Edge treatments - Tools and equipment	2	4	6
13.1.0.4	Pattern layout	- Definition	4	6	10

	and development	<ul style="list-style-type: none"> <li>- Importance of pattern development</li> <li>- Tools and equipment</li> <li>- Marking out tools</li> <li>- Cutting tools</li> <li>- Folding tools and equipment</li> <li>- Pattern development</li> <li>- Safety</li> </ul>			
13.1.0.5	Sheet metal forming	<ul style="list-style-type: none"> <li>- Folding and bending processes</li> <li>- Tools and equipment</li> <li>- Folding and bending</li> </ul>	4	4	8
13.1.0.6	Soft soldering	<ul style="list-style-type: none"> <li>- Definition</li> <li>- Application of soft soldering</li> <li>- types of fluxes</li> <li>- Types of solder</li> <li>- Soldering tools and equipment</li> <li>- Heating source</li> <li>- soldering iron</li> <li>- Soldering procedure</li> <li>- Safety precaution</li> </ul>	4	4	8
13.1.0.7	Mechanical fasteners	<ul style="list-style-type: none"> <li>• Types of mechanical fasteners</li> <li>• Selection of mechanical fasteners</li> <li>• Safety</li> </ul>	6	10	16
13.1.0.8	Oxy-acetylene welding	<ul style="list-style-type: none"> <li>• Principle of gas welding</li> <li>• Features of oxy-acetylene gas welding equipment</li> <li>• Types of welding flames</li> <li>• Welding techniques</li> <li>• Types of joints</li> </ul>	6	8	14

		<ul style="list-style-type: none"> <li>• Welding positions</li> <li>• Welding defects</li> <li>• Weld tests</li> <li>• Safety</li> </ul>			
13.1.0.9	Brazing	<ul style="list-style-type: none"> <li>• Definition</li> <li>• Applications of brazing process</li> <li>• Types of brazing rods</li> <li>• Brazing fluxes</li> <li>• Lighting and setting flame</li> <li>• Joints</li> <li>• Procedure of brazing</li> <li>• Safety precautions</li> </ul>	4	16	20
13.10	Oxy-acetylene cutting	<ul style="list-style-type: none"> <li>• Setting up gas cutting equipment</li> <li>• Gas cutting</li> <li>• Safety precautions</li> </ul>	4	14	18
13.1.11	Manual metal arc welding	<ul style="list-style-type: none"> <li>• Principle of arc welding</li> <li>• Arc welding methods</li> <li>• Principle of operation of manual metal arc welding equipment</li> <li>• Equipment set-up</li> <li>• Welding electrode selection</li> <li>• Weld joints</li> <li>• Welding positions</li> <li>• Weld defects</li> <li>• Weld tests</li> <li>• ety precaution</li> </ul>	4	12	16
<b>Total Time</b>			<b>44</b>	<b>90</b>	<b>134</b>

**13.1.01 SHEET METAL MATERIALS**

**Theory**

13.1.01T0 *Specific Objectives*  
By the end of the sub-module unit, the trainee should be able to:

- a) outline various types of sheet metal materials
- b) outline various uses of sheet metal

13.1.01C *Competence*  
The trainee should have the ability to:

- i) Fabricate consumer control unit using galvanized iron sheet
- ii) Fabricate bus bars using copper plates

*Content*

- 13.1.01T1 Types of sheet metal materials
- Black iron
  - Galvanized iron
  - Copper sheet
  - Aluminum sheet
  - Tin sheet
  - Brass sheet
  - Lead sheet
  - Zinc sheet
  - Properties of sheet metal materials

- 13.1.01T2 - Storage  
Uses of sheet metal
- Domestic
  - Industrial
  - Ornamental

**Practice**

13.1.01P0 *Specific Objectives*  
By the end of the sub-module unit, the trainee should be able to:

- a) distinguish sheet metal materials and plates
- b) observe safety when handling sheet metal materials

