

9.1.0 WORKSHOP TECHNOLOGY AND PRACTICE

9.1.1 Introduction

This module unit is designed to equip the trainee with the necessary knowledge, skills, attitudes and competences to use basic hand tools and machines. The trainee taking this course will require knowledge of basic mathematics and science.

9.1.2 General Objectives

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

- a) observe health and safety requirements in a workshop
- b) acquire knowledge on the basic principles and operation of hand and machine tools
- c) apply various methods of joining metals
- d) fabricate metal components in workshop
- e) develop skills necessary to care for and maintain tools and equipment in a plant workshop

9.1.3 Module Unit Summary and Time Allocation

Code	Sub-Module Unit	Content	Time (Hrs)		
			Theory	Practice	Total
9.1.01	Safety in Workshop	<ul style="list-style-type: none">• Safety rules• Importance of safety in a workshop	2	2	4
9.1.02	Bench work	<ul style="list-style-type: none">• Marking out tools• Measuring tools• Procedure of marking out• Hand cutting tools• Forms of threads• Hand threading tools	2	4	6
9.1.03	Sheet Metal Work	<ul style="list-style-type: none">• Types of sheet metal materials• Tools and equipment• Types of joints	6	10	16

		<ul style="list-style-type: none"> • Sheet metal preparation • Importance of pattern development • Folding and bending • Safety precautions 			
9.1.04	Oxy-acetylene Gas Welding and Cutting	<ul style="list-style-type: none"> • Principles of gas welding • Oxy-acetylene gas welding equipment • Type of flames • Techniques of oxy-acetylene gas welding • Types of filler rods • Types of joints • Welding positions • Weld defects • Principles of gas cutting 	4	6	10
9.1.05	Soldering	<ul style="list-style-type: none"> • Definition of soldering • Soldering process • Fluxes • Applications of soldering • Types of solder • Tools and equipment • Soldering process 	2	4	6
9.1.06	Brazing	<ul style="list-style-type: none"> • Principles of brazing • Tools and equipment 	2	2	4

9.1.07	Manual Metal Welding	<ul style="list-style-type: none"> • The principle of manual welding • Types of manual welding • Equipment set-up • Types of welding electrodes • Selection of welding electrodes • Welding joints • Welding positions • Weld defects 	6	6	12
9.1.08	Mechanical Fasteners	<ul style="list-style-type: none"> • Mechanical fasteners • Factors to consider when choosing fasteners • Safety precautions 	2	2	4
9.1.09	Power Saw	<ul style="list-style-type: none"> • Types of power saws • Principles of operation of the power saw 	2	2	4
9.1.10	Drilling	<ul style="list-style-type: none"> • Types of drilling machines • Parts of drilling machine • Drilling operations • Care and maintenance 	2	2	4
9.1.11	Lathe Work	<ul style="list-style-type: none"> • Types of lathes • Parts of a lathe • Work holding devices • Lathe operations 	4	6	10

9.1.12	Shaping	<ul style="list-style-type: none"> • Types of shaping machines • Parts of a shaping machine • Work holding devices • Work setting • Types of cutting tools • Cutting speeds and feeds 	2	4	6
9.1.13	Milling	<ul style="list-style-type: none"> • Types of milling machines • Parts of the milling machine • Work holding devices • Milling cutters • Work setting for given milling operations • Maintenance of milling machine 	4	4	8
9.1.14	Grinding	<ul style="list-style-type: none"> • Grinding machines • Types of grinding process • Parts of grinding machine • Classification of grinding wheels • Grinding wheel faults 	2	4	6
Total Time			40	60	100

9.1.01 SAFETY IN WORKSHOP

Theory

- 9.1.01T *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to;
- a) state the safety rules
 - b) explain the importance of safety in a workshop

- 9.1.01C Competence**
The trainee should have the ability to practice safety rules and regulations

Content

- 9.1.01T1 Safety rules
- 9.1.01T2 Importance of safety in a workshop
- i) personal
 - ii) machines

Practice

- 9.1.01P *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to observe safety at work place

Content

- 9.1.01P1 Observing safety
- i) personal

- ii) machines, tools and equipment

Suggested Teaching/Learning Resources

- Safety posters
- Safety manuals
- Personal protective equipment (PPE)
- Machine guards
- Emergency switches

9.1.02 BENCH WORK

Theory

- 9.1.02T *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to;

