

9.1.0 WORKSHOP TECHNOLOGY

9.1.01 Introduction

This module unit is intended to equip the trainee with the necessary knowledge, skill and attitude required to understand the concepts of workshop technology.

9.1.02 General Objectives

At the end of this unit, the trainee should be able to:

- a) observe safety rules and regulations in the workshop.
- b) acquire knowledge of engineering materials and processes.
- c) create awareness of the human aspect of error in handling tools and equipment.
- d) appreciate quality of finished products.
- e) apply metal processing techniques to produce articles

9.1.03 Module Summary and Time Allocation Workshop Technology

Code	Sub-Module Unit	Content	Time Hrs
9.1.1	Occupational Safety	<ul style="list-style-type: none"> • General workshop safety • Causes of accidents • Industrial safety • Classification of fires • Electrical safety • Workshop layout 	4
9.1.2	Materials and Processes	<ul style="list-style-type: none"> • Metals and non- metals • Properties of materials • Extraction process • Finishes and decorative process • Electrical materials and applications • Metal forming processes 	10
9.1.3	Metal Shop Tools and Measurements	<ul style="list-style-type: none"> • Term used in measurement • Marking out techniques • Workshop hand tools 	6

Code	Sub-Module Unit	Content	Time Hrs
9.1.4	Joining of Metals	<ul style="list-style-type: none">• Mechanical joining of metals• Thermal joining	11
9.1.5	Workshop Machines and Applications	<ul style="list-style-type: none">• Workshop machines• Operation of different types• Safety precautions while using various machines	10
9.1.6	Sheet Metal Work	<ul style="list-style-type: none">• Common sheet metals• Uses of tools• Forming in sheet metal• Edge treatment of joints• Fabrication machines	14
Total Time			55

9.1.1 OCCUPATIONAL SAFETY

9.1.1T0 *Specific Objectives*

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

- a) explain the safety regulations in the workshop
- b) describe courses of accidents in a workshop
- c) outline legislation regarding industrial safety
- d) explain classification of methods of extinguishing fires
- e) explain electrical safety in the buildings
- f) explain factors considered in workshop layout

Competence

The trainee should have the ability to:

- i) Demonstrate the knowledge of safety in work places
- ii) Handle a first aid kit
- iii) Perform first aid
- iv) Identify and sources of accidents and prevent the same
- v) Carry out

Content

9.1.1T1 General workshop safety

9.1.1T2 Courses of accidents

- 9.1.1T3 Industrial safety
- i) Factory act
 - ii) Special regulations
 - iii) Hazardous areas

- 9.1.1T5 Classification of fires
- i) Fire fighting procedure
 - ii) Extinguishers

- 9.1.1T6 Electrical safety
- i) Treatment of electric shock
 - ii) Mouth to mouth
 - iii) Holger nelson method

- 9.1.1T7 Workshop layout
- i) Factors
 - ii) Location
 - iii) Material handling
 - iv) Storage
 - v) Safety
 - vi) Aesthetic
 - vii) Plan of workmanship
 - viii) Machine layout
 - ix) Electrical supply

Practice

9.1.1P0 *Specific Objectives*

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

- a) handle a first aid kit
- b) explain safety in a work place
- c) identify the sources of accidents and

- precautions to be taken in electrical workshop
- d) perform first aid.
- e) describe the procedure of rescuing victim from a live wire and administer first aid
- f) carry out fire extinguishing drills for various classes of fire

Content

- 9.1.1P1 Workshop rules and regulations
 - i) the `dos` and `don`ts`
 - ii) good grooming in the workshop
 - iii) cleaning
 - iv) interpersonal relationship
 - v) conduct in the workshop
 - vi) safety for others
- 9.1.1P2 The first aid kit
 - i) the need for a first aid kit
 - ii) the Content of a first aid kit and their applications
 - iii) care for a first aid kit
 - iv) Burns
 - v) Electric shock
 - vi) Cuts and HIV and AIDs prevention
 - vii) Toxic materials
 - viii) HIV and aids prevention and