*Content*

- 13.1.01P1 Sheet metal materials
- Black iron sheet
  - Galvanized iron sheet
  - Stainless steel sheet
  - Aluminum sheet
  - Copper sheet
  - Tin sheet
  - Lead sheet
  - Brass sheet
- 13.1.01P2 Plates
- Mild steel plates
  - Aluminium plates
  - Copper plates
  - Brass plates
  - Stainless steel plates

	<i>Suggested Learning Resources</i>		<ul style="list-style-type: none"> <li>○ Forming</li> <li>○ Folding</li> <li>○ Marking out</li> </ul>
	- Sheet metal plates in various sizes and materials	13.1.02T2	Care and maintenance <ul style="list-style-type: none"> <li>- Cleaning</li> <li>- Sharpening</li> <li>- Storage</li> </ul>
<b>13.1.02</b>	<b>SHEET METAL TOOLS AND EQUIPMENT</b>		
	<b>Theory</b>		<b>Practice</b>
13.1.02T0	<i>Specific Objectives</i> By the end of the sub-module unit, the trainee should be able to: <ul style="list-style-type: none"> <li>a) describe various tools and equipment used in sheet metal work</li> <li>b) care for and maintain sheet metal tools and equipment</li> </ul>	13.1.02P0	<i>Specific Objectives</i> By the end of the sub-module unit, the trainee should be able to: <ul style="list-style-type: none"> <li>a) select the correct tools for a given task</li> <li>b) use various sheet metal tools and equipment</li> </ul>
			<i>Content</i>
		13.1.02P1	Selection of tools <ul style="list-style-type: none"> <li>- Measuring tools</li> <li>- Marking out tools</li> <li>- Cutting tools</li> <li>- Forming tools</li> <li>- Folding tools</li> </ul>
13.1.03C	<i>Competence</i> The trainee should have the ability to fabricate a fire place hood		
		13.1.02P2	Usage of tools and equipment <ul style="list-style-type: none"> <li>- Measuring</li> <li>- Marking</li> <li>- Cutting</li> <li>- Forming</li> <li>- Folding</li> </ul>
	<i>Content</i>		<i>Suggested Learning Resources</i>
13.1.02T1	Tools and equipment <ul style="list-style-type: none"> <li>- Marking out tools</li> <li>- Measuring tools</li> <li>- Cutting tools</li> <li>- Forming tools</li> <li>- Folding equipment</li> <li>- Use of tools and equipment <ul style="list-style-type: none"> <li>○ Measuring</li> <li>○ Cutting</li> </ul> </li> </ul>		<ul style="list-style-type: none"> <li>- Marking out tools</li> <li>- Measuring tools</li> <li>- Cutting tools</li> </ul>

	- Forming tools - Folding equipment	13.1.03T2	Identification of edge treatment - Hem - False wired edge - Wired edge
<b>13.1.03</b>	<b>SHEET METAL JOINTS AND SEAMS</b>	13.1.03T3	Tools and equipment - Steel rule - Odd leg calliper - Mallet - Stake - grooving tool - Riveting - soldering tools - Folding bars - Making sheet metal joints o Lap o Seam o Locked seam o Grooved seam - Sheet metal edges preparation o Hem o False wired edge o Wired edge o Safety precautions o Personal o Equipment
	<b>Theory</b>		
13.1.03T0	<i>Specific Objectives</i> By the end of the sub-module unit, the trainee should be able to: a) distinguish between various types of joints used in sheet metal work b) describe sheet metal edge treatments c) describe tools and equipment used in making joints and treating edges		
13.1.03C	<i>Competence</i> The trainee should have the ability to: i) produce various types of joints, seams and edges of sheet metals ii) observe safety precautions		
	<i>Content</i>		
13.1.03T1	Types of joints - Lap - Seam - Locked seam - Grooved seam	13.1.03P0	<i>Specific Objectives</i> By the end of the sub-module unit, the trainee should be able to: a) prepare sheet metal edges b) make sheet metal joints
			<b>Practice</b>