- a) describe various marking out tools
- b) describe various measuring tools
- c) explain the procedure of marking out
- d) describe hand cutting tools used in a workshop
- e) explain various forms of threads
- f) describe hand threading tools

- 9.1.02C Competence**
The trainee should have the ability to carry out a phase test

	<i>Content</i>		
9.1.02T1	Marking out tools		ii) correct posture
9.1.02T2	Measuring tools		iii) correct tool handling
9.1.02T3	Procedure of marking out		iv) correct pressure and stroke
9.1.02T4	Hand cutting tools	9.1.02P3	Care and maintenance of tools
9.1.02T5	Forms of threads		i) reconditioning handling
	i) acme		ii) storage
	ii) buttress		iii) cleaning
	iii) vee	9.1.02P4	Observe Safety
	iv) British whitworth		
	v) square		
	vi) British association pipe		
9.1.02T6	Hand threading tools		<i>Suggested Teaching/Learning Resources</i>
	i) Taps		- Measuring tools
	ii) Dies		- Mark out tools
			- Hand cutting tools
			- Work pieces
			- Thread cutting tools
	Practice		
9.1.02P	<i>Specific Objectives</i>		
	By the end of the sub-module unit, the trainee should be able to;	9.1.03	SHEET METAL WORK
	a) select appropriate tools for specific work		Theory
	b) use hand cutting tools correctly	9.1.03T	<i>Specific Objectives</i>
	c) care and maintain tools		By the end of the sub-module unit, the trainee should be able to;
	d) observe safety when using hand cutting tools		a) outline various types of sheet metal materials
			b) describe various tools and equipment used in sheet metal work
			c) distinguish between various types of joints used in sheet metal work
	<i>Content</i>		
9.1.02P1	Selection of appropriate tools		
9.1.02P2	Use of hand cutting tools		
	i) correct clamping		

	d) describe sheet metal preparation		
	e) explain the importance of pattern development		
	f) explain the difference between folding and bending processes		
	g) explain safety precautions to be observed in sheet metal work		
9.1.03C	Competence		
	The trainee should have the ability to:		
	i) produce various sheet metal items using given forming processes		
	ii) produce various types of joints, seams and edges of sheet metals		
		9.1.03T2	Tools and equipment i) marking out tools ii) measuring tools iii) cutting tools iv) forming tools v) bending tools vi) folding tool and equipment vii) box and pan brake viii) cornice brake ix) rolling machine (slip roll former)
		9.1.03T3	Types of joints i) lap seam ii) locked seam iii) grooved seam
		9.1.03T4	Sheet metal preparation
		9.1.03T5	Importance of pattern development i) proper layout of an object ii) uses of template iii) cost effective
		9.1.03T6	Folding and bending i) folding ii) bending iii) applications of each processes iv) angular folds v) cylindrical shapes vi) conical shapes
		9.1.03T7	Safety precautions i) personal ii) tools and equipment
	<i>Content</i>		
9.1.03T1	Types of sheet metal materials		
	i) black iron		
	ii) galvanized iron		
	iii) copper sheet		
	iv) aluminium sheet		
	v) tin sheet		
	vi) brass sheet		
	vii) lead sheet		
	viii) zinc sheet		

	Practice		
9.1.03P	<i>Specific Objectives</i> By the end of the sub-module unit, the trainee should be able to;		
	a) select sheet metal materials and plates for a suitable application		- stainless steel - aluminium - copper - tin - lead - brass
	b) select the correct tools and equipment for a given task	ii) plates	- mild steel - aluminium - copper - brass - stainless steel
	c) use various sheet metal tools and equipment	9.1.03P2 Selection of tools and equipment	
	d) prepare sheet metal edges	i) tools	- measuring - marking out - cutting - forming - folding
	e) make sheet metal joints	ii) equipment	- measuring - marking - cutting - forming - folding
	f) carry out pattern and development for a given component	9.1.03P3 Use of sheet metal tools and equipment	
	g) carry out folding and bending processes	9.1.03P4 Preparation of sheet metal edges	
	h) select the correct tools and equipment for bending and folding	i) hem ii) wired edge iii) false wired edge iv) braded edge	
	<i>Content</i>	9.1.03P5 Sheet metal joints	
9.1.03P1	Selection of sheet metal materials and plates	i) lap joint ii) seam iii) grooved seam	
	i) sheet metals		
	- black iron		
	- galvanized iron		