- wound cleaning and dressing
- ix) Assessing the need for a physician
- 9.1.1P3 Sources of accidents in the workshop and work places
 - i) Slippery floors
 - ii) Exposed live wires
 - iii) Dressing
 - iv) Tools handling
 - v) Defective tools
 - vi) Machines and situations
 - vii) Unsafe working habits
 - viii) Movements in the workshop
- 9.1.1P4 Procedures of rescuing a victim from a live wire
 - i) Use of dry non conducting material
 - ii) Proper positioning of the rescuer and the victim
 - iii) Mouth to mouth rescustation (Kiss of life)
 - iv) Holger Nielsen method of rescustation.
- 9.1.1P5 Fire extinguishing drills
- 9.1.1P6 Fire extinguishers

Suggested Learning Resources

- i) Protective clothing
- ii) First aid kit
- iii) First aid specialist (personnel)
- iv) Teachers notes
- v) Fire extinguishers
- vi) Charts on safety

vii) Resource persons for fire fighting

iii) Safety in handling materials in engineering field

9.1.2 MATERIALS AND PROCESSES

9.1.2T0 *Specific Objectives*

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

- a) distinguish between metals non metals and alloys
- b) explain the properties of engineering materials
- c) describe methods of extraction of different materials
- d) explain finishes and decorative process of materials
- e) explain the properties electrical materials and their applications
- f) explain the various methods of metal forming processes

Competence

The trainee should have the ability to:

- i) Identify various materials used in the engineering field
- ii) Select various materials for various applications

Content

- 9.1.2T1 Metals and non- metals
 - i) Metals
 - ii) Non metals
 - iii) Alloys
 - iv) Ferrous metal
 - v) Non ferrous metals
- 9.1.2T2 Properties of materials
 - i) Ductility
 - ii) Toughness
 - iii) Strength
 - iv) Hardness
 - v) Malleability
 - vi) Corrosion
 - vii) Resistance
 - viii) Heat treatment
- 9.1.2T3 Extraction process
 - i) Iron
 - ii) Steel
 - iii) Alluminium
 - iv) Copper
 - v) Bronze
 - vi) Plastic materials
- 9.1.2T4 Finishes and decorative process
 - i) Picking and cleaning
 - ii) Polishing
 - iii) Electroplating
 - iv) Colouring
 - v) Lacquering
 - vi) Enameling
 - vii) Etching
- 9.1.2T5 Electrical materials and applications
 - i) conductors and application

- ii) insulators and application
 - iii) semi – conductors and application
 - iv) properties
 - v) construction of cables
 - vi) cable sizes
- 9.1.2T6 Metal forming processes
- i) forging-folding
 - ii) laundry work/casting
 - iii) filing, bending treading

Practice

- 9.1.2P0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
- a) identify ferrous and non ferrous materials
 - b) identify plastics materials
 - c) identify various types of cables
 - d) select cable sizes

Content

- 9.1.2P1 Ferrous material
- i) iron
 - ii) steel
 - iii) alloy steel
- 9.1.2P2 Non ferrous materials
- i) alluminium
 - ii) bronze
 - iii) zinc
 - iv) copper
 - v) brass
 - i) tin

- 9.1.2P3 Plastic materials
- ii) pvc
 - iii) rubber
 - iv) mica
 - v) porcelain
 - vi) synthetic materials

- 9.1.2P4 Cables
- i) construction
 - ii) extrusion
 - iii) drawing
 - iv) rolling
 - v) stranding
 - vi) insulating and sheathing

- 9.1.2P5 Size

- i) selection
- ii) ambient temperature
- iii) table of current rating
- iv) IEE regulations

Suggested Learning Resources

- i) metals – ferrous and non ferrous
- ii) alloys
- iii) plastics
- iv) ceramics
- v) fibre glass
- vi) synthetic materials
- vii) rubber
- viii) charts
- ix) reference books
- x) internet

9.1.3 METAL SHOP TOOLS AND MEASUREMENTS

- 9.1.3T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:

- a) define terms used in workshop measurement
- b) explain marking out techniques
- c) state correct use of workshop tools

Competence

The trainee should have the ability to:

- i) Use measuring tools correctly
- ii) Use various tools safely
- iii) Carry out various metal fitting exercises