	c) observe safety precaution		b) explain the importance of pattern development
	<i>Content</i>		c) list tools for pattern layout and development
13.1.03P1	Preparation of sheet metal edges		d) describe the operation procedure for developing the pattern for a given component
	- Hem		
	- Wired edge		
	- False wired edge		
13.1.03P2	Joints		
	- Lap joint		
	- Seam		
	- Grooved seam		
13.1.03P3	Safety precautions		
	<i>Suggested Learning Resources</i>	13.1.04C	<i>Competence</i>
	- sheet metals in various thicknesses and material		The trainee should have the ability to:
	- steel rule		i) Develop a cylindrical container
	- odd-leg caliper		ii) Develop and fabricate a sugar scoop
	- mallet		
	- stake		
	- grooving tool		
	- work bench	13.1.04T1	<i>Content</i>
			Definition of pattern development
		13.1.04T2	Importance of pattern development
			- Proper layout of an object
			- Uses of template
			- Economical
		13.1.04T3	Tools and equipment
			- Measuring tools
			- Trammel
			- Punches
			- Cutting tools
			- Scratch awl
			- Try square
		13.1.04T4	Operation procedure
			- Interpretation of drawing
<b>13.1.04</b>	<b>PATTERN LAYOUT AND DEVELOPMENT</b>		
	<b>Theory</b>		
13.1.04T0	<i>Specific Objectives</i>		
	By the end of the sub-module unit, the trainee should be able to:		
	a) define the term pattern development as used in sheet metal work		

13.1.04T5	<ul style="list-style-type: none"> <li>- Material preparation</li> </ul> Pattern layout and development		<ul style="list-style-type: none"> <li>- Transition piece (square to round)</li> <li>- Rectangular box frustum of cone</li> </ul>
	<ul style="list-style-type: none"> <li>- Laying down the pattern             <ul style="list-style-type: none"> <li>o Parallel line method</li> <li>o Radial line method</li> <li>o Triangulation method</li> </ul> </li> </ul>	13.1.04P3	Safety precautions  <i>Suggested Learning Resources</i>
13.1.04T6	Safety <ul style="list-style-type: none"> <li>- Personal</li> <li>- Tools and equipment</li> </ul>		<ul style="list-style-type: none"> <li>- Sheet metal in various thickness and materials</li> <li>- Measuring tools</li> <li>- Hand tools</li> <li>- Punches</li> <li>- Cutting tools</li> <li>- Marking out tools</li> <li>- Work bench</li> </ul>
	<b>Practice</b>		
13.1.04P0	<i>Specific Objectives</i> By the end of the sub-module unit, the trainee should be able to:	13.1.05	<b>SHEET METAL FORMING</b>
	<ul style="list-style-type: none"> <li>a) identify tools and equipment used for pattern layout and development</li> <li>b) carry out pattern, and development for a given component</li> <li>c) observe safety precautions</li> </ul>	13.1.05T0	<i>Specific Objectives</i> By the end of the sub-module unit, the trainee should be able to:
	<i>Content</i>		
13.1.04P1	Identification of tools and equipment <ul style="list-style-type: none"> <li>- Measuring tools</li> <li>- Marking out tools</li> <li>- Cutting tools</li> </ul>		<ul style="list-style-type: none"> <li>a) explain the difference between folding and bending processes</li> <li>b) outline the tools used in folding and bending</li> <li>c) explain folding and bending processes for various shapes</li> <li>d) explain safety precautions to be observed when performing folding</li> </ul>
13.1.04P2	Laying out and developing		



