

8.1.0 WORKSHOP TECHNOLOGY

8.1.01 INTRODUCTION

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

8.1.02 GENERAL OBJECTIVES

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

- a) Observe safety rules and regulations in the workshop and other work places.
- b) Acquire knowledge of electrical materials and processes.
- c) Create awareness of the human aspect of error in handling tools and equipment.
- d) Appreciate quality of finished products.

8.1.03 MODULE SUMMARY AND TIME ALLOCATION

WORKSHOP TECHNOLOGY

| Code | Sub-Module Unit | Content | Time Hrs | | |
|-------|-------------------------|---|----------|-------|-------|
| | | | Theory | Pract | Total |
| 8.1.1 | Occupational Safety | <ul style="list-style-type: none">• General workshop safety regulations• Causes of accidents• Industrial safety• Classification of fires• Electrical safety• Workshop layout | 2 | 2 | 4 |
| 8.1.2 | Materials and Processes | <ul style="list-style-type: none">• Metals, non- metals and alloys• Properties of materials• Extraction process• Finishes and decorative process• Electrical materials and applications• Metal forming processes | 6 | 10 | 16 |

| | | | | | |
|-------------------|------------------------------------|--|-----------|-----------|-----------|
| 8.1.3 | Metal Shop Tools and Measurements | <ul style="list-style-type: none"> • Term used in workshop measurement • Marking out techniques • Workshop hand tools | 8 | 15 | 23 |
| 8.1.4 | Joining of Metals | <ul style="list-style-type: none"> • Mechanical joining of metals • Thermal joining | 8 | 10 | 18 |
| 8.1.5 | Workshop Machines and Applications | <ul style="list-style-type: none"> • Workshop machines • Operation of different types of workshop machines • Safety precautions while using various machines | 8 | 10 | 18 |
| 8.1.6 | Sheet Metal Work | <ul style="list-style-type: none"> • Common sheet metals • Application of sheet metal tools • Process of sheet metal work • Edge treatment of joints • Fabrication machines | 10 | 10 | 20 |
| Total Time | | | 42 | 57 | 99 |

| | | |
|---------|--|--|
| 8.1.1 | OCCUPATIONAL SAFETY | sources of accidents and prevent the same |
| | Theory | Carry out |
| | | <i>Content</i> |
| 8.1.1T0 | <i>Specific Objectives</i> By the end of the sub-module unit, the trainee should be able to: a) explain the safety regulations in the workshop b) explain causes 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 | 8.1.1T1 General workshop safety regulations 8.1.1T2 Causes of accidents 8.1.1T3 Industrial safety - Factory act - Special regulations - Hazardous areas 8.1.1T4 Classification of fires - Fire fighting procedure - Extinguishers 8.1.1T5 Electrical safety - Treatment of electric shock - Mouth to mouth - Holger nelson method 8.1.1T6 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 |
| 8.1.1C | <i>Competence</i> The trainee to 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 causes and | 8.1.1P0 <i>Practice</i> 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) explain 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

- 8.1.1P1 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
- 8.1.1P2 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
- vii) prevention
- viii) Toxic materials
- ix) HIV and aids prevention
- x) and wound cleaning and
- xi) dressing
- xii) Assessing the need for
- xiii) a physician

8.1.1P3 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
- ix) Workshop

8.1.1P4 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 resuscitation (Kiss of life)
 - iv) Holger Nielsen method of resuscitation.
- 8.1.1P5 Fire extinguishing drills
- 8.1.1P6 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

- b) explain the properties of engineering materials
- c) explain methods of extraction of different materials
- d) explain finishes and decorative process of materials
- e) explain the properties of electrical materials and their applications
- f) explain the various methods of metal forming processes

8.1.2C *Competence*

The trainee should have the ability to:

- i) identify various materials used in the engineering field
- ii) select various materials for various applications
- iii) safety in handling materials in engineering field

8.1.2 **MATERIALS AND PROCESSES**

Theory

8.1.2T0 Specific Objectives
By the end of the sub-module unit, the trainee should be able to:

- a) distinguish between metals, non metals and alloys

Content

- 8.1.2T1 Metals and non-metals
- Non metals
 - metals
 - Alloys

| | | | |
|---------|--|---------|---|
| | -Ferrous metal | | vi) cable sizes |
| | -Non ferrous metals | 8.1.2T6 | Metal forming processes |
| 8.1.2T2 | Properties of materials | | i) forging-folding |
| | i) Ductility | | ii) laundry work/casting |
| | ii) Toughness | | iii) filing, bending treading |
| | iii) Strength | | |
| | iv) Hardness | | |
| | v) Malleability | | |
| | vi) Corrosion | | |
| | vii) Resistance | | <i>Practice</i> |
| | viii) Heat treatment | 8.1.2P0 | <i>Specific Objectives</i> |
| 8.1.2T3 | Extraction process | | By the end of the sub-module unit, the trainee should be able to: |
| | i) Iron | | a) identify ferrous and non ferrous materials |
| | ii) steel | | b) identify plastics materials |
| | iii) aluminium | | c) identify various types of cables |
| | iv) copper | | d) select cable sizes |
| | v) bronze | | |
| | vi) plastic materials | | |
| 8.1.2T4 | Finishes and decorative process | | |
| | i) picking and cleaning | | |
| | ii) polishing | | |
| | iii) electroplating | | |
| | iv) colouring | | |
| | v) lacquering | | |
| | vi) enamelling | | |
| | vii) etching | | |
| 8.1.2T5 | Electrical materials and applications | | <i>Content</i> |
| | i) conductors and application | 8.1.2P1 | Ferrous material |
| | ii) insulators and application | | -iron |
| | iii) semi – conductors and application | | -steel |
| | iv) properties | 8.1.2P2 | -alloy steel |
| | v) construction of cables | | Non ferrous materials |
| | | | -aluminium |
| | | | -bronze |
| | | | -zinc |
| | | | -copper |
| | | | -brass |
| | | | -tin |
| | | 8.1.2P3 | Plastic materials |
| | | | - PVC |
| | | | - rubber |

- mica
 - porcelain
 - synthetic materials
- 8.1.2P4 Cables
- construction
 - extrusion
 - drawing
 - rolling
 - stranding
 - insulating and sheathing
- 8.1.2P5 Size
- selection
 - ambient temperature
 - table of current rating
 - IEE regulations

Suggested Learning

Resources

- metals – ferrous and non ferrous
- alloys
- plastics
- ceramics
- fibre glass
- synthetic materials
- rubber
- charts
- reference books
- internet

Theory

- 8.1.3 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

8.1.3C *Competence*

The trainee should have the ability to:

- i) use measuring tools correctly
- ii) use various tools safely carry out various metal fitting exercises

Content

8.1.3T1 Term used in measurement

- scales – linear and non linear
- tolerance
- limits
- fits

8.1.3T2 Marking out techniques

- i) line and measurement
- ii) use of rulers

8.1.3 **METAL SHOP TOOLS AND MEASUREMENTS**

| | | | |
|---------|---|--|--|
| | <ul style="list-style-type: none"> iii) vernier calliper iv) scribes v) scribing block vi) vernier height gauge vii) centre punch viii) surface plate ix) micrometer screw gauge x) angular measurement | | |
| 8.1.3T3 | <p>Workshop hand tools</p> <ul style="list-style-type: none"> i) vices ii) files iii) saws iv) hammer v) chisels vi) snips vii) tap and dies | | |
| | <i>Practice</i> | | |
| 8.1.3P0 | <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"> 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 | <p><i>Content</i></p> <p>8.1.3P1 Ordinary measurement</p> <ul style="list-style-type: none"> -steel rules -inside and outside calliper <p>8.1.3P2 Precision measurement</p> <ul style="list-style-type: none"> i) vernier callipers ii) micrometers iii) angle measurements if use protectors iv) precautions in use of measuring <p>8.1.3P3 Marking out tools</p> <p>scriber, divider, centre punch surface plat, angle place, vernier height gauge, protector v-block</p> <p>8.1.3P4 Precautions in use of marking tools</p> <ul style="list-style-type: none"> -Workshop cutting hand tools -chisels -hacksaw -punches -files -Precautions in the use of hand tools <p>8.1.3P5 Maintenance of tools</p> | |
| | | | <p><i>Suggested Learning Resources</i></p> <ul style="list-style-type: none"> - work shop tools and equipment |