- 9.1.03P6 Pattern and development
- i) transition piece
(square to round)
 - ii) rectangular box
frustum of cone
 - iii) folding and bending
processes

- 9.1.03P7 Folding and bending
processes
- i) raising
 - ii) hollowing
 - iii) drawing
 - iv) bending
 - v) punching
 - vi) grooving
 - vii) knocked up seam

- 9.1.03P8 Folding and bending
tools and equipment
- i) forming tools
 - stakes
 - mallets
 - clamps
 - folding bars
 - ii) bending equipment
 - bar folder
 - Box and pan
brake
 - Slip roll former
 - Cornice brake
 - Rotary
machine

*Suggested
Teaching/Learning
Resources*

- Marking out tools
- Measuring tools
- Cutting tools
- Forming tools
- Stakes

- Mallets
- Clamps
- Cornice brake
- Rolling machine
- Sheet metals in
various thickness
- Steel rule
- Odd-leg calliper

**9.1.04 OXY-ACETYLENE
GAS WELDING AND
CUTTING**

Theory

9.1.04T *Specific Objectives*

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

- a) explain the
principles of gas
welding
- b) describe oxy-
acetylene gas
welding
equipment
- c) describe the
types of gas
welding flames
- d) explain the
techniques of
oxy-acetylene gas
welding
- e) explain the types
of filler used in
gas welding
- f) describe the
types of joints

	g) explain the types of welding positions	9.1.04T3	Type of flames
	h) explain welding defects		i) neutral
	i) explain the principles of gas cutting		ii) oxidizing
			iii) carburizing
		9.1.04T4	Techniques of oxy-acetylene gas welding
			i) right ward
			ii) left ward
			iii) intermittent
			iv) zigzag
			v) circular
		9.1.04T5	Types of filler rods
		9.1.04T6	Types of joints
		9.1.04T7	Welding positions
			i) vertical
			ii) horizontal
			iii) overhead
		9.1.04T8	Weld defects
			i) undercut
			ii) lack of fusion
			iii) porosity
			iv) poor penetration
			v) overlapping
		9.1.04T9	Principles of gas cutting
			Practice
		9.1.04P	<i>Specific Objectives</i>
			By the end of the sub-module unit, the trainee should be able to:
			a) identify tools and equipment used in gas welding
			b) set gas welding equipment
			c) light gas welding torch to produce various flames
9.1.04C	Competence		
	The trainee should have the ability to:		
	i) fabricate various pre-set items		
	ii) identify weld defects		
	iii) carry out weld tests		
	iv) carry out gas cutting		
	<i>Content</i>		
9.1.04T1	Principles of gas welding		
	i) production of heat		
	ii) fusion		
	iii) fuel gases		
9.1.04T2	Oxy-acetylene gas welding equipment		
	i) cylinders		
	ii) regulators		
	iii) hoses/fittings		
	iv) torches		
	v) nozzles		
	vi) spanners		
	vii) cylinder key		
	viii) welding stand		
	ix) nozzle cleaner		
	x) gas lighter		

	d) carry out gas welding on various materials	9.1.04P4	Welding various metals i) mild steel ii) aluminium iii) stainless steel iv) cast iron
	e) identify weld defects		
	f) carry out weld test	9.1.04P5	Identification of weld defects i) porosity ii) lack of fusion
	g) carry out gas cutting		
	h) observe safety while gas welding and cutting	9.1.04P6	Weld test i) visual ii) bend test
		9.1.04P7	Gas cutting i) speed ii) nozzle position
9.1.04P1	<i>Content</i> Identification of tools and equipment i) cylinders ii) hoses iii) regulator iv) torches v) nozzles vi) spanners vii) cylinder key viii) welding stand ix) nozzle cleaner x) gas lighter xi) welding manifold xii) cutting torch	9.1.04P8	Safety precautions i) personal safety ii) equipment safety iii) environment safety
			<i>Suggested Teaching/Learning Recourses</i> - Oxy-acetylene set - Various work pieces - Welding rods - Protective gear
9.1.04P2	Setting up gas welding equipment	9.1.05	SOLDERING
9.1.04P3	Lighting gas welding torch to produce various flames i) neutral ii) carburizing iii) oxidizing	9.1.05T	Theory <i>Specific Objectives</i> By the end of the sub-module unit, the trainee should be able to: a) define the term soldering