	and bending processes		By the end of the sub-module unit, the trainee should be able to:
13.1.05C	<i>Competence</i> The trainee should have the ability to: i) Make gutters ii) Make water tank Make a cyclone		a) identify tools and equipment used for folding b) carry out folding and bending process c) observe safety precaution while folding and bending
13.1.05T1	<i>Content</i> Folding and bending processes - Folding - Bending - Applications of each processes		
13.1.05T2	Tools and equipments - Measuring tools - Stakes - Mallets - Clamps - Folding bars - Box and pan brake - Cornice brake - Rolling machine (slip roll former) - Rotary machine	13.1.05P1	<i>Content</i> Identification of folding and bending tools and equipment - Forming tools - Stakes - Mallets - Clamps - Folding bars
13.1.05T3	Folding and bending processes - Angular folds - Cylindrical shapes - Conical shapes	13.1.05P2	Bending equipment - Bar folder - Box and pan brake - Slip roll former - Cornice brake - Rotary machine
13.1.05T4	Safety precautions - Personal - Tools and equipment	13.1.05P3	Safety - Personal safety - Equipment safety
	<b>Practice</b>		<i>Suggested Learning Resources</i> - Measuring tools - Stakes - Mallets - Clamps - Folding bars
13.1.05P0	<i>Specific Objectives</i>		

	<ul style="list-style-type: none"> <li>- Box and pan brake</li> <li>- Cornice brake</li> <li>- Rolling machine (slip roll former)</li> <li>- Rotary machine</li> </ul>	13.1.06T1	Definition of soft soldering
		13.1.06T2	Applications of soft soldering <ul style="list-style-type: none"> <li>- Water tanks</li> <li>- Funnels</li> <li>- Electrical and electronic circuits</li> <li>- Buckets</li> <li>- Repair of radiators</li> </ul>
<b>13.1.06T1</b>	<b>SOFT SOLDERING</b>		
	<b>Theory</b>	13.1.06T3	Types of solder <ul style="list-style-type: none"> <li>- Tinman's</li> <li>- Plumbers</li> <li>- Resin cored</li> </ul>
13.1.06T1	<i>Specific Objectives</i> By the end of the sub-module unit, the trainee should be able to:	13.1.06T4	Fluxes <ul style="list-style-type: none"> <li>- Active</li> <li>- passive</li> </ul>
	a) define the term soft soldering	13.1.06T5	Tools and equipment <ul style="list-style-type: none"> <li>- heat source <ul style="list-style-type: none"> <li>o Tin mans stove</li> <li>o blow lamp</li> <li>o charcoal burner</li> </ul> </li> <li>- Soldering iron <ul style="list-style-type: none"> <li>o Straight</li> <li>o Hatchet</li> <li>o Electrical</li> <li>o Wire brush/file</li> </ul> </li> </ul>
	b) explain various types of fluxes		
	c) outline the uses of soft soldering	13.1.06T6	Soldering processes <ul style="list-style-type: none"> <li>- Material preparation</li> <li>- Heating soldering iron</li> <li>- Tinning</li> <li>- Sweating</li> </ul>
	d) explain various types of solder		
	e) outline various soldering tools and equipment		
	f) explain the soldering process		
13.1.06C	<i>Competence</i>		
	i) The trainee should have the ability to;		
	ii) fabricate a box by soldering		
	iii) The trainee should have the ability to produce a water tight soldered joint on a bucket	13.1.06P0	<i>Specific Objectives</i> By the end of the sub-module unit, the trainee should be able to:
			<b>Practice</b>

*Content*

	a) identify various types of solder		- Heating soldering iron
	b) identify various type of fluxes		- Tinning
	c) identify various soldering tools and equipment	13.1.06P5	- Sweating Inspection of soldered joints
	d) carry out soft soldering on a given component	13.1.06P6	- Visual inspection - Leak test Safety precautions
	e) inspect a soldered joint	13.1.06P7	- Personal safety - Equipment safety Care and maintenance
	f) observe safety precaution		- Tools
	g) care for and maintain soldering tools and equipment		- Equipment
			<i>Suggested Learning Resources</i>
	<i>Content</i>		Types of solder
13.1.06P1	Types of solder		- Tinman's
	- Tinman's		- Plumber's
	- Plumber's		- Resin cored
	- Resin cored		Fluxes
13.1.06P2	Fluxes		- Active
	- Active		- Passive
	- Passive		Tools and equipment
13.1.06P3	Tools and equipment		- Heating
	- Heating		o Tinman's stove
	o Tinman's stove		o Blow lamp
	o Blow lamp		o Charcoal burner
	o Charcoal burner		- Soldering iron
	- Soldering iron		o Straight
	o Straight		o Hatchet
	o Hatchet		o Electrical
	o Electrical		o Wire brush/file
	o Wire brush/file	13.1.07	<b>MECHANICAL FASTENERS</b>
13.1.06P4	Making soldered joint		<b>Theory</b>
	- Material preparation	13.1.07T0	<i>Specific Objectives</i>