Content

- 9.1.3T1 Term used in measurement
 - i) scales – linear and non linear
 - ii) tolerance
 - iii) limits
 - iv) fits
- 9.1.3T2 Marking out techniques
 - i) line and measurement
 - ii) use of rulers
 - iii) vernier caliper
 - iv) scribes
 - v) scribing block
 - vi) vernier height gauge
 - vii) centre punch
 - viii) surface plate
 - ix) micrometer screw gauge
 - x) angular measurement
- 9.1.3T3 Workshop hand tools

- i) vices
- ii) files
- iii) saws
- iv) hammer
- v) chisels
- vi) snips
- vii) tap and dies

Practice

9.1.3P0 *Specific Objectives*

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

- a) use measuring instruments correctly
- b) identify and use marking out tools
- c) safely use various workshop cutting tools
- d) mark and carry out a given practical exercise
- e) maintain tools

Content

- 9.1.3P1 Ordinary measurement
 - i) steel rules
 - ii) inside and outside caliper
- 9.1.3P2 Precision measurement
 - i) vernier calipers
 - ii) micrometers
 - iii) angle measurements if use protectors
 - iv) precautions in use of measuring
- 9.1.3P3 Marking out tools

- i) scribe, divider, centre punch surface plat, angle place, vernier height gauge, protector v-block
- 9.1.3P4 Precautions in use of marking tools
 - i) Workshop cutting hand tools
 - ii) chisels
 - iii) hacksaw
 - iv) punches
 - v) files
 - vi) Precautions in the use of hand tools
- 9.1.3P5 Maintenance of tools

Suggested Learning Resources
 - work shop tools and equipment

9.1.4 JOINING OF METALS

Theory

- 9.1.4T0 *Specific Objectives*
 By the end of the sub-module unit, the trainee should be able to:
 - a) explain various methods of mechanical jointing of metals
 - b) explain various methods of thermal joining of metals

Competence

The trainee should have the ability to:

- i) Select the right tools for the right job
- ii) Use right procedures in metal joining
- iii) Observe quality control and safety
- iv) Carry out a given exercise correctly within a given time
- v) Maintain tools and equipment

Content

- 9.1.4T1 Mechanical joining of metals
 - i) Temporary removable joints
 - ii) Screw – types – threads – applications
 - iii) Bolts and nuts
 - iv) Studs and keys
 - v) Riveting
 - vi) Pop riveting
 - vii) Precautions

- 9.1.4T2 Thermal joining
 - i) Soldering
 - ii) Soft soldering
 - iii) Hard soldering
 - iv) Brazing
 - v) Oxy-acetylene welding
 - vi) Electric arc welding
 - vii) Necessary pre cautioning

Practice

- 9.1.4P0 *Specific Objectives*

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

- a) identify tools and equipment used in various mechanical joining of metals
- b) identify tools and equipment used in various internal joining of metals
- c) use the various tools safety when joining metals
- d) join metals using various methods
- e) demonstrate safe working habits in metal joining process

Content

- 9.1.4P1 Mechanical joining
 - i) Fasteners screws, bolts and nuts
 - ii) Self interlocking joints
 - iii) Grooved seam
 - iv) Folding seam
 - v) Paned seam
 - vi) Care of tools and equipment
 - vii) Mechanical riveting
 - viii) Types of rivets
 - ix) Materials
 - x) Size
- 9.1.4P2 Thermal joining
 - i) Soldering
 - ii) Brazing
 - iii) Arc welding

- iv) Sport welding
- v) Seam welding
- vi) Heat sources
- vii) Seam welding
- viii) Filler metal
- ix) Fluxes

- 9.1.4P3 Safe working habits in metal joining process
 - i) Personal
 - ii) Others

Suggested Learning

Resources

- i) soldering iron
- ii) soldering wire/rod
- iii) rivet grim and rivets
- iv) screws nuts and bolts
- v) oxy – acetylene gas equipment
- vi) drilling machine
- vii) arc welding machine
- viii) blow lamp
- ix) films and posters