	b) state types of soldering process	9.1.05T5	Types of solder
	c) explain various types of fluxes		i) tinman's
	d) state applications of soldering	9.1.05T6	ii) plumbers
	e) explain various types of solder		iii) resin cored
	f) outline various soldering tools and equipment		Tools and equipment
	g) explain the soldering process		i) tin mans stove
			ii) blow lamp
			iii) charcoal burner
			iv) straight soldering iron
			v) hatchet soldering iron
			vi) electrical soldering iron
			vii) wire brush/file soldering
9.1.05C	Competence		
	The trainee should have the ability to:	9.1.05T7	Soldering process
	i) solder a work piece		i) material preparation
	ii) solder a water tight joint		ii) heating soldering iron
			iii) tinning
			iv) sweating
			v) fusing
	<i>Content</i>		
9.1.05T1	Definition of soldering		
9.1.05T2	Soldering process		
	i) soft soldering		
	ii) hard soldering		
9.1.05T3	Fluxes		
	i) active		
	ii) passive		
9.1.05T4	Applications of soldering	9.1.05P	Practice
	i) water tanks		<i>Specific Objectives</i>
	ii) funnels		By the end of the sub-module unit, the trainee should be able to:
	iii) electrical and electronic circuits		a) select appropriate types of solder for a given application
	iv) buckets		b) select various type of fluxes for a given application
	v) repair of radiators		

- c) select various soldering tools and equipment for a suitable application
- d) carry out soldering on a given work piece
- e) carry out inspection of a soldered joint
- f) observe safety precaution
- g) care for and maintain soldering tools and equipment

- ii) equipment

Suggested Teaching/Learning Resources

- Tinman's solder
- Plumber's solder
- Resin cored solder
- Tinman's stove
- Blow lamp
- Charcoal burner
- Straight soldering Iron
- Hatchet soldering iron
- Electrical soldering iron
- Wire brush/file
- Work pieces

Content

- 9.1.05P1 Selection of solder
- 9.1.05P2 Selection of fluxes
- 9.1.05P3 Selection of tools and equipment
- 9.1.05P4 Making soldered joints
 - i) material preparation
 - ii) heating soldering iron
 - iii) tinning
 - iv) fusing
 - v) sweating
- 9.1.05P5 Inspection of soldered joints
 - i) visual inspection
 - ii) leak test
- 9.1.05P6 Safety precautions
 - i) personal safety
 - ii) equipment safety
- 9.1.05P7 Care and maintenance
 - i) tools

9.1.06 BRAZING

Theory

9.1.06T

Specific Objectives

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

- a) explain the principles of brazing
- b) state the tools and equipment used in brazing

9.1.06C Competence

The trainee should have the ability to repair and produce components using brazing

- Content*
- 9.1.06T1 Principles of brazing
 9.1.06T2 Tools and equipment
- i) soldering iron
 - ii) blow lamp
 - iii) oxy-acetylene torch
 - iv) flux

Practice

- 9.1.06P *Specific Objectives*
 By the end of the sub-module unit, the trainee should be able to:
- a) select brazing rods and fluxes
 - b) light up and set up flame for brazing
 - c) carry out brazing on a given component
 - d) observe safety

Suggested Teaching/Learning

Resources

- Oxy-acetylene gas set
- Assorted tools
- Fluxes
- Spelter
- Welding bench
- With fire bricks
- Measuring tools
- Fire extinguisher
- Materials to be brazed
- Gas welding goggles
- Tongs portable
- Brazing kit
- Blow lamp

Content

- 9.1.06P1 Selection of brazing rods and fluxes
 9.1.06P2 Lighting up and setting flame for brazing
 9.1.06P3 Carrying out brazing or braze welding on a given component
- i) mild steel
 - ii) galvanized iron
 - iii) copper
- 9.1.06P4 Safety precautions
- i) personal safety
 - ii) equipment safety
 - iii) environment safety