By the end of the sub-module unit, the trainee should be able to:

- a) explain the application of various types of mechanical fasteners
- b) explain factors to consider when choosing fasteners
- c) explain safety precautions to be observed while using mechanical fasteners

- Screws
- Locking devices
- Application
  - Rivets
  - Bolts and nuts
  - Screws
  - Locking devices
  - Methods of riveting
  - Application
  - Tools
- Selection of mechanical fasteners
  - Material being fastened
  - Strength of joint
  - Beauty

13.1.07C

*Competence*

The trainee should have the ability to:

- i) Fabricate a riveted roof truss
- ii) Fabricate a steel door by welding
- iii) Fabricate a funnel by soldering
- iv) Fabricate a water tank stand by using bolts and nuts

13.1.07T3

Safety precautions

- Riveting
- Screw joining
- Bolting

**Practice**

13.1.07P0

*Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

- a) identify various types of mechanical fasteners
- b) select mechanical fasteners for various application
- c) observe safety precaution while using mechanical fasteners

13.1.07T1

*Content*

Mechanical fasteners

13.1.07T2

Factors to consider when choosing fasteners

- Rivets
- Welded joints
- Soldered joints
- Temporary fasteners
  - Bolts and nuts

	<i>Content</i>		trainee should be able to explain:
13.1.07P1	Types of mechanical fasteners <ul style="list-style-type: none"> <li>- Permanent <ul style="list-style-type: none"> <li>o Rivets</li> <li>o Welded joints</li> <li>o Soldered joints</li> </ul> </li> <li>- Temporary <ul style="list-style-type: none"> <li>o Bolts and nuts</li> <li>o Screws</li> <li>o Locking devices</li> </ul> </li> </ul>		a) the principle of gas welding b) the features of oxy-acetylene gas welding equipment c) gas welding flames d) weld defects e) weld test
13.1.07P2	Selection of fasteners <ul style="list-style-type: none"> <li>- Materials being fastened</li> <li>- Strength of joints</li> <li>- Aesthetic value</li> </ul>	13.1.08C	<i>Competence</i> The trainee should have the ability to: i) Fabricate a wheel barrow trough ii) Identification of weld defect iii) Carry out weld tests iv) Carry out safety precautions
13.1.07P3	Safety <ul style="list-style-type: none"> <li>- Personal safety</li> <li>- Equipment safety</li> </ul>		
	<i>Suggested Teaching/Learning Recourses</i> <ul style="list-style-type: none"> <li>- Bolts and nuts</li> <li>- Screws</li> <li>- Locking devices</li> <li>- Materials</li> <li>- Rivets</li> <li>- Welded joints</li> <li>- Soldered joints</li> </ul>		
<b>13.1.08</b>	<b>OXY-ACETYLENE GAS WELDING</b>		
	<b>Theory</b>		
13.1.08T0	<i>Specific Objectives</i> By the end of the sub-module unit the	13.1.08T1	<i>Content</i> Principle of gas welding <ul style="list-style-type: none"> <li>- Production of heat</li> <li>- Fusion</li> <li>- Fuel gases</li> </ul>
		13.1.08T2	Features of oxy acetylene gas welding equipment <ul style="list-style-type: none"> <li>- Cylinders</li> <li>- Regulators</li> <li>- Hoses/fittings</li> <li>- Torches</li> <li>- Nozzles</li> <li>- Spanners</li> <li>- Cylinder key</li> <li>- Welding stand</li> <li>- Nozzle cleaner</li> </ul>