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|---------|--|--|
| 8.1.4 | JOINING OF METALS | i) Temporary removable joints |
| | Theory | ii) Screw – types – threads – applications |
| 8.1.4T0 | Specific Objectives By the end of the sub-module unit, the trainee should be able to: | iii) Bolts and nuts |
| | a) explain various methods of mechanical jointing of metals | iv) Studs and keys |
| | b) explain various methods of thermal joining of metals | v) Riveting |
| | | vi) Pop riveting |
| | | vii) Precautions |
| | | 8.1.4T2 Thermal joining |
| | | i) Soldering |
| | | ii) Soft soldering |
| | | iii) Hard soldering |
| | | iv) Brazing |
| | | v) Oxy-acetylene welding |
| 8.1.4C | <i>Competence</i> The trainee should have the ability to: | vi) Electric arc welding |
| | i) select the right tools for the right job | vii) Necessary pre cautioning |
| | ii) use right procedures in metal joining | <i>Practice</i> |
| | iii) observe quality control and safety | 8.1.4P0 Specific Objectives |
| | iv) carry out a given exercise correctly within a given time | By the end of the sub-module unit, the trainee should be able to: |
| | v) maintain tools and equipment | 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 safely when joining metals |
| | <i>Content</i> | |
| 8.1.4T1 | Mechanical joining of metals | |

- d) join metals using various methods
- e) demonstrate safe working habits in metal joining process

Content

- 8.1.4P1 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
- 8.1.4P2 Equipment used in thermal joining of metals
- 8.1.4P3 Safety when joining metals
- 8.1.4P4 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
- 8.1.4P5 Safe working habits in metal joining process
 - Personal
 - 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

8.1.5

WORKSHOP MACHINES AND APPLICATIONS

Practice

8.1.5T0

- Specific Objectives
- By the end of the sub-module unit, the trainee should be able to:
- a) list various types of workshop machines
 - b) explain the operation of various workshop machines
 - c) state necessary safety precautions to be observed while using various workshop machines

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|---------|---|--|
| 8.1.5C | <p><i>Competence</i> The trainee should have the ability to:</p> <ul style="list-style-type: none"> i) Select right tools for a given task ii) Perform a given task safely and correctly iii) Operate given machines correctly iv) Centre lathe | Practice |
| 8.1.5T1 | <p><i>Content</i> Types of Workshop machines</p> <ul style="list-style-type: none"> i) Drilling machine ii) Hand drills iii) Centre lathe machine iv) Shaping machine v) Grinding machine | 8.1.5P0 |
| 8.1.5T2 | <p>Operation of different types of workshop machines</p> <ul style="list-style-type: none"> i) Methods of work holding ii) Drilling iii) Turning iv) Facing | <p><i>Specific Objectives</i> By the end of the sub-module unit, the trainee should be able to:</p> <ul style="list-style-type: none"> 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 |
| 8.1.5T3 | <p>Safety precautions while using various machines.</p> | <p><i>Content</i> 8.1.5P1 Identification of tools</p> <ul style="list-style-type: none"> i) Drilling machine ii) Centre lathe iii) Pulling machine iv) Shaping machine v) Grinding machine <p>8.1.5P2 Operation of machines exercises</p> <ul style="list-style-type: none"> i) Drilling ii) Facing iii) Turning iv) Knurling <p>8.1.5P3 Safe working habit</p> <p>8.1.5P4 Maintenance of workshop machines</p> |

Suggested Learning Resources

- drilling machines
- lathe machines
- grinding machines
- necessary tools

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|---------|--|---|
| | - instructional sheets | iii) marking out tools iv) miscellaneous |
| 8.1.6 | SHEET METAL WORK | 8.1.6T3 Process of sheet metal work i) metal forming process ii) testing squareness iii) testing flatness |
| 8.1.6T0 | 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 | 8.1.6T4 Edge treatment of joints -soldering -forging -filling -binding 8.1.6T5 Sheet metal fabrication machines -shearing machines -bending machines -punching machines -notching machine |
| 8.1.6C | <i>Competence</i> The trainee should have the ability to: i. Fabricate a sheet metal project ii. Maintain tools and equipment | <i>Practice</i> 8.1.6P0 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 |
| 8.1.6T1 | <i>Content</i> Common sheet metals galvanized sheet iron tin plate | |
| 8.1.6T2 | Application of sheet metal tools i) cutting tools ii) forming tools | |

- e) make and assemble part of practical sheet metal
- f) demonstrate safety awareness in the use of sheet metal work
- g) maintain tools and machines

Content

- 8.1.6P1 Interpretation of drawing
- 8.1.6P2 Material estimate from given drawing
- 8.1.6P3 Marking out procedure
- 8.1.6P4 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
- 8.1.6P5 Sheet metal parts making and assembly
- 8.1.6P6 Observation of safety
- 8.1.6P7 Maintenance of tools and equipment

Suggested Learning Resources

- Various workshop machines and metal tools
- Folding , vices (bench portable pipe vice)
- Pipe folding machines
- Shearing machines

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