9.1.07

MANUAL METAL WELDING

Theory

9.1.07T

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

- a) explain the principle of manual welding
- b) explain various types of welding
- c) explain setting up of manual metal welding equipments

	d) explain the types of welding electrodes		ii) cost- <i>inn</i>
	e) explain the selection of welding electrodes	9.1.07T5	iii) aluminium iv) copper v) mild steel
	f) describe various welding joints		Selection of welding electrodes
	g) describe various welding positions		i) relationship with type and size of material being welded
	h) explain various weld defects		ii) non consumable electrodes (TIG)
9.1.07C	Competence The trainee should have the ability to repair and produce components using welding equipments	9.1.07T6	Welding joints
			i) butt
			ii) lap
			iii) corner
			iv) edge
			v) vee
		9.1.07T7	Welding positions
9.1.07T1	<i>Content</i> The principle of manual metal welding		i) flat
	i) generation of heat by electric arc	9.1.07T8	ii) horizontal
	ii) melting parent metal and electrode		iii) vertical
	iii) fusion		iv) overhead
9.1.07T2	Types of manual welding		Weld defects
	i) AC/DC		i) porosity
	ii) Metal Manual Arc		ii) slag inclusion
	iii) MIG		iii) cracks
	iv) TIG		iv) spatter
9.1.07T3	Equipment set-up	9.1.07P	Practice
9.1.07T4	Types of welding electrodes		<i>Specific Objectives</i> By the end of the sub-module unit, the trainee should be able to:
	i) stainless steel		a) set up manual metal welding equipments

- b) select electrode for a given job
- c) weld in various positions
- d) identify various welding defects
- e) care for and maintain manual metal welding tools and equipments
- f) observe safety when welding

Content

- 9.1.07P1 Setting up manual metal welding equipments
- 9.1.07P2 Electrode selection
 - i) materials size
 - ii) materials type
- 9.1.07P3 Welding positions
 - i) horizontal
 - ii) vertical
 - iii) overhead
 - iv) down hand (flat)
- 9.1.07P4 Welding defect
 - i) porosity
 - ii) undercut
 - iii) spatter
 - iv) slag inclusion
 - v) overlap
 - vi) lack of penetration
 - vii) lack of fusion
- 9.1.07P5 Maintenance
 - i) tools
 - ii) equipment
- 9.1.07P6 Safety precautions
 - i) personal safety

- ii) equipment safety
- iii) third party safety

Suggested Teaching/Learning Resources

- Manual metal arc welding set and accessories
- Assorted electrodes
- Plates of various metals
- Personal protective equipment
- Welding booth
- MIG welding set and accessories
- TIG welding set and accessories

9.1.08

MECHANICAL FASTENERS

Theory

9.1.08T

- Specific Objectives*
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	using mechanical fasteners
9.1.08C Competence	The trainee should have the ability to make joints using mechanical fasteners	
	<i>Content</i>	<i>Content</i>
9.1.08T1	Mechanical fasteners i) rivets ii) bolts and nuts iii) screws iv) locking devices v) studs	9.1.08P1 Selection of fasteners i) materials ii) strength of joints iii) aesthetics
9.1.08T2	Factors to consider when choosing fasteners i) material ii) strength of joints iii) aesthetics	9.1.08P2 Safety i) personal safety ii) equipment safety
9.1.08T3	Safety precautions i) personal ii) equipment	<i>Suggested Teaching/Learning Recourses</i> - Bolts and nuts - Screws - Locking devices - Materials - Rivets - Riveting gun
9.1.08P Practice	<i>Specific Objectives</i> By the end of the sub-module unit, the trainee should be able to: a) select mechanical fasteners for a suitable application b) observe safety precaution while	9.1.09 POWER SAW Theory 9.1.09T <i>Specific Objectives</i> By the end of the sub-module unit, the trainee should be able to: a) state the types of power saw b) describe principles of operation of a power saw

9.1.09C Competence

The trainee should have the ability to:

- i) cut materials using the power saw
- ii) maintain the power saw

Content

- 9.1.09T1 Types of power saws
- 9.1.09T2 Principles of operation of the power saw
 - i) reciprocating
 - ii) circular saw
 - iii) band saw

Practice

- 9.1.09P *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
 - a) operate the power saw to perform a task correctly
 - b) mount the correct power saw blade
 - c) maintain the power saw

Content

- 9.1.09P1 Operation of power saw
- 9.1.09P2 Blade mounting
- 9.1.09P3 Maintenance of power saws

Suggested Teaching/Learning Resources

- Power saws
- Cutting fluids
- Saw blades
- Materials for cutting

9.1.10 DRILLING

Theory

- 9.1.10T *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
 - a) outline various types of drilling machines
 - b) describe a drilling machine
 - c) describe drilling operations
 - d) maintain drilling machine