13.1.08T3	<ul style="list-style-type: none"> <li>- Gas lighter</li> </ul> Setting up of gas welding equipment	<ul style="list-style-type: none"> <li>c) light gas welding torch to produce various flames</li> </ul>
13.1.08T4	<ul style="list-style-type: none"> <li>- Safety</li> <li>- Leak test</li> </ul> Type of frames	<ul style="list-style-type: none"> <li>d) carry out gas welding on various materials</li> </ul>
13.1.08T5	<ul style="list-style-type: none"> <li>- Neutral</li> <li>- Oxidizing</li> <li>- Carburizing</li> </ul> Techniques of oxy-acetylene gas welding	<ul style="list-style-type: none"> <li>e) identify weld defects</li> <li>f) carry out weld test</li> <li>g) observe safety while gas welding</li> </ul>
13.1.08T6	<ul style="list-style-type: none"> <li>- Right ward</li> <li>- Left ward</li> <li>- Types of filler rod               <ul style="list-style-type: none"> <li>o Types of joints</li> <li>o Welding positions</li> <li>o Welding techniques</li> </ul> </li> </ul> Weld defects	<p style="text-align: center;"><i>Content</i></p> 13.1.08P1 Identification of tools and equipment <ul style="list-style-type: none"> <li>- Cylinders</li> <li>- Hoses</li> <li>- Regulation</li> <li>- Torches</li> <li>- Nozzles</li> <li>- Spanners</li> <li>- Cylinder key</li> <li>- Welding stand</li> <li>- Nozzle cleaner</li> <li>- Gas lighter</li> <li>- Welding manifold</li> </ul>
13.1.08T7	<ul style="list-style-type: none"> <li>- Undercut</li> <li>- Lack of fusion</li> <li>- Porosity</li> <li>- Poor penetration</li> <li>- Overlapping</li> </ul> Weld tests	
	<ul style="list-style-type: none"> <li>- Visual</li> <li>- Bend-test</li> </ul>	
<b>13.1.08P0</b>	<p style="text-align: center;"><b>Practice</b></p> <p><i>Specific Objectives</i></p> By the end of the sub-module unit, the trainee should be able to: <ol style="list-style-type: none"> <li>a) identify tools and equipment used in gas welding</li> <li>b) set gas welding equipment</li> </ol>	13.1.08P2 Setting up gas welding equipment <ul style="list-style-type: none"> <li>- Equipment assembly</li> </ul> 13.1.08P3 Lighting gas welding torch to produce various flames <ul style="list-style-type: none"> <li>- Oxidizing</li> <li>- Neutral</li> <li>- Carburizing</li> </ul> 13.1.08P4 Welding various metals <ul style="list-style-type: none"> <li>- Mild steel</li> </ul>

	- Aluminum		<i>Content</i>
	- Stainless steel	13.1.09T1	Applications
	- Cast iron		- Brazing
13.1.08P5	Identification of weld defect	13.1.09T2	Light and set flame
	- Porosity		- Brazing
	- Lack of fusion		- Flux
13.1.08P6	Weld test		- Filler metal
	- Visual		- Joints
	- Bend test		o But
13.1.08T7	Safety precautions		o lap
	- Personal safety		o Scarf
	- Equipment safety		
	<i>Suggested Teaching/Learning Recourses</i>		<b>Practice</b>
	- welding equipment	13.1.09P0	<i>Specific Objectives</i>
	- various metals		By the end of the sub-module unit, the trainee should be able to:
<b>13.1.09</b>	<b>BRAZING</b>		a) identify brazing rods and fluxes
	<b>Theory</b>		b) light up and set up flame for brazing
13.1.09T0	<i>Specific Objectives</i>		c) carry out brazing on a given component
	By the end of the sub-module unit, the trainee should be able to:		d) observe safety
	a) outline the applications of brazing process		
	b) explain the lighting up and setting of for brazing flame		
		13.1.09P1	<i>Content</i>
			Identification of brazing rods and fluxes
			Materials to be brazed
			Selection of brazing rod
			Selection of flux
13.1.09C	<i>Competence</i>	13.1.09P2	Light up and setting flame for brazing
	The trainee should have the ability to repair bicycle frames	13.1.09P3	Carrying out blazing or braze welding on a given component
			- Mild steel
			- Galvanized iron
			- Aluminum