9.1.5 WORKSHOP MACHINES AND APPLICATIONS

Theory

- 9.1.5T0 *Specific Objectives*

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

 - a) list various types of workshop machines
 - b) describe the operation of various workshop machines

- c) state necessary safety precautions to be observed while using various workshop machines

Competence

The trainee should have the ability to:

- i) Selection of right tools
- ii) Perform a given task safely and correctly
- iii) Operate given machines correctly
- iv) Centre lathe

Content

- 9.1.5T1 Types of Workshop machines
 - i) Drilling machine
 - ii) Hand drills
 - iii) Centre lathe machine
 - iv) Shaping machine
 - v) Grinding machine
- 9.1.5T2 Operation of different types of workshop machines
 - i) Methods of work holding
 - ii) Drilling
 - iii) Turning
 - iv) Facing
- 9.1.5T3 Safety precautions while using various machines

Practice

- 9.1.5T3 *Specific Objectives*

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

- a) select the right tool for the right job
- b) perform given tasks using workshop machines
- c) demonstrate safe working habits
- d) maintain workshop machine

Content

- 9.1.5P1 Identification of tools
 - i) Drilling machine
 - ii) Centre lathe
 - iii) Pulling machine
 - iv) Shaping machine
 - v) Grinding machine
- 9.1.5P2 Operation of machines exercises
 - i) Drilling
 - ii) Facing
 - iii) Turning
 - iv) Knurling
- 9.1.5P3 Demonstrate safe working habit
- 9.1.5P4 Maintenance of workshop machines

Suggested Learning Resources

- i) drilling machines
- ii) lathe machines
- iii) grinding machines
- iv) necessary tools
- v) instructional sheets

9.1.6 SHEET METAL WORK

- 9.1.6T0 *Specific Objectives*

- By the end of the sub-module unit, the trainee should be able to:
- a) list common sheet metals
 - b) explain the application of sheet metal tools
 - c) explain the process of sheet metal work
 - d) explain edge treatment of joints in sheet metal work
 - e) explain the operations of sheet metal fabrication machines

Competence

The trainee should have the ability to:

- i) Fabricate a sheet metal project
- ii) Maintain tools and equipment

Content

- 9.1.6T1 Listing common sheet metals
- i) galvanized sheet iron
 - ii) tin plate
- 9.1.6T2 Uses of tools
- i) cutting tools
 - ii) forming tools
 - iii) marking out tools
 - iv) miscellaneous
- 9.1.6T3 Forming in sheet metal work
- i) meal forming process
 - ii) testing squareness

- iii) testing flatness
- 9.1.6T4 Edge treatment of joints
- i) soldering
 - ii) forging
 - iii) filling
 - iv) binding
- 9.1.6T5 Sheet metal fabrication machines
- i) shearing machines
 - ii) bending machines
 - iii) punching machines
 - iv) notching machine

Practice

9.1.6P0 *Specific Objectives*

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

- a) interpret drawings in sheet metal work
- b) estimate materials for sheet metal work
- c) carry out marking out on a piece of sheet metal work
- d) identify sheet metal fabrication tools and machines
- e) make and assemble part of a given practical exercise on sheet metal
- f) demonstrate safely awareness in the use of sheet metal work
- g) maintain tools and machines

Content

- 9.1.6P1 Interpretation of drawing

- 9.1.6P2 Material estimate from given drawing
- 9.1.6P3 Marking out procedure
- 9.1.6P4 Identification of tools
 - i) Dividers
 - ii) Punches
 - iii) Surface plate
 - iv) Angle plate
 - v) Vernier height gauge
 - vi) Protractor
 - vii) V- block
 - viii) Machines
 - ix) Shearing machines
 - x) Bending machines
 - xi) Punching machines
 - xii) Notching machines
 - xiii) Brakes and roll forming machines
- 9.1.6 P5 Sheet metal parts making and assembly
- 9.1.6 P6 Observation of safety
- 9.1.6 P7 Maintenance of tools and equipment

Suggested Learning Resources

- i) various workshop machines and metal tools
- ii) folding , vices (bench portable pipe vice)
- iii) pipe folding machines
- iv) shearing machines