9.1.10C Competence

The trainee should have the ability to:

- i) carry out drilling operations
- ii) maintain drilling machines

Content

- 9.1.10T1 Types of drilling machines
- 9.1.10T2 Parts of drilling machine
- 9.1.10T3 Drilling operations

- i) drilling
- ii) spot facing
- iii) counter boring
- iv) counter sinking

9.1.10T4 Care and maintenance

Practice

9.1.10P *Specific Objectives*

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

- a) perform drilling operations
- b) operate the drilling machine safely
- c) maintain the drilling machine

Content

9.1.10P1 Drilling operations

9.1.10P2 Safety in the use of drilling machine

9.1.10P3 Maintenance of a drilling machine

*Suggested Teaching/
Learning Resources*

- Drilling machines
- Drill bits
- Tool kit

9.1.11 LATHE WORK

Theory

9.1.11T *Specific Objectives*

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

- a) state the types of lathes
- b) describe the parts of a lathe machine
- c) describe work holding devices
- d) explain various lathe operations

9.1.11C Competence

The trainee should have the ability to:

- i) use lathe machine to perform different tasks
- ii) maintain a lathe machine

Content

9.1.11T1 Types of lathes

- i) centre lathe
- ii) capstan
- iii) turret
- iv) Computer Numerical Machine

9.1.11T2 Parts of a lathe

- i) base
- ii) bed
- iii) headstock
- iv) tailstock
- v) carriage

- 9.1.11T3 Work holding devices
- i) chuck
 - ii) face plate
 - iii) driving plate
 - iv) steadies
 - v) mandrel
 - vi) lathe dogs

- 9.1.11T4 Lathe operations
- i) turning
 - ii) boring
 - iii) parting off
 - iv) knurling
 - v) threading
 - vi) facing
 - vii) drilling

Practice

- 9.1.11P *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
- a) select a work holding device for a given task
 - b) select lathe tools for a given task
 - c) perform various lathe operations
 - d) use the correct cutting fluids
 - e) maintain lathe machines

Content

- 9.1.11P1 Work holding devices
- i) chuck
 - ii) face plate
 - iii) driving plate
 - iv) steadies

- v) mandrel
- vi) lathe dogs

- 9.1.11P2 Lathe tools
- i) parting
 - ii) drilling
 - iii) counter boring
 - iv) knurling
 - v) threading

- 9.1.11P3 Lathe operations
- i) Facing
 - ii) Turning
 - iii) Parting
 - iv) Knurling
 - v) Thread cutting
 - vi) Drilling

- 9.1.11P4 Cutting fluids

- 9.1.11P5 Maintenance of lathes

Suggested Teaching/Learning Resources

- Centre lathe
- Capstan and Turret lathe
- Parallel strips
- Clamps
- Vernier caliper
- Steel rule
- Spirit level
- Cutting tools
- Coolant
- Oil
- Grease
- Cotton waste
- Trainers manual
- Dial test indicator

9.1.12 SHAPING

Theory

9.1.12T *Specific Objectives*

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

- a) outline the types of shaping machine
- b) describe the parts of a shaping machine
- c) describe work holding device
- d) explain how to set the stroke and cutting position for a given task
- e) describe the types of cutting tools used on the shaping machine
- f) select cutting speeds and feeds

9.1.12C **Competence**

The trainee should have the ability to:

- i) set the stroke and position cutting of the ram
- ii) shape various components
- iii) maintain a sharper

Content

9.1.12T1 Types of shaping machines

- i) standard
- ii) horizontal
- iii) draw out
- iv) vertical

- v) universal

9.1.12T2 Parts of a shaping machines

- i) base
- ii) column
- iii) table
- iv) ram
- v) bull wheel
- vi) clapper box

9.1.12T3 Work holding devices

- i) plain or parallel vice
- ii) swivel machine vice
- iii) universal vice
- iv) vertical vice
- v) rotary table

9.1.12T4 Work setting

- i) plain shaping
- ii) angular shaping
- iii) serrated shaping
- iv) stroke positioning

9.1.12T5 Types of cutting tools

- i) goose neck
- ii) round nose
- iii) roughing tool

9.1.12T6 Cutting speeds and feeds

Practice

9.1.12P *Specific Objectives*

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

- a) set work piece for a given task
- b) set the stroke and cutting position for a given task