13.1.09P4	<ul style="list-style-type: none"> <li>- Copper</li> <li>- Safety precautions</li> <li>- Personal safety</li> <li>- Equipment safety</li> </ul> <p><i>Suggested Learning Resources</i></p> <ul style="list-style-type: none"> <li>- Oxy-acetylene gas set</li> <li>- Assorted tools</li> <li>- Fluxes</li> <li>- Spelter</li> <li>- Welding bench with fire bricks</li> <li>- Measuring tools</li> <li>- Fire extinguisher</li> <li>- Materials to be brazed</li> <li>- Gas welding goggles</li> <li>- Tongs</li> <li>- Leather gloves</li> <li>- Leather apron</li> <li>- Breathing mask</li> <li>- Spelter flux</li> </ul>		<p>By the end of the sub-module unit, the trainee should be able to:</p> <ul style="list-style-type: none"> <li>a) set up gas cutting equipment</li> <li>b) use gas to cut steel</li> <li>c) observe safety when performing gas cutting</li> </ul>
		13.1.10C	<p><i>Competence</i></p> <p>The trainee should have the ability to:</p> <ul style="list-style-type: none"> <li>i) Set up of gas cutting equipment</li> <li>ii) Produce templates by gas cutting</li> <li>iii) Carry out gas cutting</li> </ul>
		13.1.10T1	<p><i>Content</i></p> <p>Setting up of gas cutting equipment</p> <ul style="list-style-type: none"> <li>- pressures</li> <li>- gas cutting torch</li> <li>- Accessories</li> </ul>
<b>13.1.10</b>	<b>OXY ACETYLENE GAS CUTTING</b>	13.1.10T2	<p>Gas cutting on various sizes of steel specimen</p> <ul style="list-style-type: none"> <li>- hand cutting</li> <li>- profile cutting using template</li> </ul>
Applications			
13.1.09T2	<ul style="list-style-type: none"> <li>- Brazing</li> <li>- Light and set flame</li> <li>- Brazing</li> <li>- Flux</li> <li>- Filler metal</li> <li>- Joints <ul style="list-style-type: none"> <li>o But</li> <li>o lap</li> <li>o Scarf</li> </ul> </li> </ul>		
		13.1.10P0	<p><b>Practice</b></p> <p><i>Specific Objectives</i></p> <p>By the end of the sub-module unit, the trainee should be able to:</p> <ul style="list-style-type: none"> <li>a) identify flame cutting torch</li> </ul>
	<b>Theory</b>		
13.1.10T0	<i>Specific Objectives</i>		



- b) select cutting nozzle size for a given job
- c) set up gas cutting equipment
- d) carry out gas cutting
- e) observe safety precautions

- a) explain the principle of arc welding
- b) name various methods of arc welding
- c) explain the principle of operation of manual metal arc welding equipment
- d) explain setting up of manual metal arc welding equipment
- e) explain the construction of welding electrodes
- f) explain welding electrodes for various applications
- g) describe various welding joints
- h) describe various welding positions
- i) outline various weld defects
- j) explain the performance of weld tests

*Content*

- 13.1.10P1 Identification of flame cutting torch
- 13.1.10P2 Selection of cutting nozzle size
  - Size of materials being cut
- 13.1.10P3 Setting up of gas cutting equipment
- 13.1.10P4 Carry out gas cutting
  - Speed
  - Nozzle height
- 13.1.10P5 Safety precaution
  - Personal safety
  - Equipment safety

*Suggested Teaching/Learning Recourses*

- o gas cutting equipment
- o gas cutting materials

13.1.11C

*Competence*

- The trainee should have the ability to:
- i) Fabricate window and steel doors
  - ii) Repair a broken bench vice

**13.1.11 MANUAL METAL ARC WELDING**

**Theory**

- 13.1.11T0 *Specific Objectives*  
By the end of the sub-module unit, the trainee should be able to:

13.1.11T1

*Content*

- 13.1.11T1 The principle of arc welding

	- Generation of heat by electric arc		- Edge
	- Melting parent metal and electrode		- Tee
	- Fusion		- welding symbols
13.1.11T2	Methods of arc welding	13.1.11T8	Welding positions
	- AC/DC		- Flat
	- MMA		- Horizontal
	o TIG\MIG		- Vertical
	o DCSP	13.1.11T9	- Overhead
	o DCRP		Weld defects
	o ACHF		- Porosity
	- Resistance		- Slag inclusion
13.1.11T3	Principle of operation of manual metal arc welding equipment	13.1.11T10	- Cracks
	- Power		- Spatter
	- Transformation		Welding tests
	- Arc generation		- Bend tests
	- Shielding gases		- X-ray
13.1.11T4	Equipment set-up		- Crack detection
	- Connections		
	- Current setting		
	- Striking the arc		
13.1.11T5	Construction of welding electrodes	13.1.11P0	<b>Practice</b>
	- Material		<i>Specific Objectives</i>
	- Size		By the end of the sub-module unit, the trainee should be able to:
	- Coating		a) identify various methods of arc welding
13.1.11T6	Selection of welding electrodes		b) set up manual metal arc welding equipment
	- Relationship with type and size of material being welded		c) select electrode for given job
	- Non consumable electrodes (TIG)		d) weld in various positions
			e) identify various welding defects
			f) carry out weld test
13.1.11T7	Welding joints		g) care for and maintain manual metal welding tools and equipment
	- Butt		
	- Lap		
	- Corner		

	h) observe safety when arc welding		- Tools - Equipment
	<i>Content</i>	13.1.11P8	Safety precautions
13.1.11P1	Identification of methods of arc welding		- Personal safety - Equipment safety
	- Alternating current/Direct current		<i>Suggested Learning Resources</i>
	- Manual metal arc welding		- Manual metal arc welding set and accessories
	- Tungsten inert gas welding		- Assorted electrodes
	- Metal inert gas welding		- Steel in various shapes and sizes
	- Resistance welding		- Cast iron pieces
	- Submerged arc welding		- Welding shield
13.1.11P2	Setting up manual metal arc welding		- Leather apron
13.1.11P3	Electrode selection		- Assorted hand tools
	- Materials size		- Chipping hammer
	- Materials type		- Clear goggles
13.1.11P4	Welding positions		- Working table (shielded)
	- Horizontal		- Bench vice
	- Vertical		- Press
	- Overhead		- Heating medium
	- Down hand (flat)		- Sheet metal of various materials and thicknesses
13.1.11P5	Welding defect		- Stakes
	- Porosity		- Mallets
	- Undercut		- Clamps
	- Spatter		- Folding bars
	- Slag inclusion		- Scratch awl
	- Overlap		- Measuring tools
	- Lack of penetration		- Work bench
	- Lack of fusion		- Folding bars
13.1.11P6	Weld test		- Rolling machine
	- Visual		- Bending machine
	- Bend test		- Cornice brake
	- X-ray		
	- Crack detection		
13.1.11P7	Maintenance		

- Oxy-acetylene gas welding set
- Assorted tools
- Welding bench with fire bricks
- Measuring tools
- Fire extinguisher
- Various materials to be welded in various sizes
- Gas welding goggles
- Leather gloves
- Leather apron
- Tongs
- Breathing mask
- Fire extinguisher
- Steel in various gauges
- Leather gloves
- Tongs
- Breathing mask

easytvvet.com