- c) select the types of cutting tools used on the shaping machine
- d) operate the shaping machine safely
- e) maintain the shaping machine

Content

- 9.1.12P1 Work setting
 - i) plain shaping
 - ii) angular shaping
 - iii) serrated shaping
- 9.1.12P2 Stroke and cutting position
 - i) Length of stroke
 - ii) Position of work piece
- 9.1.12P3 Types of cutting tools
 - i) goose neck
 - ii) round nose
 - iii) roughing tool
- 9.1.12P4 Operation of shaping machine
- 9.1.12P5 Maintenance of shaper

Suggested Learning

Resources

- Shaping machine
- Parallel strips
- Clamps
- Vernier caliper
- Steel rule
- Spirit level
- Cutting tools
- Coolant
- Oil
- Grease
- Cotton waste

- Trainers manual
- Work piece

9.1.13 MILLING

Theory

9.1.13T *Specific Objectives*

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

- a) state the types of milling machines
- b) describe the parts of milling machines
- c) describe work holding devices
- d) list the various types of milling cutters
- e) explain how to set work for a given milling operation
- f) maintain a milling machine

9.1.13C Competence

The trainee should have the ability to:

- i) operate a milling machine
- ii) perform various milling operations
- iii) maintain a milling machine

- Content*
- 9.1.13T1 Types of milling machines
- i) vertical
 - ii) horizontal
 - iii) universal
- 9.1.13T2 Parts of the milling machine
- i) base
 - ii) column
 - iii) support arm bracket
 - iv) table
 - v) spindle
 - vi) arbor
 - vii) over arm brackets
 - viii) machine vice
 - ix) indexing head
- 9.1.13T3 Work holding devices
- i) vices
 - ii) clamps
 - iii) tables
 - iv) rotary table
- 9.1.13T4 Milling cutters
- i) end mills
 - ii) side and face
 - iii) gear cutters
- 9.1.13T5 Work setting for given milling operations
- 9.1.13T6 Maintenance of milling machine

Practice

- 9.1.13P *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
- a) select work holding devices

- b) select the various milling cutters
- c) carry out various milling operations
- d) maintain milling machine

- Content*
- 9.1.13P1 Work holding devices
- i) vices
 - ii) clamps
 - iii) tables
 - iv) indexing heads
 - v) rotary table
- 9.1.13P2 Selection of milling cutters
- 9.1.13P3 Milling operations
- i) plain cutting
 - ii) gear cutting
 - iii) key cutting
- 9.1.13P4 Maintenance of milling machine

Suggested Teaching/ Learning Resources

- Milling machine
- Milling machine accessories
- Rotary table
- Indexing head
- Gears
- Cutters
- Coolant
- Vernier calliper
- Micrometer screw gauge
- Parallel strips
- Cotton waste
- Lubricants

- Trainer's manual
- Work pieces

9.1.14 GRINDING

Theory

9.1.14T *Specific Objectives*

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

- a) identify the common types of grinding machines
- b) outline types of grinding process
- c) explain the parts of grinding machine
- d) classify grinding wheels
- e) identify grinding wheel faults

9.1.14C **Competence**

The trainee should have the ability to:

- i) carry out grinding operations
- ii) mount the grinding wheel

Content

9.1.14T1 Grinding machines

- i) pedestal
- ii) hand (portable grinder)
- iii) cylindrical
- iv) surface grinders
- v) centre less

9.1.14T2 Types of grinding processers

- i) tool grinding
- ii) surface grinding
- iii) cylindrical grinding

9.1.14T3 Parts of grinding machine

9.1.14T4 Classification of grinding wheels

- i) aluminium oxide class A
- ii) cubic boron nitride class B
- iii) silicon carbide class C
- iv) diamond class D

9.1.14T5 Grinding wheel faults

- i) glazing
- ii) loading

Practice

9.1.14P *Specific Objectives*

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

- a) mount, dress and true a grinding wheel
- b) carry out grinding operations
- c) maintain a grinding machine and tools

Content

9.1.14P1 Mounting, balancing, dressing and truing

9.1.14P2 Grinding operations

9.1.14P3 Maintenance of grinding machines

*Suggested
Teaching/Learning
Resources*

- Portable grinder
- Cylindrical grinders
- Surface grinders
- Centre less grinder
- Pedestal grinder
- Bench grinder
- Blunt tool bits

- Work pieces

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